



UNIVERSITAT DE
BARCELONA

The Impact of Algeria's Limited Natural Gas Integration in the Western Mediterranean Value Chain:

Implications for Its Rentier Economy (1971-2015)

Roger Albinyana

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PhD in Economic History

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*To my sons, Guerau and Mateu, with the hope that they discover
the inspiration and fulfillment that knowledge and research can bring*

Acknowledgments

A former Dean of the Faculty of Economics and Business once told me, as we crossed paths in the corridors, that embarking on a PhD is about learning to navigate the solitude of a journey across endless seas, always envisioning the distant shore but never knowing what awaits us when we finally set foot on solid ground. Then, one day, that moment arrives, and as we look back, we realise we were never truly alone. Only then do we begin to appreciate the immense generosity of those who have walked alongside us, to whom we owe our deepest gratitude. If this journey takes you into your 40s – raising alone two beloved children of 11 and 7, balancing managerial responsibilities in a full-time job, teaching at the Faculty and navigating a personal life that is constantly shifting, sometimes even tumultuous – then reaching that distant shore becomes an even greater challenge, and when it happens, a wonderful celebration. This perfectly encapsulates the path that has led me to complete this work, making me all the more grateful to those who have encouraged and supported me over the years, especially during the last three.

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diplomatic career, his steadfast commitment to research on the Mediterranean region continues to serve as a powerful inspiration for me and for future generations. With his intellectual legacy, Ambassador Florensa has become a remarkable advocator of the shift from a confrontational, resource-dependent economy to one focused on shared prosperity, diversification, and deeper integration into global value chains, the very vision that underpins this thesis.

In the quantitative chapter of this work, I would like to express my deep gratitude to those who helped me navigate the complex calculations embedded in this research. First and foremost, my father, Josep Manuel, whose expertise and patience were invaluable in tackling the intricate matrix calculations. His background as both a mathematician and physicist has made him accustomed to working with models far more sophisticated than those employed in this thesis. Yet, he took the time to understand my objectives and assist me in handling calculations that involved matrices with millions of cells.

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and how it shaped my thesis. More importantly, they deserve my deepest appreciation for their patience and understanding, accepting, even if reluctantly, that their father often had to retreat into his thesis work late at night, in the early mornings, and even during holiday time. I hope my efforts will not have been in vain and that it will serve as an example: no matter how demanding life becomes, it is always possible to find the time to pursue and achieve one's goals.

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Table of contents

Table of contents	ix
List of acronyms and abbreviations	xiii
List of figures.....	xiv
List of tables.....	xv
Abstract	xvii
Resum	xix
Resumen.....	xxi
INTRODUCTION AND OBJECTIVES	1
CHAPTER 1: Theoretical Framework and Methodology.....	13
1.1 Introduction	14
1.2 Introduction to the evolution of the governance of the international hydrocarbon industry	15
Natural gas vs. crude oil: distinctive characteristics.....	19
1.3 The fundamental problem of hydrocarbon-rich economies: socioeconomic development and the rentier state	22
1.3.1 The rentier state.....	26
1.3.2 The rent generation and pricing policies	32
1.4 The articulation of the domestic and foreign dimensions of the rent.....	36
1.5 Theoretical approaches to establish the linkage between the domestic and global (regional) dimensions	38
1.5.1 Introduction: the concept of “value chains” within the traditional theories on trade	38
1.5.2 The integration of a territory’s gas sector into a regional gas value chain	39
1.6 The “filière” and the agro-industry studies as a step towards the notion of Global Commodity Chain.....	40
1.7 The concept of Global Value Chain.....	45
1.8 The concept of Global Production Network.....	47
1.9 Conclusions	49
CHAPTER 2: Dissecting the Historical Evolution of Algerian Natural Gas in the Construction of a Rentier Economy	53
2.1 Introduction	54

2.1	The hydrocarbon foundation: oil and gas up to the nationalisation of Algerian hydrocarbons	57
2.2.1	The National Liberation Front (FLN) as the Algerian single party.....	72
2.2.2	The accession to the Organization of the Petroleum Exporting Countries (OPEC) 75	
2.3	The role of hydrocarbons in Algeria's economic development and evolution of hydrocarbon's legislative framework.....	77
2.3.1	A hydrocarbon central planning policy for a "big push" development strategy	79
2.3.2	The corrective policies that did not avert the enfeeblement of the hydrocarbon model 90	
2.3.3	The collapse of the political and economic systems that triggered the reforms of 1991: unleashing the potential of natural gas.....	98
2.3.4	The failure of the hydrocarbon sector's liberalisation in a globalised economy	107
2.4	Evolution of pricing policies of natural gas in Algeria.....	116
2.5	Algeria as a rentier economy: the role of hydrocarbons in the public economy.....	121
2.5.1	Hydrocarbon taxation as a tool to assert the rentier economy	126
2.6	Conclusions	131
CHAPTER 3: A Comprehensive Overview and Understanding of the Natural Gas Value Chain in the Western Mediterranean		137
3.1	Introduction	138
3.2	Hydrocarbon production, reserves and transportation in retrospect.....	141
3.3	Disentangling the concept of the natural gas value chain	146
3.4	Natural gas production and the upstream activity.....	150
3.4.1	The super-giant field of Hassi R'Mel	151
3.4.2	The other main gas fields and the upstream activity.....	153
3.5	The midstream segment	163
3.5.1	The development of the Liquefied Natural Gas industry	166
3.5.2	The development of the Trans-Mediterranean Gas Pipelines.....	171
3.6	The downstream segment	183
3.6.1	The surge of gas trade between Italy and Algeria.....	188
3.6.2	The surge of gas trade between Spain and Algeria.....	199
3.6.3	The surge of gas trade between France and Algeria	209

3.7	Relational nature of agents integrated in the natural gas value chain in the Western Mediterranean. Qualitative exercise	220
	Results and discussion of the qualitative exercise of the Gas Value Chain in the Western Mediterranean.....	223
3.8	Conclusions	225
CHAPTER 4: Value Chain Analysis: Implications and Effects for Algeria as a Rentier Economy		231
4.1	Introduction	232
4.2	Analysis of the integration of Algeria's sector into the natural gas value chain	234
4.2.1	GVC analysis. A quantitative methodology	235
4.2.2	A quantitative analysis of the natural gas value chain in the Western Mediterranean 239	
4.2.3	Assessment of regional linkages.....	250
4.3	Discussion on the analysis of GVC integration.....	259
4.4	Increased integration into natural gas GVCs as a mitigator of rentierism.....	262
4.5	Algeria in the context of low integration into natural gas GVCs	273
4.6	Conclusions	276
CONCLUSIONS.....		281
REFERENCES.....		293
Monographies, reports, papers and articles.....		293
Statistics and databases.....		313
APPENDIX		315
ANNEXES.....		323

List of acronyms and abbreviations

ALNAFT	Algerian National Agency for the Development of Hydrocarbon Resources (<i>Agence nationale pour la valorisation des ressources en hydrocarbures</i>)
ARH	Hydrocarbon Regulatory Authority (<i>Autorité de régulation des hydrocarbures</i>)
BCM	Billion Cubic Metres
BOE	Barrel of Oil Equivalent
BP	British Petroleum
BTU	British Thermal Units
CAMEL	Algerian Liquid Methane Company (<i>Compagnie algérienne du méthane liquid</i>)
EC	European Commission
EIA	U.S. Energy Information Administration
ENI	National Hydrocarbons Board (<i>Ente nazionale idrocarburi</i>)
FLN	National Liberation Front (<i>Front de Libération Nationale</i>)
GCC	Global Commodity Chain
GDF	<i>Gaz de France</i>
GPN	Global Production Network
GVC	Global Value Chain
IEA	International Energy Agency
IMF	International Monetary Fund
IOC	International Oil Company
LNG	Liquified Natural Gas
LPG	Liquified Petroleum Gas
MBTU	Million British Thermal Units
MENA	Middle East and North Africa
MTPA	Million Tonnes per Year
NG	Natural Gas
NOC	National Oil Company
OECD	Organisation for Economic Co-operation and Development
OPEC	Organization of the Petroleum Exporting Countries
ROC	Regional Oil Company
SONATRACH	National Company for the Exploration, Production, Transport, Processing and Marketing of Hydrocarbons (<i>Société nationale pour la recherche, la production, le transport, la transformation, et la commercialisation des hydrocarbures</i>)
TRS	Theory of Rentier States
UfM	Union for the Mediterranean
UNCTAD	United Nations Conference on Trade and Development
VALYDH	Valorisation of the Hydrocarbons (<i>Valorisation des Hydrocarbures</i>)

List of figures

Figure 1	Evolution of natural gas and crude oil prices (1977-2015)
Figure 2	Hydrocarbon, oil and natural gas rents as a percentage of Algeria's GDP (1971-2015)
Figure 3	Natural gas production in Algeria in bcm and share of Algeria to world's production in percentage (1971-2015)
Figure 4	Allocation of resources into the Algerian economy as a percentage of GDP (1967-1989)
Figure 5	Nominal and real GDP (1967-1989), and average OPEC crude oil prices in relation with Algeria's investment Plans
Figure 6	Hydrocarbon rents as a percentage of GDP and hydrocarbon taxes as a percentage of government revenues in Algeria (1978-1987)
Figure 7	Algeria's GDP growth rate and fiscal balance (1984-1989)
Figure 8	Hydrocarbon, oil and natural gas rents as a percentage of Qatar and Norway's GDP (1971-2015)
Figure 9	Export value of oil products and oil rents from Algeria (1990-2015)
Figure 10	Role of the hydrocarbons in the Algerian public economy (2000-2015)
Figure 11	Role of the hydrocarbons in the Algerian public economy (1960-1995)
Figure 12	Location and relevance of hydrocarbon fields in Algeria in 1962
Figure 13	Transportation of hydrocarbon resources in Algeria in 1961
Figure 14	Production and transportation of hydrocarbon resources in Algeria in 2015
Figure 15	Conceptualising the natural gas value chain
Figure 16	Conceptualising the LNG value chain
Figure 17	Natural gas marketed production and domestic consumption in Algeria in bcm (1970-2015)
Figure 18	Trends of Algerian hydrocarbon exports in percentage (1960-2000)
Figure 19	Evolution of Algeria's natural gas exports in bcm (1979-2015)
Figure 20	Algeria's regional cross-border gas pipelines (2015)
Figure 21	Natural gas production and consumption in Italy in bcm (1970-2015)
Figure 22	Natural gas consumption in Spain in bcm (1970-2015)
Figure 23	Natural gas consumption in France in bcm (1970-2015)
Figure 24	Natural gas imports and exports in France in bcm (2010-2015)
Figure 25	Foreign Value Added (FVA) component in all Algerian industries and the Algerian hydrocarbon (natural gas industry), 1990-2015
Figure 26	Foreign and domestic value-added trade in Algeria's hydrocarbons (natural gas industry). Algeria's position in the hydrocarbons (natural gas) GVC, 1990-2015
Figure 27	GVC participation of Algeria, Qatar and Nigeria's hydrocarbons (gas industry), 1990-2015
Figure 28	Accumulation of Foreign Value Added (FVA) component in hydrocarbons (natural gas industry) of Algeria, Italy, Spain and France, 1990-2015
Figure 29	Accumulation of Indirect Value Added (DVX) component in hydrocarbons (natural gas industry) of Algeria, Italy, Spain and France, 1990-2015
Figure 30	GVC Participation of hydrocarbons (natural gas industries) of Algeria, Italy, Spain and France (1990-2015)
Figure 31	Participation and position indicators in hydrocarbons (natural gas industries) GVC for Norway, Qatar and Algeria (1990-2015)
Figure 32	Scatter plot of GVC participation vs. Rent to GDP
Figure 33	Predicted vs. Actual Values for Rent-to-GDP

List of tables

Table 1	Hydrocarbon exports and revenues in Algeria (1960-1971)
Table 2	Exports of primary energy in Algeria (1980-2005)
Table 3	Algeria's current account balance and total debt service (1984-1989)
Table 4	Main natural gas upstream projects in Algeria (1991-2015)
Table 5	Number of hydrocarbon discoveries in Algeria (2005-2010)
Table 6	Key upstream players in the Algerian hydrocarbon sector (2015)
Table 7	LNG Terminals in Algeria (2015)
Table 8	Sonatrach's portfolio of LNG long-term contracts (1963-2015)
Table 9	Sonatrach's portfolio of long-term contracts to export pipeline gas (1977-2015)
Table 10	List of LNG import terminals in Italy (2015)
Table 11	Volumes of imported natural gas by Italian entry point in bcm (2002-2015)
Table 12	Trade flow of natural gas between Algeria and Italy (1983-2015)
Table 13	List of LNG import terminals in Spain (2015)
Table 14	Volumes of imported LNG by terminal in Spain in bcm (2005-2010)
Table 15	Volumes of imported and exported natural gas by Spanish entry point in bcm (2010-2015)
Table 16	Trade flow of natural gas between Algeria and Spain (1983-2015)
Table 17	Volumes of imported and exported natural gas by French entry point in bcm (2005 and 2015)
Table 18	List of LNG import terminals in France (2015)
Table 19	Trade flow of natural gas between Algeria and France (1983-2015)
Table 20	Categorisation of energy companies (oil and gas)
Table 21	Possibility of being the lead firm among energy companies, according to category
Table 22	Who can be the lead firm in a value chain?
Table 23	Western Mediterranean's hydrocarbon (natural gas) exports decomposition (1990)
Table 24	Western Mediterranean's hydrocarbon (natural gas) exports decomposition (2015)
Table 25 A/B	Supply exposure in percentage to the Western Mediterranean value chain (1990)
Table 26 A/B	Supply exposure in percentage to the Western Mediterranean value chain (1998)
Table 27 A/B	Supply exposure in percentage to the Western Mediterranean value chain (2007)
Table 28 A/B	Supply exposure in percentage to the Western Mediterranean value chain (2015)
Table 29 A/B	Foreign demand exposure in percentage between Western Mediterranean countries (1990 and 2015)
Table 30	Characteristics of natural gas GVC participation
Table 31	GVC participation indicator and Rent to GDP of the largest natural gas exporting economies
Table 32	Estimates for equation 1
Table 33	Estimates for equation 1 using the GMM approach

Abstract

This PhD thesis examines the dynamics of Algeria's natural gas sector within the Western Mediterranean region, focusing on its implications for Algeria's rentier economy from 1971 to 2015. Despite Algeria's significant role as a natural gas exporter via pipelines and liquefied natural gas (LNG), the study identifies the country's limited integration into the broader natural gas value chain. This disconnection exacerbates Algeria's reliance on hydrocarbon rents, limiting economic diversification and domestic decision-making capacity.

The research adopts a regional perspective, conceptualising the Western Mediterranean as a geo-energy space shaped by cross-border natural gas transport projects and LNG trade. It highlights the interdependence among Algeria, France, Italy and Spain, tracing the evolution of these relationships against the backdrop of Algeria's nationalisation of its hydrocarbon industry in 1971 and the European Union's adoption of an Energy Union strategy in 2015. Using a comprehensive framework, this research critically reviews the traditional Theory of Rentier State and the "resource curse" thesis, which often fail to account for the interplay between domestic and international economic dynamics. To address these gaps, the research integrates insights from Global Commodity Chains (GCC), and Global Value Chains (GVC) and Global Production Networks (GPN) frameworks, particularly focusing on Algeria's role within the natural gas value chain.

The research uncovers Algeria's limited and asymmetric integration in the natural gas value chain. Despite being a leading exporter, the country remains primarily confined to upstream extraction, with limited involvement in downstream and midstream segments, resulting in disproportionately low value capture. In addition, the findings reveal that while Algeria's natural gas export volumes have risen, the majority of hydrocarbon rents continue to stem from crude oil rather than natural gas. This discrepancy is attributed to the absence of a unified international market and single pricing for natural gas, contrasting with the global oil market structure. Furthermore, the study contributes to academic literature by offering new analytical methodologies for assessing GVC participation of rentier economies, some of which have seldom been applied to the hydrocarbons sector, as well as presenting detailed data on Algeria's natural gas sector. It underscores the need for greater regional integration into the natural gas value chain to mitigate the effects of rentierism. Finally, this research argues for a shift from a confrontational, resource-based economic model to one emphasising shared prosperity, economic diversification, and deeper integration into global value chains.

Keywords: Economic Development, Hydrocarbon Resources, Theory of Rentier States, Global Value Chain, Algeria

JEL CODES: D57, L71, O13, Q35

Resum

Aquesta tesi doctoral, que es titula *L'impacte de la integració limitada del gas natural d'Algèria a la cadena de valor del Mediterrani occidental: implicacions per a la seva economia rendista (1971-2015)*, examina la dinàmica del sector del gas natural a Algèria al si de la regió de la Mediterrània Occidental, centrant-se en les seves implicacions per a l'economia rendista d'Algèria des de 1971 fins al 2015. Tot i el paper significatiu d'Algèria com a exportador de gas natural a través de gasoductes i gas natural liquat (GNL), l'estudi identifica la limitada integració del país en la cadena de valor del gas natural. Aquesta desconexió agreuja la dependència d'Algèria de les rendes dels hidrocarburs, restringint la diversificació econòmica i la capacitat de presa de decisions a escala nacional.

La recerca adopta una perspectiva regional, conceptualitzant la Mediterrània Occidental com un espai geoenergètic configurat per projectes transfronterers de transport de gas natural i el comerç de GNL. Es destaca la interdependència entre Algèria, França, Itàlia i Espanya, traçant l'evolució d'aquestes relacions en el context de la nacionalització de la indústria d'hidrocarburs a Algèria el 1971 i l'adopció de l'estratègia d'Unió Energètica per part de la Unió Europea el 2015. Mitjançant un marc analític integral, aquesta recerca revisa críticament la Teoria Tradicional de l'Estat Rendista i la tesi de la “maledicció dels recursos”, que sovint no aconsegueixen explicar la interacció entre les dinàmiques econòmiques nacionals i internacionals. Per abordar aquestes mancances, l'estudi integra perspectives dels enfocaments de les Cadenes Globals de Mercaderies (GCC), les Cadenes Globals de Valor (GVC) i les Cadenes Globals de Producció (GPN), amb especial èmfasi en el paper d'Algèria dins la cadena de valor del gas natural.

La recerca revela la limitada i asimètrica integració d'Algèria en la cadena de valor del gas natural. Tot i ser un exportador líder, aquest país continua principalment confinat a l'extracció en la fase alta de la cadena de valor, amb una participació limitada en els segments mitjans i baixos de la cadena, el que provoca una captura de valor desproporcionadament baixa. A més, els resultats mostren que, malgrat l'augment dels volums d'exportació de gas natural, la major part de les rendes dels hidrocarburs a Algèria continuen provenint del petroli enlloc del gas natural. Aquesta discrepància es deu a l'absència d'un mercat internacional unificat i d'un preu únic per al gas natural, en contrast amb l'estructura del mercat global del petroli.

Així mateix, l'estudi contribueix a la literatura acadèmica oferint noves metodologies analítiques per avaluar la participació d'economies rendistes en les cadenes globals de valor, algunes de les quals s'han aplicat poques vegades al sector dels hidrocarburs. També proporciona dades detallades sobre el sector del gas natural a Algèria. Es subratlla la necessitat d'una major integració regional en la cadena de valor del gas natural per mitigar els efectes del rendisme. Finalment, aquesta recerca defensa una transició d'un model econòmic basat en la confrontació pels recursos cap a un que posi l'accent en la prosperitat compartida, la diversificació econòmica i una integració més profunda en les cadenes globals de valor.

Paraules clau: Desenvolupament econòmic, Hidrocarburs, Teoria dels Estats Rendistes, Cadena de valor global, Algèria

Resumen

Esta tesis doctoral, que se titula ***El impacto de la integración limitada del gas natural de Argelia en la cadena de valor del Mediterráneo occidental: implicaciones para su economía rentista (1971-2015)***, examina la dinámica del sector del gas natural en Argelia dentro de la región del Mediterráneo Occidental, centrándose en sus implicaciones para la economía rentista de Argelia desde 1971 hasta 2015. A pesar del papel significativo de Argelia como exportador de gas natural a través de gasoductos y gas natural licuado (GNL), el estudio identifica la limitada integración del país en la cadena de valor del gas natural. Esta desconexión agrava la dependencia de Argelia de las rentas de los hidrocarburos, restringiendo la diversificación económica y la capacidad de toma de decisiones a nivel nacional.

La investigación adopta una perspectiva regional, conceptualizando el Mediterráneo Occidental como un espacio geo-energético conformado por proyectos transfronterizos de transporte de gas natural y el comercio de GNL. Se resalta la interdependencia entre Argelia, Francia, Italia y España, rastreando la evolución de estas relaciones en el contexto de la nacionalización de la industria de hidrocarburos en Argelia en 1971 y la adopción de la estrategia de Unión Energética por parte de la Unión Europea en 2015. Utilizando un marco analítico integral, esta investigación revisa críticamente la Teoría Tradicional del Estado Rentista y la tesis de la “maldición de los recursos”, que a menudo no logran explicar la interacción entre las dinámicas económicas nacionales e internacionales. Para abordar estas limitaciones, el estudio integra perspectivas de los enfoques de Cadenas Globales de Mercancías (GCC), Cadenas Globales de Valor (GVC) y Cadenas Globales de Producción (GPN), con especial énfasis en el papel de Argelia dentro de la cadena de valor del gas natural.

La investigación revela la limitada y asimétrica integración de Argelia en la cadena de valor del gas natural. A pesar de ser un exportador líder, el país sigue estando principalmente confinado a la extracción en la fase superior de la cadena de valor, con una participación limitada en los segmentos medios y bajos de la cadena, lo que resulta en una captación de valor desproporcionadamente baja. Además, los hallazgos muestran que, aunque los volúmenes de exportación de gas natural han aumentado, la mayor parte de las rentas de hidrocarburos en Argelia continúan derivándose del petróleo en lugar del gas natural. Esta discrepancia se debe a la ausencia de un mercado internacional unificado y de un precio único para el gas natural, en contraste con la estructura del mercado global del petróleo.

Asimismo, el estudio contribuye a la literatura académica al ofrecer nuevas metodologías analíticas para evaluar la participación de economías rentistas en las cadenas globales de valor, algunas de las cuales rara vez se han aplicado al sector de los hidrocarburos. También proporciona datos detallados sobre el sector del gas natural en Argelia. Se subraya la necesidad de una mayor integración regional en la cadena de valor del gas natural para mitigar los efectos del rentismo. Finalmente, esta investigación aboga por una transición de un modelo económico basado en la confrontación por los recursos hacia uno que enfatice la prosperidad compartida, la diversificación económica y una mayor integración en las cadenas globales de valor.

INTRODUCTION AND OBJECTIVES

This thesis was conducted under the Interuniversity PhD Programme in Economic History formed by the University of Barcelona (UB), the University Carlos III of Madrid and the University of Valencia in its line of Growth, economic integration and inequality. The thesis was supervised by Dr Aurèlia Mañé-Estrada from the Department of Economic History, Institutions, Policy and World Economy at the UB, full professor in the Faculty of Economics and Business at this university.

The general hypothesis of this PhD thesis is the following: **despite the steady outflow of natural gas exports via pipeline and liquefied natural gas (LNG) from Algeria to most Western Mediterranean countries, the characteristics of Algeria's rentier economy have been further exacerbated by its limited integration into the broader natural gas value chain.**

There is no doubt for academic research of the relevant role played by natural gas in the last forty years as a crucial energy source in the economic and energy systems, contributing significantly to energy supply and security. As a versatile and relatively cleaner fossil fuel (BP Statistical Review of World Energy, 2023; IEA, 2016), it is used for electricity generation, heating, and as an industrial feedstock. Its strategic relevance stems from its ability to provide a reliable and flexible energy source that can quickly respond to fluctuations in demand, making it essential for balancing intermittent renewable sources of energy (IEA, 2016). Additionally, natural gas-fired power plants emit less carbon dioxide while maintaining energy reliability. The growing adoption of LNG has also enhanced global gas trade, enabling regions without direct pipeline connections to access natural gas supplies.

From an energy security perspective, natural gas can be critical in reducing vulnerabilities associated with energy supply disruptions. Countries that have access to domestic gas reserves or multiple supply routes via pipelines or LNG imports are better insulated from geopolitical risks. However, gas supplies are subject to geopolitical influence, particularly in regions without their own endowment of natural gas and heavily dependent on few suppliers from abroad, which has fostered investments in infrastructure, such as LNG and regasification terminals, as well as

the development of natural gas pipelines. Overall, the latter has triggered relations of interdependence between natural gas producing and consuming countries that have not been analysed in depth so often by academic research.

This PhD thesis focuses on the natural gas sector in the Western Mediterranean,¹ envisioned as a regional *geo-energy space* (Mañé-Estrada, 2006), shaped by transnational and cross-border natural gas transport projects alongside substantial LNG trade flows. These developments have fostered a network of energy relationships and physical linkages involving various public and private actors from Algeria, France, Italy, Morocco, Portugal, Spain and Tunisia. It covers the timespan 1971 to 2015, with February 1971 as the date when the Algerian hydrocarbon industry came fully under government control with the nationalisation of all foreign territorial rights and resource assets, which were transferred to the Algerian public company Sonatrach;² and with February 2015 as the date on which the European Commission adopted its strategy to achieve a resilient Energy Union that encompasses a secured, diversified, efficient and interconnected energy community (EC, 2015). In this vein, the starting point of the research (1971) signals the momentum with which Algeria culminates the process of reclaiming control over its hydrocarbon assets. Thus, it is coherent from the research perspective as it allows us to understand how hydrocarbon rents are starting to accrue to the Algerian state and what implications the latter entail for the Algerian economy. Similarly, the end point of the research (2015) coincides with the adoption by the EU of its Energy Union, in which the question of the energy dependence on external suppliers (particularly Russia) emerges as a central element of this strategy, and the role that Algeria plays in this configuration becomes highly strategic.

¹ From an institutional standpoint, the geopolitical term “Western Mediterranean” brings together 10 countries, five from the north Western and five from the south Western Mediterranean. For the purposes of this research thesis, the term “Western Mediterranean” refers to a regional *geo-energy* limited space built upon transnational and cross-border natural gas transport projects and significant LNG trade flows, which have led to a set of energy relationships and physical interconnections amongst different public and private agents from Algeria, France, Italy, Morocco, Portugal, Spain and Tunisia.

² Sonatrach, Algeria’s state-owned enterprise, is the largest oil and gas company in both the country and the African continent. Its activities span exploration, production, pipeline transportation, and the marketing of hydrocarbons and their derivatives. As part of its diversification efforts, Sonatrach has increased investments in power generation, renewable and alternative energy sources, water desalination, and mining exploration and development. On the international front, the company conducts operations across various regions, including Africa (Mali, Niger, Libya and Egypt), Europe (Spain, Italy, Portugal and the United Kingdom), Latin America (Peru), and the United States. Apart from being the world’s eleventh-biggest oil producer, Sonatrach is also the fourth-biggest global LNG exporter, the third-largest LPG exporter and the sixth-biggest gas exporter.

It is worth noting that to date and beyond the period covered by this research thesis, at least two very meaningful geostrategic events have taken place in direct connection with the theme being researched. The first one dates back to October 2021, when the Maghreb-Europe Gas Pipeline ceased to operate after Algeria unilaterally decided to close it as a result of a deterioration of political relations between Algeria and Morocco. In 2022, Spain partly re-opened it to supply gas to Morocco. The second major geopolitical shock was the Russian aggression against Ukraine, which began in 2014 but escalated in February 2022, triggering profound and far-reaching consequences in the global energy field, particularly for Europe, including a severe supply shock as Russia has historically been Europe's largest supplier of natural gas. This situation has posed the need to quickly diversify the imports of natural gas to reduce Europe's reliance on Russian gas. In this new strategy, Algeria is perceived as a reliable and strong supply partner, and this has had consequences in the Western Mediterranean.

There is a chronological parallelism between the surge of the natural gas sector in the Western Mediterranean and the setting up of the post-colonial Algerian economy in the late 1960s and early 1970s, which led to the accretion of a series of cross-border and regional relationships of dependence between Algeria and other countries in the Western Mediterranean (Albinyana & Mañé-Estrada, 2018). Although the first natural gas discoveries in Algeria occurred in 1956, during the 1960s and most of the 1970s, the Algerian natural gas industry did not fully develop until the 1980s. However, after the 1971 nationalisation of hydrocarbon resources in Algeria, the economy took advantage of its membership of the Organization of the Petroleum Exporting Countries (OPEC) by heavily relying on revenues generated by hydrocarbon exports. The latter not only triggered an increasingly financial dependence on the foreign economic rents generated by this industry and a bad economic performance, but also curtailed its decision-making capacity to take decisions at the domestic level.

The academic literature within the discipline of development economics has often relied on the "resource curse" thesis (Auty, 1986, 1993, 2001; Gelb et al., 1988; Ranis, 1991; Bulmer-Thomas, 1994; Lal & Myint, 1986; Sachs & Wener, 1995, 1997, 1998; Luong & Weinthal, 2006; Rosser, 2006; Frankel, 2012) and more specifically for the Arab states on the Theory of the Rentier State (TRS) (Mabro, 1969; Mahdavi, 1970; Beblawi & Luciani, 1987; Beblawi, 1990; Luciani, 1988, 1994, 1995; Sid Ahmed, 1980, 1995; Anderson, 1987) to underpin the political economy of hydrocarbon-abundant economies like Algeria. Nonetheless, part of the academic literature

seems to neglect the fact that for the rentier state to exist, rent needs to be generated by the exploitation of the hydrocarbon industry in a unified international market (or great pool), and it must accrue to the state, as only then will the state be able to distribute this rent within the domestic economy. This leads to a decoupling of two juxtaposed dimensions, one external (or foreign) and one internal (or domestic), which have not always been properly combined and embraced by the academic literature.

Statement of the problem. The TRS, albeit a useful description rather than explanation of a phenomenon (Mañé-Estrada & Albinyana, 2023), is reductionist (Talahite, 2012) as it tends to consider the totality of revenues redistributed by the state as a rent, assimilated to hydrocarbon rent: it tends to mix the cause (rents generated in the international market) and the effects (rents generated in the domestic market), and also considers the rents accruing from the international markets as “flows like manna from heaven” (Beblawi & Luciani, 1987:9). It is precisely the understanding that power is being constrained by the international oil governance framework that brings this research to suggest the incorporation of other theoretical frameworks as a way to complement the resource curse thesis, the TRS and other literature referring to hydrocarbon-rich economies such as the Dutch disease (Corden & Neary, 1982; Gelb, 1988; Gylfason, 2004).

One of the schools of thought that has dared to question this absence of a relational articulation between domestic political dynamics and global economic dynamics is the Manchester School’s approach of Global Production Networks (GPN) applied to the extractive sector (Bridge, 2008:389-419). Henderson et al. (2002) define global production networks as the “globally organised nexus of interconnected functions and operations by firms and non-firm institutions through which goods and services are produced and distributed.” The concept has many predecessors, ranging from Global Commodity Chains (GCC) (Hopkins & Wallerstein, 1979; Gereffi & Korzeniewicz, 1994) to Global Value Chains (GVC) (Kaplinsky & Morris, 2002).

Hence, this research thesis aims to go beyond the various contemporary theoretical frameworks that focus on the challenge of development of hydrocarbon-rich economies given that they are heavily rooted in national paradigms of development, and this suggests at least two underlying tensions in the theoretical frameworks of the natural gas value chain and production network in the Western Mediterranean. The first tension lies in the relation between the owners of the

natural resources, meaning the Algerian state – and its National Oil Company (NOC),³ Sonatrach –, and the international or regional companies – the international and regional oil companies (IOCs/ROCs)⁴ – that intend to exploit these resources, and how this tension has prompted much of the dynamism when shaping the emergence of an energy space in the Western Mediterranean. The second tension is related to the distribution of the value between producers (both states and companies), transit countries, and consumers. This distribution is a function of the relative power exerted by the different actors that intervene in the value chain and production network of natural gas and is affected by the contractual policy, prices, the costs of extraction and transportation, and so on.

As regional,⁵ national and local economies, and companies and individuals embedded in the natural gas value chains have come into closer contact through trade, the complexity of the analytical problem has increased. Institutions – public and private –, rules set up by states, and regional and multilateral organisations have substantial power to alter this relational nature. Against this backdrop, the extensive literature on the challenges of hydrocarbon-rich economies like Algeria is often limited by the overflow of the nation-state into increasing cross-border and regional relations of interdependence. Indeed, there is a tradition of national-scale models of analysis that triggers questions about the transnational organisation of production and commercialisation in the background.

This reality recommends coupling the aforementioned traditional literature on rentier states with new analytical frameworks that place at its core focus the concern with regionally inter-organisational relationships that underpin the power and value dynamics therein. In this context, this thesis is based on the premise that greater shared prosperity, stability, and improved

³ National Oil Company (NOC) is a commonly used term to refer to state-owned upstream companies, which might also engage in midstream activity, and which serve as an instrument of national, public intervention with the main objective of generating as much national income as possible for the producer country. With the passing of time, some of these companies have become transnational, and thus have been used as instruments to gain power on the regional or international stage (World Bank, 2009).

⁴ International or Regional Oil Companies (IOCs or ROCs), or Private Oil Company (POC), are commonly used terms to refer to large, integrated, private and transnational energy companies that are clustered around the International Energy Agency (IEA). Their main objective, like most private companies, is to obtain as much profit as possible (World Bank, 2009).

⁵ Throughout this research thesis we use the term “regional” to define a particular part of the world, a collection of countries united by a shared sense of identity, and sometimes purpose, accompanied by the establishment and enforcement of institutions and rules that reflect that identity.

developmental objectives can be achieved with more integration into a natural gas value chain (Kowalski et al., 2015; Tran et al., 2020), and it is therefore preferable to a business-as-usual scenario of confrontation. Similarly, this research not only refers to the extent to which an economy participates in the GVC configuration, but also the nature of such participation in a GVC by trying to examine the symmetry of this integration. While a limited integration into a natural gas value chain would mean that the country is mainly involved in resource extraction and not so much in downstream activities like refining, marketing or advanced processing, an asymmetric integration would reflect that the country is deeply embedded in raw gas supply but gains disproportionately less value compared to countries handling downstream refining, distribution and marketing in the GVC.

Main contributions to the academic literature. This research offers three key contributions to the academic literature. First, it reveals that the majority of hydrocarbon rents accruing to the Algerian state during the period examined – approximately 85% on average – were derived from crude oil rather than natural gas. This finding stands in stark contrast to production and export data, which suggests a more balanced contribution from both resources. In the 1990s, the shares of natural gas and crude oil in Algeria’s production and exports were roughly equivalent (Mañé-Estrada, 2009). However, by the year 2000, natural gas export volumes surpassed those of crude oil (BP Statistical Review of World Energy, 2016). Despite this shift, the value of natural gas exports and the rents they generated for the state have consistently lagged behind those of crude oil (OPEC Statistical Bulletins and World Bank Database, 2016).

The underlying reason is the absence of a unified international market and single price for natural gas, conditions that have been met for crude oil since the 1970s. The establishment of a global crude oil price allowed Algeria to secure substantial oil rents. In contrast, natural gas exports, lacking these market structures, have not yielded comparable rent levels. This explains why, despite Algeria’s increasing prominence as a natural gas exporter, as discussed in the research, the country continues to derive the majority of its hydrocarbon rents from oil rather than natural gas.

The second key contribution of this research lies in the insights derived from an in-depth analysis of the natural gas value chain, utilising the EORA global supply chain database. This database employs a multi-region input-output (MRIO) model, offering a time series of high-resolution

intersectoral transfer data. It includes a balanced global MRIO table that documents interactions across 15,909 sectors in 194 countries, spanning the period from 1990 to 2015.

Through extensive calculations, the research reveals Algeria's limited integration into the global natural gas value chain, particularly when compared to other Western Mediterranean countries. Despite Algeria's status as a leading natural gas exporter in the region, this position has not been translated into meaningful integration into the natural gas value chain, highlighting a significant disconnect between its primary export prominence and its role within the broader value-added network, thus exacerbating the character of Algeria as mono-exporter country of primary energy.

The third contribution of this research lies in advancing the methodological debate surrounding the notions of rentierism and interdependence. By intersecting the degree of integration into a GVC with the rentier nature of an economy, this thesis provides a new perspective that has often been overlooked in academic discourse. While much of the existing literature has concentrated on the broader economic implications of GVC participation, particularly its role in fostering economic diversification, there has been relatively little focus on how this integration impacts rentier economies specifically.

Objectives of this study. Based on these original contributions, this research aims to respond to this need: it proposes an in-depth analysis of the natural gas value chain in the Western Mediterranean with the aim of determining the consequences for Algeria as a hydrocarbon rentier economy. What are the specific objectives?

1. To conduct a critical review of the existing literature of development economics applied to hydrocarbon-abundant economies, particularly those that integrate frameworks emphasising regionally interconnected organisational relationships and the structuring of fragmented production on regional and global scales. This review will enable us to identify and propose new quantitative and qualitative methodologies that effectively address the research question, offering a more comprehensive understanding of the dynamics at play.
2. To better substantiate how and why Algeria has become a rentier economy since its independence in 1962, and particularly since the country's membership of OPEC in 1969 and the nationalisation of its hydrocarbon industry in 1971, by looking into the evolution

of its hydrocarbon industry (laws, institutions, policies) and the role of natural gas in this economy.

3. To detail the unfolding of the natural gas value chain in the Western Mediterranean, this analysis examines the emergence of cross-border and transnational relationships of dependence, along with the diverse public and private actors, formal and informal institutions, and infrastructure integrated within the chain, all of which are systematically identified. These relationships of dependence are also qualitatively assessed.
4. To determine the degree of integration of both public and private agents into the natural gas value chain by utilising both quantitative and qualitative tools in order to better assess how this integration has been shaped and has impacted the rentier nature of the Algerian economy.

These four main objectives of the PhD thesis determine four main chapters as follows:

CHAPTER 1: Theoretical Framework and Methodology

CHAPTER 2: Dissecting the Historical Evolution of Algerian Natural Gas in the Construction of a Rentier Economy

CHAPTER 3: A Comprehensive Overview and Understanding of the Natural Gas Value Chain in the Western Mediterranean

CHAPTER 4. Value Chain Analysis: Implications and Effects for Algeria as a Rentier Economy

Chapter 1, which was partly published as an article in the *UNISCI Journal* under the title **Energy interdependence: the linkage of the political economy of Algeria's natural gas with that of the Western Mediterranean region. A methodological approach** (Albinyana & Mañé-Estrada, 2018), outlines a critical review of the main theoretical frameworks and methodologies underpinning this research thesis. It mostly explores the so-called problem of hydrocarbon-rich economies or resource curse within the discipline of development economics, and among them the TRS that is often applied to hydrocarbon-rich Arab economies like Algeria. Moreover, the chapter suggests complementing the latter's theories with other schools of thought (GCC, GVC and GPN) that aim to address the absence of a relational articulation between the domestic

political dynamics and the global and regional economic dynamics, which is instrumental in this research thesis.

This chapter was prepared by reviewing more than 60 existing monographies and articles of very distinct disciplines and schools of thought (development economics, rentierism, GCC, GVC and GPN), thanks to which a methodology was later defined to be applied in Chapter 4 of the thesis. This new quantitative methodology, based on the previous works of Hummels et al. (2001), Koopman et al. (2011 and 2014), Foster-McGregor et al. (2016), Antràs et al. (2012), Del Prete et al. (2016), Ayadi, Giovannetti et al. (2021), Pahl et al. (2021), World Bank (2014) and Borin (2019), has not been previously applied to the study of hydrocarbon value chains and provides guidance by measuring the extent of GVCs and of agents' involvement in such chains, and eventually of individual countries, with the use of international Input-Output (IO) tables. Moreover, in order to obtain data for the figures set out in Chapter 1, a number of databases have been accessed (World Bank database, BMI Research, BP Statistical Review of World Energy), some of which can be accessed freely while others are subject to a fee.

Chapter 2 looks at the historical evolution of the Algerian hydrocarbon industry and its role in the economic development as a rentier country. This chapter probably contributes less to the genuine research of the thesis, but is key to understanding the underlying reasons behind the unfolding of the natural gas value chain, as Algeria is the only existing natural gas producing country in the Western Mediterranean. In preparing this chapter, more than 30 existing monographies and articles have been reviewed in order to understand Algeria's colonial and post-colonial legacy, as well as the different policies steered by the successive administrations, paying significant attention to the role that hydrocarbons have played in the country.

In addition, an important number of databases and time series have been accessed in paper format (OPEC Statistical Bulletin, Petroleum Economist), electronic format (BP Statistical Review of World Energy, IEA, Cedigaz, Algeria's Ministry of Energy, Algeria's Ministry of Finance, and World Bank database) and for payment (CEIC data, Cedigaz). It is worth mentioning that, while during the research process we have emphasised accessing reliable and robust data in the realm of hydrocarbons, especially from public NOCs and private IOCs, it is particularly difficult considering the opaqueness through which these agents normally operate. The latter explains why other intermediary companies offer this data for payment.

Chapter 3 describes the historical unfolding of the natural gas value chain in the Western Mediterranean by looking separately into the three segments of the chain: the upstream segment, mainly developed in Algeria with a key role performed since 1971 by the Algerian NOC Sonatrach but also by other IOCs since the moment that the Algerian hydrocarbon law allowed it in 1991; the midstream segment with the evolution of the two activities involved in the value chain, namely the LNG industry and the cross-border gas pipelines across the Western Mediterranean; and, finally, the downstream segment, examining the surge of the natural gas consuming markets in the three countries better integrated in the chain: Italy, Spain and France, as well as their natural gas trade relations with Algeria. In order to qualitatively analyse these relations of dependency, a methodology established by Mañé-Estrada et al. (2012) is used in the case of the Western Mediterranean natural gas chain.

This chapter is definitely more analytical and contributes to the literature with new tables and comprehensive data that encompasses:

- a) an exhaustive list of the natural gas upstream projects in Algeria (1991-2015), in which foreign companies already participate after the legislative reforms of 1991
- b) Sonatrach's portfolio of LNG long-term contracts (1963-2015)
- c) Sonatrach's portfolio of long-term contracts to export pipeline gas (1977-2015)

These three very exhaustive tables that contain meaningful information contribute decisively to the literature given that the existing information is scattered in numerous reports, monographies, yearbooks and press releases issued by the Algerian NOC and the private IOCs. Most data contained in these tables has been obtained from various sources, on paper (Petroleum Economist and monographies) and electronic format with free access but mostly for payment (CEIC data, Cedigaz, BMI Research).

Other tables in the chapter contribute to the literature by showing a detailed list of natural gas infrastructures in Algeria, Italy, France and Spain, as well as time series data on the trade flow of natural gas between Algeria and the other Western Mediterranean economies examined in this research.

Chapter 4, which was partly published in an article in the French journal *Revue internationale des études du développement* under the title **Revisiting Rentierism through the Lens of Algerian Gas** (Mañé-Estrada & Albinyana, 2023), concludes the research carried out throughout this thesis by conducting not only qualitative analyses but reflecting on the results of quantitative and evidence-based exercises that provide a test of the hypothesis announced in the beginning of this work. The chapter analyses in-depth the nature of the natural gas value chain in the Western Mediterranean to determine the degree of symmetry in the integration of the various agents embedded in the gas chain and discusses the results, while offering a perspective on the relationship between this integration into the gas chain and the evolution of Algeria as a rentier economy.

In order to carry out the first part of the quantitative analysis, we have used the EORA global supply chain database that consists of an MRIO table model that provides a time series of high-resolution IO tables with a balanced global MRIO table documenting the inter-sectoral transfers amongst 15,909 sectors across 194 countries for a complete time series from 1990 to 2015. This has obliged us to work and carry out extensive calculations, which had never been done before for the case of Algerian gas sector, but it has also allowed us to obtain multiple results that certainly contribute to the literature and the results of the thesis.

For the second part of the quantitative analysis carried out in this chapter, dynamic panel data has been formulated for which data has been obtained from the previous calculations in the first part of the quantitative analysis (GVC indicators) and from the World Bank database for the indicator on hydrocarbon rent to gross domestic product (GDP).

In order to complement the theoretical and most empirical part of the research that has given way to these four chapters on which the thesis is structured, a number of in-person interviews were conducted during the preparation of this thesis, as follows:

- **Gonzalo Escribano**, Head of the Energy and Climate Programme, the Elcano Royal Institute. Madrid, 30 March 2017
- **Houda Allal**, Director, Observatory for Mediterranean Energy (OME). Paris, 28 May 2018

- **Sohbet Karbuz**, Director of Hydrocarbons and Energy, Observatory for Mediterranean Energy (OME). Paris, 28 May 2018
- **Réda Bouchair**, Strategy Division, Sonatrach. Algiers, 28 June 2018
- **Luis Óscar Moreno García-Cano**, Director General for Economic Diplomacy at the Ministry of Foreign Affairs, European Union and Cooperation. Madrid, 13 October 2021
- **Fatiha Talahite**, former senior researcher at the Centre national de la recherche scientifique (CNRS). Paris, 14-15 December 2021
- **Saïd Souam**, professor at the University of Paris Nanterre and researcher at the Centre national de la recherche scientifique (CNRS). Paris, 14-15 December 2021
- **Filippo del Grosso**, Head of the Research Unit, Fondazione Eni Enrico Mattei. Tunis, 24 June 2024
- **Ramses Ninou**, Operations and Maintenance Coordinator, Enagas. Barcelona, 27 November 2024

This PhD thesis concludes with a final chapter that synthesises the key findings from the four preceding chapters. This concluding chapter not only summarises the main insights and takeaways derived from each chapter but also seeks to validate the hypothesis by offering empirical evidence and analysis of the interplay between rentierism and participation in GVCs. Ultimately, this research advances understanding of how GVC participation can serve as both a challenge and an opportunity for rentier economies seeking sustainable pathways to economic transformation.

CHAPTER 1: Theoretical Framework and Methodology

CHAPTER 1: Theoretical Framework and Methodology

1.1 Introduction

This chapter aims to dissect the theoretical framework and methodology underpinning this research thesis. It begins by looking into the evolution of the governance of the international hydrocarbon industry (section 1.2), as it is relevant to understand how the natural gas industry flourishes in the shadows of such a governance framework of the oil industry. With that in mind, we go on to describe the large body of research literature (section 1.3) that since the first half and more intensively the second half of the 20th century has attempted to explain how and why hydrocarbon-rich economies have developed. Out of the latter, we examine two main bodies of literature that become instrumental in our analysis of the unfolding of the Algerian hydrocarbon economy to be elucidated in Chapter 2, such as the “big push” (Rosenstien-Rodan, 1943) and the notion of the “rentier state” (Mahdavi, 1970; Beblawi, 1987) as a cause of the economic phenomena of the resource curse (Auty, 1993), and which has paved the way to evolved concepts like the Theory of the Rentier State (TRS).

Following this analysis on the overall literature that exists on this matter, the chapter considers its core part (section 1.4): for the rentier state to exist, rent needs to be generated by the exploitation of the hydrocarbon industry at a unified international market, it must accrue to the state, and only then will the state be able to distribute this rent within the domestic economy. This leads to a decoupling of two dimensions that are juxtaposed, one external (or foreign) and one internal (or domestic), which have not always been properly combined and embraced by the academic literature. However, this is precisely what part of this research thesis is about when applying this juxtaposition to the case of the Algerian gas industry and its particular relation with the regional (and global) gas market.

In order to assess the nature of the linkage between the global (and regional) with the domestic dimensions of any natural gas industry, this chapter proposes the use of theoretical approaches initiated by Hopkins and Wallerstein (1979), Porter (1982), and Henderson (2002) and the Manchester Business School based on their Global Commodity Chain (GCC), Global Value Chain (GVC) and Global Production Network (GPN) (sections 1.5, 1.6, 1.7 and 1.8). These tools used in Chapters 3 and 4 of the research thesis allow us to infer the degree of integration

and power asymmetry along the chain, and ultimately assess how the latter have an impact on the rent accruing to the state.

1.2 Introduction to the evolution of the governance of the international hydrocarbon industry

The flourishing of the natural gas industry happened in the shadows of the established international governance framework of the oil industry. This is due to the fact that the oil industry has been the preeminent and dominant pillar within the hydrocarbon sector, and it is not until the last quarter of the 20th century that the gas industry started to increase the pace of production. Arguably, by understanding the evolution of the governance of the international oil industry, we will better understand the context in which the natural gas industry expanded.

According to Mommer (1999), throughout the 20th century the governance of the international hydrocarbon industry, that is the set of political and legal rules based on power relations, can be divided into three periods in accordance with the dominance of one of the three actors involved: the owners of the International Oil Companies (IOCs), i.e, private agents; the states that own the National Oil Companies (NOCs), i.e., landlord states; and the consuming countries. In each of these three periods the dominant actors altered the rules to their advantage.

In the first period, which lasted until 1950, the governance of the industry was dominated by international tenant companies (Mommer, 1999), backed by the European powers and the United States, which could control the level of production, keep prices very high, and thus capture most of the economic rents. With the exception of the United States, most powerful countries had to look for concessions elsewhere, mainly in colonies or dependent territories. The tenant companies often managed to enforce considerably long-term contracts with fixed royalties or payments to the embryonic landlord states (those endowed with hydrocarbon reserves), which brought enormous profits to those companies, while depriving the sovereign rights of the landlord states (Mommer, 1999).

In the second period, from 1950 to 1970, oil-exporting countries, many of which had recently turned independent and had become aware of the potential riches of their lands, accepted the view that the relationship between landlord states and IOCs must be subordinated to the objective of national development, and therefore existing contractual schemes must evolve to

respect sovereign rights of the former. Notably, as all hydrocarbon exporting countries were subject to a similar scheme of profit sharing with the same international companies, collective action was relatively easy to achieve (Mommer, 2000). Consequently, in 1960 the Organization of the Petroleum Exporting Countries (OPEC) was established. The first actions promoted by OPEC focused on price policy, fiscal mechanisms and control of production. Oil prices had fallen sharply during the 1960s due to an increase of competition originating from new market entrants or the emergence of new producing countries, the decline in the demand for imports from the US or Europe, and even a general decrease in production costs. As OPEC members came to the conclusion that it was not possible for them to control prices, they tried to agree with the tenant companies on an increase of their profit shares to a minimum of 60 percent, in spite of the fact that by the end of the 1960s international tenant companies still controlled 80 percent of the global exports of oil and gas (Chevalier, 1974).

The adoption in 1962 of a Resolution on “Permanent Sovereignty over Natural Resources” by a majority of developing countries of the United Nations General Assembly⁶ paved the way for the hydrocarbon industry to claim a bigger participation in the value chain, in particular in the upstream phase, which was a very effective means to control production levels and prices. Indeed, by the end of the 1960s the governance of the hydrocarbon industry was on the brink of collapsing as a result of OPEC oil becoming more important to the world economy. This is the main reason why in the early 1970s most hydrocarbon exporting countries⁷ decided to take over the foreign tenant companies, thus converting these foreign companies into operating companies and facilitating the accession of locally-produced oil and natural gas to international markets, when they used to be solely traded across the markets of the former colonial rulers. Alongside these reasons of political economy, geopolitical rivalries also triggered the collapse in 1970 of the previous energy governance framework and its replacement by a new one. These major geopolitical rivalries encompassed the closing of the Trans-Arabian Pipeline⁸ and the

⁶ UN General Assembly Resolution 1803 (1962), which reads “Except as otherwise provided for in the legal system of a Member Country, all disputes arising between the Government and operators shall fall exclusively within the jurisdiction of the competent national courts or the specialised regional courts, as and when established.”

⁷ It was the case of producing countries like Algeria, Iraq, Libya and Venezuela, which sought to take full control of production in order to revert the economic rents generated by the industry into the economic development and modernisation of their respective countries (Chevalier, 1974).

⁸ The Trans-Arabian Pipeline (Tapline) was an oil pipeline from Qaisumah in Saudi Arabia to Sidon in Lebanon, which in 1969 transported around 17 percent of Saudi production through Jordan, Syrian and Lebanon to the Mediterranean to supply Western Europe. Since the 1967 Six-Day War, the section of the pipeline which runs

reduction of oil production by the new Libyan authoritarian leadership,⁹ which triggered a severe shortage on the supply side (Chevalier, 1974).

The effects of the 1970-71 crisis were unequal for the three groups of actors involved; whereas the exporting countries reported a considerable surge in hydrocarbon prices, which prompted a drastic increase in the accrued economic rents,¹⁰ the importing countries suffered a considerable increase in energy prices, and thus a loss of competitiveness and an increase in prices of their manufactured goods.¹¹ As for the IOCs operating on the global stage, the crisis resulted in a surge in prices imposed on end consumers.

Similarly, the 1971 crisis was not a conjunctural one but literally swept away the previous energy governance: from decreasing to increasing costs in the hydrocarbon industry, which severely hit energy prices in the developed economies and resulted in large windfall revenues accrued by the hydrocarbon-abundant developing economies that had nationalised their hydrocarbon sector with the aim of obtaining the maximum of those revenues in order to utilise them for development purposes. It was the beginning of the use of the hydrocarbon industry as an instrument of economic and public policy intervention.

The counterpart of this development was the change in regime and in the power relations within the framework of the international governance framework of the oil industry (Palazuelos, 2009), resulting from the reconfiguration of OPEC and the change in the ownership regime of the fields following nationalisation in the producing countries. And, in parallel, the consequence of the creation in 1973 by the US administration of the International Energy Agency (IEA), in the

through the Golan Heights came under Israeli occupation, though the Israelis permitted the pipeline's operation to continue. After years of constant arguing between Saudi Arabia and Syria and Lebanon over transit fees, the emergence of oil super-tankers, and pipeline breakdowns, the section of the line beyond Jordan ceased operation in 1976. In May 1970 the flow was interrupted through the pipeline causing major damage in the supply to Western Europe.

⁹ Libya took over from Algeria in 1964 as the first African oil producing country. In 1969 Libya became the first world oil exporting economy, but with the ascent to power of Mohammad Gaddafi in 1969 a change of policy began and in 1970 all hydrocarbon distributing companies became nationalised. One of the first reactions was a heavy decrease in the production of oil, which severely shortened the supply to Western Europe. Algeria was not an alternative option at that time due to the intransigent attitude of its government after the nationalisation of 1971.

¹⁰ As a matter of fact, before nationalisation of the industry in 1970, Algeria reported a rent of 88 cents of USD per oil barrel produced, whereas in 1973 rents had increased to USD 9 per barrel produced.

¹¹ For the United States the situation was particularly different given that the crisis allowed a revaluing of its own oil production, which could only be profitable at a certain price.

framework of the Organisation for Economic Co-operation and Development (OECD), which grouped the companies and the governments of the so-called consuming countries.

This reconfiguration had several outcomes. One of them was the re-alignment of international crude oil prices with American prices (Chévalier, 1974). Indeed, when the period of the “energy crisis” was over, the benchmark price of crude oil in the US – the West Texas Intermediate (WTI) – was already quite similar to the price of Brent crude oil, which paved the way for the unification of the oil market (Mañé-Estrada, 2016). Hence, in this span of time, conditions were created for the emergence of an international oil rent, which meant that oil produced in countries rich in hydrocarbons could be sold at the price of North Sea oil. The latter triggered an “appropriate” rent generation that started providing the producing countries with “sufficient” national rent and the IOCs with “adequate” profits (Mommer, 2000).

One of the regions in the world characterised by its unusually large scale of rent flows and its extreme dependence on them are the Middle East and North African (MENA) economies since the discovery of massive hydrocarbon reserves in the 1950s (Yousef, 2004; El Badawi, 2005). Since then the economies in the region have been classified in the economic literature along two lines: resources and labour, so that one might encounter (1) natural resource-abundant and labour-scarce economies, but also labour-abundant, some of which might be (2) natural resource-rich and others (3) natural resource-scarce.¹² The political economy dynamics have traditionally underpinned three categories of distinct types of economy when classifying the region by rent endowments: capital-surplus oil exporters, capital-scarce oil exporters, and resource-poor labour surplus economies (AfDB, 2015).

During the so-called first “oil shock”¹³ (1973-1980) all three groups of economies favoured the use of hydrocarbon revenues as an instrument of public policy intervention by allocating rents that undermined markets and competitive structural change, even if the development strategies

¹² The first group could encompass countries such as those in the Gulf and Libya, the second group countries like Algeria, and the third group other countries like Egypt, Syria and Morocco.

¹³ In October 1973, an oil crisis emerged when OPEC members imposed an embargo on countries perceived to have supported Israel during the Yom Kippur War. Initially targeting Canada, Japan, the Netherlands, the United Kingdom, and the United States, the embargo was later extended to include Portugal, Rhodesia, and South Africa. By the time the embargo ended in March 1974, global oil prices had surged nearly 400 percent, from USD 3 per barrel to nearly USD 12. This escalation triggered an oil crisis, or “shock,” with significant short- and long-term global impacts, including stagflation. Referred to as the “first oil shock,” it was followed by the “second oil shock” during the oil crisis of 1979.

differed across the various categories of economies. Nevertheless, the next “oil boom”, which began in the 1990s, led to a slightly different strategy by encompassing moderate responses to the windfall revenues accruing from the higher rents generated by the exploitation of the hydrocarbon industry. Indeed, some Arab countries, albeit not the case for Algeria, increased savings to channel them to reduce public debts, as data shows that total debt from Arab countries fell from 50 percent to 17 percent of GDP in the 2000-2007 period when hydrocarbon revenues increased by four (World Bank, 2015).

Overall, the surge in hydrocarbon revenues indicates that one of the causes of the evolution of the energy governance framework is the hydrocarbon rent accruing to Arab economies, which is estimated at USD 750 billion per year (AfDB, 2015). Given the significance that these figures entail in the development of these economies, in the next section we will revisit the existing literature on hydrocarbon-rich economies, placing a special focus on the development of the rentier state. However, we will first set out a very broad and descriptive set of characteristics for both crude oil and natural gas, as the pillars of the hydrocarbon industry.

Natural gas vs. crude oil: distinctive characteristics

Natural gas and crude oil are the two primary pillars of the hydrocarbon industry, serving as indispensable sources of power for a variety of applications. Despite their shared origin as fossil fuels and similar utilisation in energy production, these resources exhibit distinctive characteristics, from composition to applications. In actual fact, the origins of natural gas and oil lie in the decomposition of organic matter over geological timescales, but their distinct compositions set them apart. Natural gas is predominantly composed of methane (CH_4) with trace amounts of other hydrocarbons, such as ethane, propane and butane. Conversely, crude oil is a complex mixture of hydrocarbons, encompassing alkanes, cycloalkanes, and aromatic hydrocarbons. This compositional diversity influences their physical states: natural gas exists in a gaseous state at room temperature, while crude oil is a liquid.

Natural gas and oil are often found together in subsurface reservoirs, and extraction methods vary based on their physical states. Natural gas extraction involves drilling wells and often occurs concurrently with oil extraction. Reservoirs containing both resources offer operational efficiencies, as the extraction process can yield multiple energy sources from the same site. Notably, natural gas fields are distinct entities where natural gas is the primary target.

In terms of reserves, both natural gas and oil boast significant global stores. However, the geographical distribution and accessibility of these reserves differ, contributing to the strategic importance of certain regions in the global energy landscape. Technological advancements, such as hydraulic fracturing (fracking), have unlocked vast shale gas reserves, reshaping the global natural gas market.

The natural gas industry is very capital intensive and involves many direct activities, such as drilling or equipment manufacturing, as well as complimentary activities, such as construction of a network for transportation. Value is created along the different phases of the natural gas chain as in any other industry. Furthermore, the natural gas trade has expanded from a regional to a global market since the early 2000s with the emergence of Qatar as a Liquefied Natural Gas (LNG) exporter hub, considering that the historical complexity of natural gas processing and transportation (onshore pipelines and processing) quite drastically limited long-distance trade flows and diversity of trade flows (BP Statistical Review of World Energy, 2015). The latter is precisely one of the major differences between the chains of natural gas and crude oil; indeed, the transportation of natural gas requires a liquefaction process in the absence of physical interconnections (gas pipelines), and in the downstream phase it requires physical interconnections to the end consumers (industries and households). In view of such expensive and unique gas transportation projects, the gas industry also requires substantial investments, and thus long-term contracts, which have led to monopolistic or oligopolistic markets and significant variations of gas prices across global markets (World Bank, 2011).

In this vein, unlike other internationally-traded commodity markets such as oil, natural gas has disparate regional benchmark prices, making oil indexation the dominant mechanism for international gas trade, which originated in Europe in the 1960s and later spread to Arab and Asian countries. A contrasting mechanism based on hub pricing and traded markets¹⁴ developed in the US in the 1980s and spread to continental Europe in the 1990s through the UK.

Natural gas in energy production is extensively used for electricity generation through gas-fired power plants that are known for their efficiency and flexibility, allowing for quick start-up and ramping to meet fluctuations in demand, and for combined cycle gas turbine (CCGT) plants,

¹⁴ Traded markets, spot markets and spot prices are used in their broadest sense to cover the wide range of gas commodity markets and dynamic pricing systems that include formal and informal quotes, spot and future trades, virtual and physical trades, and over-the-counter and bilateral contracts.

which use both gas and steam turbines and are a common technology for efficient power generation. Natural gas is also used for residential and commercial heating and cooling, as a common fuel for furnaces, boilers and water heaters. In industrial processes, natural gas is also utilised for high-temperature applications and as a feedstock for the production of chemicals.

Natural gas in the field of transportation is not as prevalent as oil-based fuels, but it is used as a fuel for vehicles: Compressed Natural Gas (CNG) and LNG are the two primary forms used in natural gas vehicles (NGVs).

In contrast to natural gas, the primary role of crude oil in energy production is as a source of transportation fuels: gasoline and diesel derived from crude oil power the majority of cars, trucks, airplanes and ships globally. Oil also has an industrial use as a raw material for various industries, providing feedstock for the production of plastics, chemicals, lubricants and other products. In addition, while not as common as natural gas, oil can also be used in power plants for electricity generation. However, it is more common in regions where natural gas is less accessible. Oil is also used for residential and industrial heating in areas where natural gas is not readily available. Heating oil, a refined product of crude oil, is used in furnaces and boilers. Finally, oil is often used as backup power generation during emergencies or in locations where a reliable electrical grid is not available.

Both natural gas and crude oil can be measured using different units. Throughout this research thesis, we use volumetric units such as cubic metres (m^3) or billion cubic meters (bcm) to measure natural gas, and million tonnes per year (mtpa) to measure LNG. Normally, thousands of barrels of crude oil per day are used.

Considering that geographical distribution and accessibility for both oil and natural gas differ across the globe, transportation of both materials has become a key element to ensure the constant flow across a global market. In this regard, the transportation of natural gas takes place through pipelines, which are the dominant mode of transporting it. They connect gas fields to processing plants, storage facilities, and distribution networks. Pipelines offer an efficient and cost-effective means of transporting large volumes of natural gas over long distances, but they might also face regulatory and environmental challenges. Natural gas can also be transported converting it into a liquefied form (LNG) by cooling it to -162°C . LNG can then be transported via specially designed cryogenic tanker ships, which facilitates international transport and

storage, allowing natural gas to reach markets where pipelines are impractical or do not exist. It is first liquefied, then transported and finally it can be regasified at regasification plants and distributed through local pipelines to end users, be they industries or households. A standard tanker ship has capacities ranging from around 125,000 m³ to 267,000 m³. However, LNG infrastructure, including specialised terminals and vessels, is costly to build. Alongside gas pipelines and LNG infrastructure, natural gas can also be transported using CNG in high-pressure containers for use as a fuel for vehicles.

The transportation of crude oil primarily takes place using pipelines, which are the most efficient means of transporting crude oil over long distances. They connect oil fields to refineries and distribution points. They are cost-effective, have high capacity, and can transport large volumes of crude oil with minimal environmental impact, but the building of pipelines can face regulatory hurdles and public opposition due to environmental concerns. Crude oil can also be transported across oceans using oil tankers. These vessels are specially designed to carry large quantities of oil and provide flexibility for transporting crude oil internationally, while connecting oil-producing regions with refining and consumption centres. Other means of transporting oil are rail transport, which is used when pipelines are not available or are insufficient, and tanker trucks over short distances.

The differentiation between crude oil and natural gas is relevant, insofar as traditionally the hydrocarbon sector has been dominated by crude oil and not by natural gas, whereas this research is mainly focused on the natural gas sector in the Western Mediterranean. In the coming sections we will explore why.

1.3 The fundamental problem of hydrocarbon-rich economies: socioeconomic development and the rentier state

There is a large body of research literature that tries to cover and better understand the impact of the extractive resource industry in the development of an economy. In fact, the impact of natural resources has long attracted interest from a variety of angles and sources of development economics. Before the oil shocks of the 1970s, the focus was given to primary products generally, but after that, attention was extended to the impact on oil and other extractive industry exporters such as natural gas (Stevens, 2003) for the reasons set out in the previous section: the ability for

these particular developing economies to concentrate large windfall rents from the hydrocarbon sector.

The case for resource extraction as an engine of national development was first underpinned by the classical theory of comparative advantage in international trade, which assumed that countries should focus on developing commodities in areas where they are relatively abundant. More specifically, the potential limits of resource extraction as a vehicle for development was first theorised in the 1920s by economic historian Harold Innis, who concluded that “specialisation around raw material extraction,” observing the case of Canada, “did not drive economic diversification but produced a dependent form of development”. He named it “staples trap”. On a different scale, neoclassical economics asserted that extractive resources are capital assets, the value of which can be realised only when they are extracted and exported. Only then can a “virtuous circle of economic upgrading” be initiated (Hotelling, 1931).

In addition, oil and gas developments are also often motivated by reference to specific theories of modernisation, such as the “big push”, whereby in order for poor countries to be developed, the latter must break “the vicious circle of poverty” (Rosenstien-Rodan, 1943) or must invest in large infrastructure projects (Sachs, 1999). In this line, others were of the opinion that development is constrained by low levels of investment, the so-called “capital fundamentalism” views that so widely dominated during the 1960s (Lewis, 1955; Rostow, 1960). Indeed, Rostow states that capital accumulation is required in order to move a society from the beginning of take-off to maturity.

Against this background, during the 1950s and 1960s some development economists expressed concern over the negative consequences for resource-abundant countries, including Prebisch and Singer (1950), who upheld that exporters of primary sector goods would face difficulties to compete with manufacturing goods coming from industrialised economies. Similar arguments were underpinned by other authors (Hirschman, 1958; Seers, 1964; Baldwin, 1966). Later on, several research works have conducted an assessment comparing data from many countries and concluded that many resource-rich countries appear to have experienced a worse performance in terms of economic development and poverty reduction than many other resource-poor countries (Sachs & Warner, 1999; Ross, 1999; Watts, 2005; Rosser, 2006; Humphreys et al., 2007).

The aftermath of the first oil shock in the 1970s gave ground to speculations that large windfall revenues from hydrocarbons could heavily impact the development prospects of this type of exporting country. Amidst such a situation, a literature devoted to hydrocarbons began to emerge. Likewise, the experience of the Netherlands following the then newly-found North Sea gas revenues gave rise to the commonly known notion of Dutch disease (Corden & Neary, 1982; Gelb, 1988; Gylfason, 2004), de-industrialisation as a result of a real appreciation of the exchange rate following the gas export boom, which caused inflation and brought reductions in competitiveness. Amongst the theoretical models leading to Dutch disease one can find the Salter-Swan model (1960).

In the 1990s, the impact of the revenues accrued from the hydrocarbon sector on the governance of the hydrocarbon-abundant countries became the focus of attention. One of these core debates was commonly known as the “resource curse” thesis used for the first time by Richard M. Auty in 1993, which tries to establish a negative relationship between resource abundance and economic performance.

Much of the empirical work carried out to show evidence of the resource curse is focused on countries that happen to be rich in natural resources, thus beyond the hydrocarbon sector. Many of these pieces of work (Auty, 1986, 1993, 2001; Gelb et al., 1988; Ranis, 1991; Bulmer-Thomas, 1994; Lal & Myint, 1986; Sachs & Wener, 1995, 1997, 1998; Luong & Weinthal, 2006; Rosser, 2006; Frankel, 2012) conclude that there is a negative correlation between economic growth and resource-abundant economies. The works of Frederick Van der Ploeg (2011: 2) appear to be particularly relevant when pointing out that “OPEC as a whole saw a decline in GNP per capita while other countries with comparable GNP per capita enjoyed growth between 1970 and 1990.” The resource curse also draws arguments on the crowding out effects that take place when a big hydrocarbon project captures most of the resources of an economy at the expense of other sectors that find it difficult to secure the factors needed to develop (Buffie, 1990).

Notwithstanding the fertile evidence-based literature on the resource curse, there are other authors (Wright & Czelusta, 2002; Alexeev & Conrad, 2009; Haber & Menaldo, 2010; Torres et al., 2012) who often object to the previous works, mostly on methodological grounds. In this regard, Ross (2012) shows that during the timespan 1990-2006, the economic growth rate of oil-producing countries grew 40 percent more than the rest of the world. In addition, Lederman

and Maloney (2008) and Brunnschweiler (2008) also challenge the statistical claim that resource-rich countries are condemned to low growth.

As previously stated, those voices that dissent on the empirical work carried out to prove the negative correlation between GDP growth and resource-abundant economies do so on the basis of the methodology rather than on the overall conclusions. There are four of these conclusions associated with the prevalence of the resource curse in hydrocarbon-rich economies: 1) difficulties tackling income inequalities (Auty, 1993; Sarraf & Jiwaji, 2001) and alleviating poverty amidst the most excluded part of society (Ross, 2001); 2) increase of social conflict (Collier & Hoeffler, 2004; Rosser, 2006); 3) lack of sufficient progress on political and institutional reforms to advance democratisation (Auty, 2001)¹⁵; 4) environmental damage at the sub-national and local levels.

With regards to the poor records in terms of quality of the governance in most of the abovementioned countries whereby hydrocarbon resources belong to the state, authors such as Mahdavy (1970), Yates (1996) and Clark (1997) believe that the curse occurs when bad governance or wrong decision-making take shape, including in the form of widespread corruption (Mbaku, 1998; Auty, 1999; Sarraf, 2001; Stevens, 1986). Indeed, it was not until the 1980s that the impact of hydrocarbon revenues on government behaviour became the focus of attention when large-scale revenues from such projects appeared to change the way in which governments behaved, causing damage to both economic growth and development prospects (Gelb, 1986). The abovementioned authors argued that government involvement in the allocation of rents would inevitably lead to their misallocation.

One of the most commonly used theoretical frameworks to exemplify the resource curse in the Arab countries is the TRS, even if it has been applied to all kinds of hydrocarbon-rich economies. This relationship between hydrocarbon resources and development in the Arab region has been recently well documented by Yousef (2004) and El Badawi (2005), among others.

¹⁵ There are academic voices (Haber & Menaldo, 2010) who have conducted evidence-based research concluding that the effects of natural resource wealth were politically neutral for a considerable number of natural resource-abundant economies.

1.3.1 *The rentier state*

The literature on the rentier state is vast and fertile and has been commonly applied to the Arab world, both in hydrocarbon-abundant and hydrocarbon-scarce economies. Considered as “one of the main contributions from political science to Middle Eastern studies” (Anderson, 1987), this concept was initially developed to describe Libya’s and Iran’s economic stagnation in light of its growing oil revenues (Mabro, 1969; Mahdavi, 1970) to be later transposed into the Arab state (Beblawi & Luciani, 1987; Beblawi, 1990; Luciani, 1988, 1994, 1995; Sid Ahmed, 1980, 1995; Anderson, 1987; Crystal, 1995). This concept is widespread in most of the works that focus on the Arab region. In the Arab political economy, most schools of thought often use it, from neoclassicals to neo-institutionalists to the most heterodox schools, in spite of relying on different views of the theories of rent (rent-seeking, on one side, to Ricardian and Marxist theories of rent, on the other).

The concept of rentier state is underpinned by the notion of rent, inspired by Ricardian rent.¹⁶ Amidst these various connotations of the term “rent” in the context of the Arab state, the concept of rentierism is assimilated to foreign rents, mainly generated by the exploitation of natural resources. To better delimit it, Beblawi uses the term “external rent” as it includes political and military aid, royalties such as from the Suez Canal and oil and gas pipelines for the countries of transit, and even remittances from migrant workers (Beblawi, 1990: 97).

Likewise, in accordance with Beblawi (1987), the rentier economy is defined by three aspects: (1) the rent is the predominant revenue of the economy, but not necessarily the only one; (2) such a rent is originated outside the country; and (3) the rent is channelled through a minority group within the country, even though the majority of the population benefits from the domestic distribution of the rent.

¹⁶ The notion of rent was extensively covered by A. Smith (1776), D. Ricardo (1809, 1817) and K. Marx (1894, 1905). From the works of Ricardo, it is worth mentioning that the concept of “rent” should not be confused with contract rent, which are the actual payments tenants make for the use of the properties of others. In fact, the notion of “Ricardian rent”, from which the theory on the rentier states is underpinned, establishes that the rent of a land or a mine site is equal to the economic advantage obtained by exploiting the site in its most productive use, relative to the advantage obtained by using the marginal land or mine for the same purpose, given the same inputs of labour and capital. In this vein, Ricardo states that “any rent, including the rent of the land, is the effect, and never the cause of the high value of their produce” (Ricardo, 1817: 77), which gives a “natural value” to the extracted or produced goods, different to the value of labour that intervenes in this process. As the price, at least for the extractive and mining industries, is set at the international level, the rent will vary accordingly.

Further exploring the notion of rentier economies, as a matter of fact, it is worth highlighting the need for differentiation between a rentier state and a distributing state, even though both models might be applicable to the same state simultaneously. To this end, following the rationale of Beblawi and Luciani (1987), Matsunaga (2000) defines the rentier state as “a state which collects a substantial part of its revenues from abroad in the form of a rent,” whereas he defines a distributing state as “a state whose expenditure represents a very large portion of the national income.”

However, the foundations of the rentier state lie in the capacity of the state to accrue hydrocarbon rents. From this very first definition one can infer that as soon as the share of foreign rents grows (i.e., through hydrocarbon fiscal revenues) in government revenue, the relative importance of taxation will tend to decrease. The importance here lies in the fact that rents come from the outside: this is what distinguishes the rentier state from the “capitalist” or “producing” state (Mabro, 1969; Luciani, 1987). In fact, the latter, which obtains most of its gross income domestically, will try to maximise the tax base through economic growth, while the rentier state can maintain its economy “without fostering strong productive sectors” (Beblawi, 1987).

It is in this context that the vast literature that explains why the role of rent-seeking is greater in rentier states with large hydrocarbon revenues (Mahdavi, 1970; Ferkat, 1979) is also considered as an argument for the resource curse as it concerns how people in these economies compete for “artificially contrived transfers” (Tollison, 1982: 576). The result is that government expenditure creates no social value and can subsequently distort markets and the way the economy operates. This rent-seeking behaviour of the administrators of the rentier state is more widespread in hydrocarbon-rich economies as a consequence of wealth being concentrated in the public sector and possibly in a small number of companies (Auty, 1999). A bureaucratic elite, a majority of whom can be members of a politically dominant group, is tasked with the channelling of the rents and block much needed economic reforms, along extremely powerful lobby groups that emerge as guarantors of the rent-allocating system. In addition, Beblawi and Luciani (1987) were the first authors to develop a systematic typology, whereby natural resource rents have allowed ruling elites to expand instruments of both patronage and control. According to Balbawi, any government that accounts for 42 percent or more of its total foreign rental income is considered a rentier government (Beblawi & Luciani, 1987).

The theory of rent-seeking in the broader scheme of a rentier state provides an adequate explanation of why the latter results in “reduced economic efficiency through poor allocation of resources, reduced actual wealth creation, lost government revenue, increased income inequality, and (potentially) national decline” (Dabla-Norris & Wade, 2001). According to Bhagwati (1982), these directly unproductive profit-seeking activities that cause a direct loss for national income also manage to attract capital as a consequence of the increase in their profit rates, to the detriment of other sectors where the expected profits are lower. Hence, rent-seeking is not a zero-sum game for the economy. The public choice theory differentiates rent-seeking in contrast to profit-seeking, an activity whose social marginal gain is larger than the private marginal gain (Buchanan, 1980).

It is not the hydrocarbon rent that creates these effects, but the way the state and public institutions intervene in the economy (Belarbi, 2017). The hydrocarbon rent offsets the rent-induced production decline to a certain extent, while it also provides the state with the means to finance any fiscal balance deficits caused by its intervention in the economy. However, rent-seeking can also occur in the absence of an existing hydrocarbon rent.¹⁷

Considering that tax collection is often an unpopular action, the existence of an “external rent” can prove to deliver an effective replacement to leveraging taxes; hence, one can reasonably assume that under these circumstances the state will raise few or no taxes whatsoever. The TRS defines in general this situation as “state autonomy”, not only with regards to what would be, in other circumstances, its tax base, but also with regards to its citizens as political actors. In other words, this fiscal autonomy as a consequence of the liberation of the state from imposing direct taxation would come along with political autonomy (Luciani, 1987, 1988, 1994, 1995; Anderson, 1987; Crystal, 1994, 1995).

Richards and Waterbury (1996) argue in the same direction that external rents have entailed these types of governments to avoid imposing taxes on their own citizens, thus breaking a vital but sometimes conflictual connection that links governments with tax payers. With the breaking of social contracts, insists Anderson (1987), the state is not accountable to its citizens anymore. Contrary to the model devised in rentier economies, if the state wants to leverage taxes it will

¹⁷ For instance, in Algeria rent-seeking intensified during the decade of 1990s, the so-called Algeria’s Black Decade, in which state revenues from the hydrocarbon sector severely decreased (Dillman, 2000).

have to promote economic growth, which will end up polarising societies into different groups that will advocate and confront exclusive public policies, a precondition for democratic regimes to flourish. However, the opposite situation, the one embedded in “autonomous or rentier states”, does not necessarily impede these countries from promoting political reforms in order to become more democratic and inclusive societies, as pointed out by other authors (Matsunaga, 2000; Talahite, 2012).

The redistribution of this rent by the state is carried out through cash transfers and benefits-in-kind as public sector spending measures directed at achieving political or economic objectives. Therefore, as long as the hydrocarbon rent is at the origin of the revenues of the state, thus indirectly of the rents resulting from its redistribution by the state, these two are not of the same nature. While it is the (international) market that generates the former, the latter is a result of its redistribution by the state in the form of transfers. The modalities of this redistribution (regulated prices, subsidies, allowances...) can generate non-natural rents and cause market distortions in the economy favourable to rent-seeking.

Mañé-Estrada and de la Cámara (2005) offer a twofold analysis of the patterns unveiled in a rentier economy. On the one hand, a macroeconomic approach, whose theoretical foundation is underpinned by Mahdavi (1970), Abdel-Fadil (1987) and Amuzegar (1998). These authors believe that a hydrocarbon-rich economy is rentier when the share of hydrocarbons in GDP, exports and tax revenues are very high, and when the GDP is elastic in relation to the evolution of the hydrocarbon prices. On the other hand, these authors (Mañé-Estrada & de la Cámara, 2005) also offer a political approach that is supported by Luciani (1987) and Lal (1995) when a country's elite enacts and employs certain instruments of public intervention. These instruments pursue the obtaining of the maximum possible national income that can be distributed to the population as a whole, according to national legitimization strategies, by utilising the NOC with the primary goal of collecting (through property income or taxation) at the expense of other criterion such as maximising profits, establishing suitable distributing institutions.

Other recent literature has shown that the existence of rentier states not only impedes long-term economic growth and development (Mahdavi, 1970; Auty, 2004; Harding & Venables, 2016; Tran et al., 2020), but also serves as a strong impediment to democratic rule (Ross, 2001), which prompts failures that are seen to lead to violence and civil war (Collier & Hoeffler, 1998), and

also conflict and weak institutions (Collier & Hoeffler, 2004) and adverse outcomes on education and inequality (Gylfason & Zoega, 2002).

An OPEC founding member, Kuwait, has been classified by various authors as the most extreme rentier economy (Beblawi, 1987) and autonomous state (Auty & Gelb, 2004) in the sense that the state does not rely on “domestic taxation” to function. Alternatively, the state relies on oil taxation, which is obtained thanks to an activity that is valued abroad, but which does not depend on the work of the local population. In fact, Mañé-Estrada and de la Cámara (2005) assert that rentierism is not a condition that is reached as the volume of hydrocarbons in an economy increases, but instead when the income generated by the hydrocarbon sector is distributed over time. From that standpoint, one would argue that Algeria, albeit considered a rentier economy, is less rent allocator than other OPEC members. In this context, the case of Kuwait is certainly the most extreme.

It is important to highlight that the hydrocarbon rent does not accrue from the domestic market due to the difference between its extraction cost and its market value. As external revenue, it builds upon the value given in the international market. It is thanks to this value acquired in the foreign market that hydrocarbons generate a rent for the owner of the resource. This rent is then captured by the state through a hydrocarbon tax, a part of which belongs to the NOC as it often enjoys a monopoly in the exploitation of these resources.¹⁸

In the most accepted definition of the rentier state (Beblawi & Luciani, 1987), there are three elements worthy of attention: the first one is that while rent is an economic concept, the author chooses to place this question in the background (Beblawi & Luciani, 1987: 49) and focuses on rentierism as a categorisation of a group that, without actively participating in the production tasks, receives a significant share of the produce. Hence, he states that the basic characteristic of rentierism is defined by rentier behaviour – or lack of productive behaviour (Beblawi & Luciani, 1987: 50). That is why, in the later dissemination of the term, rentierism is related to [rentier] behaviours or mentalities of states, groups or individuals. However, this overlooks the fact that certain conditions are necessary for the rent to exist as a foundation of rentierism.

¹⁸ In the case of Algeria, the Algerian State is the owner of the hydrocarbon natural resources, whereas the NOC is Sonatrach.

The second point is that, although rentierism emerged during the period when crude oil prices rose significantly and oil assets in OPEC countries – particularly in Arab states – were nationalised, its definition makes little reference to this specific context. This lack of context leads to the idea that rentierism is the result of the individual choice of OPEC members (mainly in the MENA region), which gives way to an Orientalist conception of such notion (Talahite, 2006: 3), which also “considers the rents accruing from the international markets as ‘flows like manna from heaven’” (Beblawi & Luciani, 1987: 7). In short, rentierism is considered the outcome of a “given” behaviour – the result of a “certain” mentality of the leaders and MENA populations – in the face of an external and spurious phenomenon.

The third, which is the methodological corollary of the two previous points, is that according to this view, rentierism is the individualistic version of a fact that is systemic. Rentierism is perceived as the result of the decisions taken by groups with rentier behaviours or mentalities, whose way of acting results in this phenomenon, regardless of the objective conditions required for the generation of rent. This individualistic form of analysing the rentier phenomenon was strengthened with the simultaneous use of two additional concepts: the autonomous state (Lal, 1995) and distributive state (Beblawi & Luciani, 1987). Both reinforce the idea of an “individual choice” of the state.

Rentierism has been conceived as a useful description rather than an explanation of a phenomenon (Mañé-Estrada & Albinyana, 2023). With the passing of time, the concept of rentier state has transformed itself into the TRS as a cause of the economic phenomena (Stevens, 2003) of the curse of resources (Auty, 1993; Auty & Gelb, 2004) in all its variants; a cause of the political phenomena (Herb, 2017) of lack of democracy or the explanation for the tendency towards conflict of certain states (Ross, 2001; Collier, 2006; Collier & Hoewffler, 2005). This transformation from a descriptive category into an explanatory one went hand in hand with the geographical extension – and homogenisation – of rentierism to most of the hydrocarbon-rich economies (Herb, 2017).

The TRS is reductionist (Talahite, 2012) as it tends to consider the totality of revenues redistributed by the state as a rent, assimilated to the hydrocarbon rent: firstly, because it tends to mix the cause (rent generated at the international market) and the effects (rents generated at the domestic market); secondly, as it ignores the difference in nature between these rents; and,

thirdly, because it considers the rents accruing from the international markets as “flows like manna from heaven” (Beblawi & Luciani, 1987:9).

But are hydrocarbon rents flows like manna from heaven? The rent accruing to the state that owns the hydrocarbon resources cannot be taken for granted, especially because the price at which the extractive goods are sold is determined at the international level. Ignoring or undermining this reality can only entail a partial view.

Likewise, the membership of these rentier economies under the umbrella of OPEC, as well as the role that this institution plays within the international governance framework of the oil industry, hinders the possibility for these economies to adopt unilateral decisions, given that their hydrocarbon policies are the result of decisions adopted with the framework of OPEC and not the result of the rentier mentality of their leaders (Mañé-Estrada & Albinyana, 2023).

To conclude, it is important to underline that although the TRS mostly focuses on the consequences of the domestic distribution of the rent accruing to the state, this research focuses on the dynamics imposed by the external conditions through which the rent is generated. That is the reason why the TRS does not offer a fully suitable theoretical framework. That said, these external conditions on the rent generation in the field of hydrocarbons are directly connected with the pricing policies of these hydrocarbons.

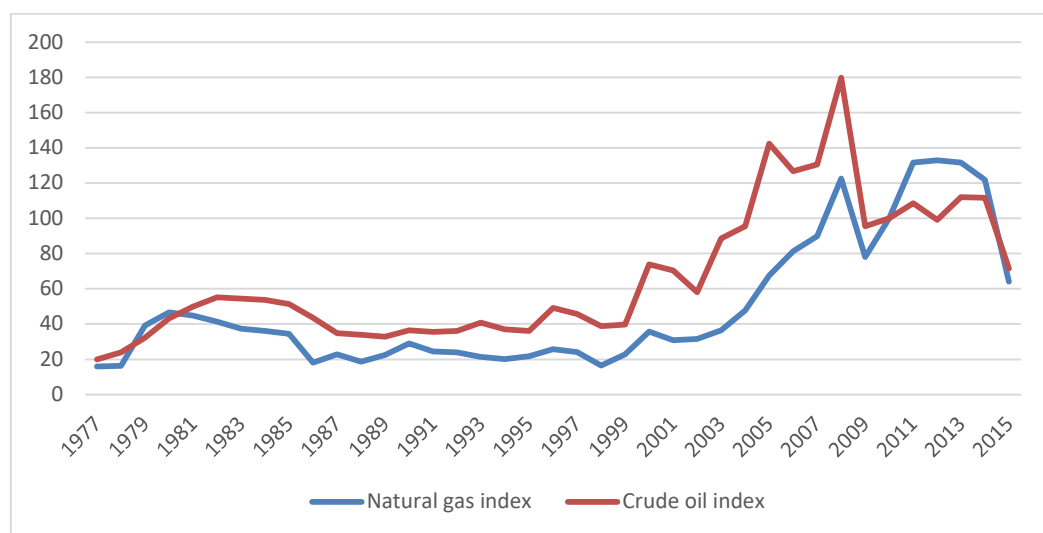
1.3.2 The rent generation and pricing policies

As we have explained, the rentier state is generally both the owner of the natural resource and the distributor of the rent it generates by using tools such as a low level of taxation and a high level of public expenditure and investment. The process of capital accumulation and the remuneration of factors of production (capital and labour) are hence seen as determined by, on the one hand, exogenous factors associated with the global oil market and, on the other, by expansions in domestic demand, with a low level of non-oil exports hampered by an over-valuated exchange rate (Mommer, 1996). In this context, understanding pricing policies in the hydrocarbon industry, particularly in the natural gas industry, is of utmost importance to determine the amounts of rent accruing to the rentier state. For these rents to accrue to the state, external conditions have to exist, as we have already seen.

We will look into theoretical approaches that allow us to cross the gap that exists between the domestic and foreign dimensions of rent given that most academic literature has traditionally dealt with these two concepts separately (Regnault, 2023).

From a historical perspective, international trade in natural gas, unlike crude oil, was quite limited, as it was produced and consumed locally or regionally. Pricing mechanisms ranged from regulated prices set by governments, prices indexed to competing fuels or spot market pricing in competitive markets. Contracting structures in each of the major market areas evolved independently of the others, and there was little reason for the pricing structures to be linked because gas was not an international commodity like crude oil with large global petroleum markets. To this end, the practice of indexing gas prices to other fuels, in particular oil, was favoured early on in Europe and thereafter in other regions like the Arab countries. Therefore, growth in these markets was correlated with increasing international trade in natural gas that was contractually based on linking gas prices to oil product prices for both pipeline gas and LNG, the two means that allow gas transportation. Figure 1 shows such a correlation in terms of price between crude oil and natural gas based on indices created on average prices for both commodities during the timespan 1977-2015, in which the value 100 corresponds to the price for both commodities in 2010.

Figure 1: Evolution of natural gas and crude oil prices (1977-2015)



Source: Compiled by the author based on data retrieved from World Bank Commodity Price Data (The Pink Sheet).
Index based on nominal prices (1977-2015) where 2010=100

In addition, whereas the transportation of natural gas required dedicated pipeline systems, with enormous capital costs, producing companies demanded that purchasers provided a higher annual minimum bill commitment, reflecting the need to repay the heavy investments. Not only this, but also the difficulties of storing natural gas in consuming countries, unlike with crude oil, and the consequent need for producing and transportation companies to supply a permanent flow of natural gas. Accordingly, the principle became that purchasers would commit to pay for a minimum annual quantity (negotiable), typically 80 to 90 percent of the agreed annual contract quantity. The clauses became known as “take-or-pay” terms. Not only a downward threshold was determined but also an upward volume flexibility was negotiable, and the majority of long-term contracts were settled at 110 or 115 percent of annual contract quantity.

Over time, natural gas pricing policies have encompassed the following general features: first, they are often government regulated prices, usually based on a cost of service, which relates to the cost of providing a service including an opportunity for the company to earn a reasonable return on its investment; second, price indexation to fuels (commonly known as oil-indexed pricing) is the most commonly used formula; and third, spot market pricing in more competitive gas markets has been gaining momentum since liberalisation of consuming markets have taken shape.

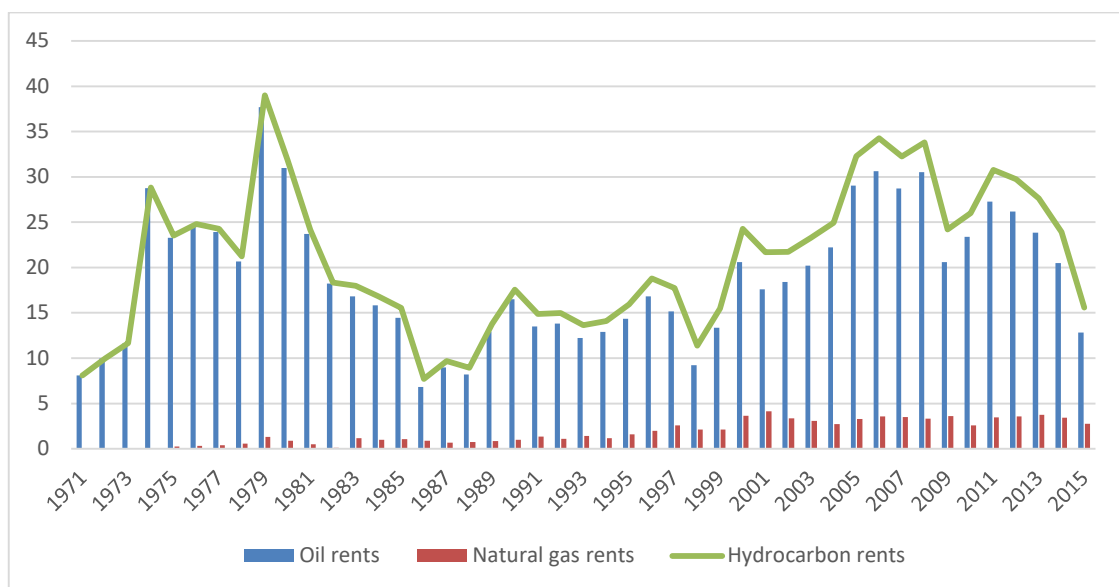
Such a pricing policy has determined the extent to which rents accrue to the state. However, evidence reports that these rents are mainly generated by the exploitation of crude oil and not of natural gas. A likely explanation for this disparity in the behaviour between oil and gas is a consequence of the gas market not being able to fulfil the requirements for generating rent (scarcity, deposits of different qualities and a set international price), while the oil market does meet them.

In the case of Algeria, Figure 2 data shows the evolution of Algerian hydrocarbon rents¹⁹ as a percentage of Algeria’s GDP from 1971, when the Algerian state reclaimed full control over the

¹⁹ As they are defined by the World Bank, rents are calculated based on the difference between the value of hydrocarbon production at global and regional prices and total costs of production. Therefore, rents are defined as revenues above industry costs and normal profits.

hydrocarbon sector, to 2015. Hydrocarbon rents in Algeria nearly represent the totality of natural resource rents generated by the country.²⁰

Figure 2: Hydrocarbon, oil and natural gas rents as a percentage of Algeria's GDP (1971-2015)



Source: Compiled by the author based on data retrieved from the World Bank database

Most of these hydrocarbon rents (85 percent throughout this period) are generated by oil rather than natural gas, even though hydrocarbon production and export data indicate a starkly different picture. In the 1990s, both gas production and export shares were like those of crude oil (Mañé-Estrada, 2009) but the year 2000 was a turning point, insofar as volumes of natural gas exports became higher than those of crude oil exports (BP Statistical Review of World Energy, 2016). However, this has never been the case for the export values and rents accruing to the state (OPEC statistical bulletins & World Bank database, 2016), and the underlying reason is that rents generated by natural gas exports have never met the external condition of the existence of a unified market (great pool) or single price, which in contrast has been met by crude oil exports since the 1970s when the price was unified. Pricing policies in the natural gas sector are mostly set at the regional and not global arena. This explains why Algeria, despite its growing role as a natural gas exporter, as discussed in Chapter 3, derives the majority of its hydrocarbon rents from oil rather than natural gas.

²⁰ Since 1974 hydrocarbon rents have represented over 97 percent of all rents from natural resources.

1.4 The articulation of the domestic and foreign dimensions of the rent

In the analysis of hydrocarbon rents for rentier economies, one of the difficulties lies in the juxtaposition of two heterogeneous spheres. On the one hand, the international (or regional) market where the hydrocarbon rent is generated, and on the other, its redistribution within the country (Algeria), and thereby in the process of transposition to the second sphere of a concept that finds its genesis in the first. Two spheres that converge in a geographical area for which the category of rent does not match because the hydrocarbon rent is radically different from the rents generated in the process of its internal redistribution.

The TRS, which is underpinned by political science, focuses on the political aspects of the distribution of hydrocarbon revenues within the nation through political processes. In addition, this process tends to dismiss the power relations set up on the international (regional) scale, which do have an effect on the distribution of the hydrocarbon rent. Thus, by isolating the centres of power within the nation from interferences abroad, not only is the external-internal (or international-domestic) connection broken, but different modalities of allocating the rent domestically are being hidden. In the end, the internal redistribution of hydrocarbon rents is the last segment of a chain whose dynamics are internationalised (or regionalised). In fact, through the hydrocarbon rent the whole nation is connected to the world market, but at the expense of other forms of production that are steadily swept away.

Whereas these hydrocarbon rents do not accrue to the state in spite of everything, the external conditions in which the latter are generated become very important. One of the schools of thought that has dared to question this absence of a relational articulation between domestic political dynamics and global economic dynamics is the Manchester School's approach of GPN applied to the extractive sector (Bridge, 2008: 389-419). Henderson et al. (2002) define GPNs as the "globally organised nexus of interconnected functions and operations by firms and non-firm institutions through which goods and services are produced and distributed." The concept has many predecessors, ranging from GCC to GVC, and the literature will be reviewed later.

Gavin Bridge (2008) argues that there seems to be an undisputed consensus on the fact that cases of underperformance in hydrocarbon-abundant economies are due primarily to state failure or inadequate governmental management. Hence, a state's institutional capacities and effectiveness provide an adequate measure on whether these economies work or not in favour

of general development (Swyngedouw, 2007). Bridge believes that what is missing from the current debate on hydrocarbon-abundant economies and development is a sense of “the relational way in which production is organised via inter-firm networks and massively exceed the boundaries of the nation state, and a mode of analysis, which is time and space sensitive.”

In this regard, the various contemporary theoretical frameworks that focus on the challenge of development of hydrocarbon-rich economies are heavily rooted in national paradigms of development, and this suggests at least two defining tensions in the natural gas value chain and production network in the Western Mediterranean. The first tension lies in the relation between the owners of the natural resources, meaning the Algerian state – and its NOC, Sonatrach –, and the IOCs and Regional Oil Companies (ROCs), and how this tension has prompted much of the dynamism when shaping the emergence of an energy space in the Western Mediterranean. The second tension is related to the distribution of the value between producers (both states and companies), transit countries, and consumers. This distribution is a function of the relative power exerted by the different actors that intervene in the value chain and production network of natural gas and is affected by the contractual policy, the prices, the costs of extraction and transportation, and so on.

As the foregoing analysis sustained by the literature on rentierism is not properly embedded with a reality whereby a set of inter-firm networks exceed the boundaries of Algeria across the Western Mediterranean region, in the next section we intend to offer some theoretical approaches that aim at examining the degree to which a natural gas industry is integrated into global and regional natural gas chains. The result of this exercise will determine the degree to which a hydrocarbon economy’s internal functioning is affected as a rentier economy. To that end, the next section also offers some qualitative and quantitative approaches to assess the level of interdependence between a hydrocarbon economy such as Algeria and the rest of the countries in the region, and ultimately the rest of the world economies.

1.5 Theoretical approaches to establish the linkage between the domestic and global (regional) dimensions

1.5.1 *Introduction: the concept of “value chains” within the traditional theories on trade*

The case for resource extraction as an engine for national/regional development was first underpinned by the classical theory of comparative advantage in international trade, which assumed that countries should focus on developing commodities in areas where they are relatively abundant.

Mainstream models from Heckscher-Ohlin²¹ to Samuelson underpinned three classic premises: (a) markets are perfectly competitive and producers operate at constant returns to scale; (b) countries only trade final products, whereas these products are made exclusively using the production factors of the exporting country; (c) an industry consists of homogeneous producers. The first of these classic premises was challenged in the mid-1980s and in the 1990s when a new school of thought – New Trade Theory²² – emerged, which was founded on the premise that markets in international trade were imperfectly competitive. This new model provided a sound explanation for the existence of intra-industrial trade between countries with similar technology and resource endowments, a reality that could not be explained by the (neo-)classical theory of international trade introduced by Ricardo, Heckscher-Ohlin and Samuelson.

Against this backdrop, with the rapid development of transportation modes and information and communication technology, production processes can now be fragmented into several production segments, each corresponding to a particular slice. These fragments can be relocated, often across national borders, to locations whereby corporations can benefit from lower production costs and their tasks can be performed more efficiently. The latter has led to the emergence of a new bulk of literature, whose core subject is no longer the movement of end products, as classical theories generally focused on, but the cross-national transfer of tasks, and therefore the value generated along this chain of transnational production. Hence, new models

²¹ Eli Heckscher and Bertil Ohlin built this model at the Stockholm School of Economics in 1933 based on David Ricardo's theory of comparative advantage. The model essentially predicts that countries export products that use their abundant and cheap factors of production, whereas they import products that use the countries' scarce factors.

²² Instructed by Paul Krugman in 1985, it was the theoretical approach when considering production technology with increasing returns of scale.

beyond the classical theory are still being underpinned by the literature on frameworks such as GCC, GVC and GPN.

Two of the main features of the GCC/GVC/GPN paradigms are the variety of their intellectual origins and the fact that their conception did not follow a linear development path. The basic contributions to the terms were fostered in various scientific subfields in different manners and at different moments. Yet, they continue to evolve along different interactions of theories. In this regard, the term “value chains” was firstly conceived in business management studies by the work of Michael Porter (1980, 1985, 1990).

1.5.2 The integration of a territory's gas sector into a regional gas value chain

Energy relations are an important intersection between politics and geopolitics, economy, history, law and geography, shaped by a combination of economic policy goals, geopolitical and geo-economic shifts in power through history, and environmental objectives.

Against this backdrop, there is a significant body of work in the literature on the challenges of extractive-based forms of development, most notably those underpinned by the “resource curse” thesis (Auty, 1993), the notion of Dutch disease (Corden & Neary, 1982; Gelb, 1988; Gylfason, 2003) or the TRS (Mahdavi, 1970; Luciani, 1987; Lal, 1995). During the late 20th century, the changing nature of the international economy, and in particular trade, triggered profound alterations in the business structure of many economic sectors. Hydrocarbon industries, and in particular natural gas, have not escaped this pattern through a surge of LNG trade, accompanied by a deeper process of integration associated with cross-border production chains and networks for making, selling, and transporting natural gas, what is commonly referred to as the gas supply chain. This process has transcended the boundaries of the nation-state and has become regional, and even global, with the evolutionary dynamics of the LNG sector.

Production spatially dispersed over networks is increasingly acknowledged as a significant organisational form within the global economy. Nonetheless, the territorial configuration of GVCs and production networks remains largely unexplored. A better understanding of the territoriality of value chains and production networks, and how the latter emerges from increasing relationships between private sector, public sector, extra-economic actors and intermediaries is necessary in order to assess the past, present and future of geo-energy spaces.

Therefore, the research thesis proposes to use a framework approach to assess the degree of integration in the global and regional natural gas chains, in particular of Algeria's gas industry, and thus determine the consequences that this integration entails for the gas rent.

1.6 The “filière” and the agro-industry studies as a step towards the notion of Global Commodity Chain

The transformations that occurred in the agricultural sector after the Second World War revealed the inadequacies of the previous theoretical frameworks, mainly as a consequence of the development of the agro-food industry and the agrarian modernisation process, which made it increasingly difficult to isolate agriculture from other economic activities.

This greater interrelation of the agricultural sector with the other economic sectors – and particularly with the industrial sector – took shape in two different ways. On the one hand, agriculture was no longer a self-sufficient sector, but increased the demand for industrial goods (fertilisers, pesticides, agricultural machinery...) and also for services (technical and financial services...). On the other, agriculture was not only producing final goods but increasingly intermediate goods that would later be transformed by the agro-food industry into final goods. Therefore, a set of intermediate steps were added between the agricultural producer and the end consumer.

In 1957, John H. Davis and Ray A. Goldberg published *A Concept of Agribusiness* in which they introduced for the first time the term “agribusiness” in agrarian studies, which encompassed “the total sum of all operations included in the production and distribution of agricultural inputs, production operations in the agricultural holding, storage, processing and distribution of agricultural products and their derivatives” (Davis & Goldberg, 1957: 74).

In this vein, the concept of *filière* was firstly used by the researchers of INRA (*Institut National de Recherche Agronomique*) in France such as Louis Malassis (1979), who is one of the first authors to build on this concept (closely linked to the idea of “agribusiness”). For Malassis, the study of the *filières* involved two fundamental methodological aspects: its identification (the product, the following itineraries, the agents, and the operations that these agents carried out) and the analysis of the regulatory mechanisms (structure of operation of markets, public regulation...). Other authors such as Gérard Destanne de Bernis (1966) and François Perroux (1973) also referred to

the term *filière* as “constituted by a chain of economic activities, ranging from the extraction of natural resources to the final distribution of the goods. The units of production of which belong to different industries linked together by buyer-supplier relationships.”

Therefore, the term *filière* has its origin in the research on agriculture, and perhaps for this reason some perceive it as an instrument of empirical research that with the passing of time has become valid for different studies on applied economics. In this vein, it should also be noted that the “agribusiness” and *filière* have also been a bridge to other methodological trends. On the one hand, it has involved an approach to studies and methodologies encompassing the economic theory of the firm, especially with Michael Porter's approaches to the value chain (Porter, 1982). The irruption of the concept of “competitiveness” as a basis for business success can also be transferred to a chain approach. Competitiveness is what determines the survival of a certain sector (or *filière*) in global markets.

On the other hand, with the implementation and extension of a business model that aims to integrate various segments (functions) of a production process under a single capital and management umbrella through the acquisition of a variety of companies, significant changes have taken place in the scope of the chain, whose tendency is towards greater vertical integration. This has led to numerous studies on vertical integration and the forces pushing forward these processes. The neo-institutionalist school, and in particular its theory on transaction costs, is one of the approaches that has encountered the greatest predicament when it comes to explaining the coordination between the different links that constitute the agro-food chain (Williamson, 1985).

The notions of *filière* and agribusiness have significantly contributed to the analytical framework of Wallerstein's and Hopkins' commodity chain, which later led to Gereffi's concept of Global Commodity Chain to evolve into Kaplinsky and Morris' concept Global Value Chain.

In 1979, Terence Hopkins and Immanuel Wallerstein defined a commodity chain as “a network of labor and production processes whose end result is a finished commodity” (Hopkins & Wallerstein, 1979:159).

The different phases of production constitute a segment along the commodity chain. Different segments are connected by linkages that define the degree of vertical integration within the chain.

In this regard, the concept of commodity chain is greatly influenced by the theory of the World System underpinned by Wallerstein himself in 1974. Hence, the dynamic nature of the commodity chain makes it a suitable instrument to assess the dynamics of the world economy: “The greatest virtue of a commodity chain approach is its emphasis on process. Not only do commodities move extensively through chains, but the chains are scarcely static for a moment. The capitalist world economy reveals itself via this kind of radiography as a fast-moving network of relations that nonetheless constantly reproduces a basic order that allows the endless accumulation of capital, or at least that’s why it has reproduced this basic order” (Wallerstein & Hopkins, 1994: 50).

One of the main contributions that this approach entails is the possibility to assess within the chain the process of capital accumulation and how the surplus generated between the different segments is distributed. The greatest surplus is generated in the box with the highest degree of monopoly, even though the latter does not lead to a static situation: the degree of monopoly in different segments might be in constant evolution, with which capital will move accordingly.

Similarly, a key event in the development of the works on the GCC was the publication in 1994 of the book *Commodity Chains and Global Capitalism*, coordinated by Gary Gereffi and Miguel Korzeniewicz, and where the main concepts and lines of research on the GCC are defined. The book stems from the concept of commodity chain by Wallerstein and Hopkins, but adapts it to the context by transforming it into the GCC. As Gereffi points out (Gereffi & Korzeniewicz, 1994), the GCC approach reformulates conceptual categories to analyse new patterns of change and global organisation. In fact, Gereffi's first definition of the concept of GCC is closely linked to that of Wallerstein and Hopkins: “A GCC consists of sets of interorganizational networks clustered around one commodity or product, linking households, enterprises, and states to one another within the world economy. These networks are situationally specific, socially constructed, and locally integrated, underscoring the social embeddedness of economic organization” (Gereffi & Korzeniewicz, 1994: 2).

And in the same line he emphasises: “The analysis of a commodity chain shows how production, distribution, and consumption are shaped by the social relations (including organizations) that characterize the sequential stages of input acquisition, manufacturing, distribution, marketing and marketing” (Gereffi & Korzeniewicz, 1994: 2).

The promoters of the GCC presented this new approach as a way to overcome the limitations of other analytical frameworks that were framed within the boundaries of the nation-state, and as a way of integrating different theoretical developments that cover macro and microeconomic aspects. In this vein, one can read: “The analysis of GCCs provides a bridge between the macro-historical concerns that have usually characterized the world-systems literature, and the micro-organizational and state-centered issues that have stimulated recent studies in international political economy” (Gereffi & Korzeniewicz, 1994: 9).

Similarly, elements such as competition and innovation play a crucial role within this particular framework. Indeed, innovation allows a firm to create entry barriers against its competitors and thus safeguard and increase its rents, in a very similar way to Schumpeter’s analyses. This idea applied to the current context shows how companies and nations located at the “centre” have the capacity through innovation to exert competitive pressure to the activities carried out by companies located at the “periphery”. Entry barriers can be “natural” or “dynamic”. Regarding the latter, studies of the GCC frequently use the concept of upgrading defined as the type of innovation that is capable of generating entry barriers that will allow the rent captured by a company (or the segment within the GCC) to be maintained and/or increased.

The GCC approach facilitated the incorporation of new aspects that traditional paradigms did not consider. For instance, it is traditionally considered that the distribution of wealth within the value chain is determined in a hierarchical manner, with the production phases involved at the initial stages of the production process, such as agriculture or production of raw materials, those that have more difficulties capturing and maintaining the rents within the chain. However, in the agricultural sector, “new” value chains are emerging, which will allow the primary producer sector to retain an important part of the added value of the final product (Kaplinsky, 2006). In addition, the GCC also facilitates the incorporation of the services sector in a more effective way, given that the methodology does not make any distinction whatsoever between the different economic sectors (in line with Wallerstein and Hopkins).

Gereffi points out that a GCC has three main dimensions: the flow of inputs and outputs, territoriality, and governance: “Commodity chains have three main dimensions: an input-output structure (a set of products and services linked together in a sequence of value-adding economic activities); a territoriality (spatial dispersion or concentration of enterprises in production and

distribution networks); and a governance structure (authority and power relations)” (Gereffi, 1994: 97).

These three dimensions integrated under the same concept incorporate elements of the *filière* (the input-output flow) to the GCC approach, as well as of phenomena such as the internationalisation of the value chain (by integrating the territorial dimension). The concept of “governance” used by the GCC approach acquires great relevance ahead of the organisational changes in the business structures: “(...) as commodity chains have become more globalized in the second half of the twentieth century, some links that were internal to the modern corporation are being externalized, thereby becoming the tasks of a network of independent firms. Under these circumstances, the governance structure, which is essential to the coordination of transnational production systems, is no longer compatible with a corporate hierarchy” (Gereffi & Korzeniewicz, 1994: 7).

A turning point in this type of literature was the concept underpinned of GCC as “sets of inter-organisational networks around one commodity or product, linking households, enterprises and states to one another within the global economy” (Gereffi & Korzeniewicz, 1994; Henderson et al., 2002). The latter very much stems from the previous works of Wallerstein, and it reformulates conceptual categories in order to analyse patterns of change and global organisation. Governance in the GCC is characterised as either producer-driven or buyer-driven commodity chains, and it acknowledges the significant influence that leading firms exert on the structure and operations of the rest of the chain (Gereffi, 1999; Kaplinsky & Morris, 2002). The first one relates to vertically integrated industrial companies that control the chain and coordinate the linkages backward and forward along the chain. Normally, this type of chain is located in capital and technology-intensive sectors. On the other hand, in the buyer-driven commodity chain, the governance of the chain is determined either by companies of large commercial brands or by distribution companies. In this case, it is production of labour-intensive consumer goods (textiles, footwear, toys...) in which companies that control the chain capture the highest added value, linked to design and marketing. Similarly, Gereffi asserts that a producer-driven chain makes it easier for producers to control the chain due to the high barriers to entry, whilst a buyer-driven chain gives a greater role to commercialisation, design and innovation in relation to the end product due to the fewer barriers to entering the productive sector.

In Gereffi's opinion, one of the greatest transformations in recent years is the shift from producer-driven to buyer-driven commodity chain in important manufacturing sectors. Studies that have used the GCC framework have provided insights into a wide range of aspects, including upgrading market expansion and trade patterns, as well as several industries, including hydrocarbons (Mañé-Estrada et al., 2005).

1.7 The concept of Global Value Chain

Since the mid-1990s the literature on the GCC framework has been expanded, with new contributions and conceptualisations that have been further developed, which are also suitable for analysing chains with a more restricted territorial scope (national or subnational). This has resulted in a more compacted and structured theoretical framework. In this context, Raphael Kaplinsky and Mike Morris published *A Handbook for Value Chain Research* (2002), in which they replace Gereffi's GCC concept with the GVC, which they consider more appropriate to the object of study: "Gereffi's phrase *global commodity chain* suffers because the word *commodity* implies the production of undifferentiated products in processes with low barriers to entry. The problem with this, as we shall see below, is that the search for sustainable income growth requires producers to position themselves precisely in non-commodity, high barriers to entry activities in the value chain. For these reasons, and in the absence of an agreed phraseology, we will continue to use the words *value chain*, but to do so in an analytical context" (Kaplinsky & Morris, 2002:25).

In order to understand the dynamics of industrial organisation, international trade and regional development in accordance with the proposed approaches, the concepts of the value chain and commodity chain provide a valid starting point (World Bank, 2017), in the sense that it has been documented as far back as the 1960s in the context of development paths for extractive exporting economies. However, in the 1980s the term was commonly used in the business literature thanks to the works of Michael Porter (1980, 1985, 1990). While his contributions provided limited utility in the analysis of socioeconomic dynamics and development, they provided many of the theoretical foundations for the value chain today (Henderson et al., 2002). In this context, the new institutionalism (Williamson, 1985) has also helped explain the relationship that exists between the different components of the chain.

This concept was also transposed into economic geography (Dicken, 1986) by integrating value chains into a territorial context and was followed by a large body of literature on transnational

corporations and regional development (Hess & Yeung, 2006). Furthermore, with the consolidation of value chain efforts, the definition of value chains found in the literature has been very consistent over the past two decades and is defined as “a full range of activities that are required to bring a product or service from conception, through different phases of production, delivery to final consumers and final disposal after use” (Kaplinsky, 2000, 2004; Gereffi et al., 2001).

This new terminology was widely adopted by the studies of the GCC, to the point that Gereffi himself, in his recent works, uses the concept of GVC to the detriment of his original GCC (Gereffi, Humphrey, & Sturgeon, 2005). Most authors use both terms alike.

Akin to the GCC concept, the GVC framework (Kaplinsky & Morris, 2002; Gereffi et al., 2005; Bair, 2005) allows one to better understand how global industries are organised by examining the structure and dynamics of different actors involved along the chain of a given industry. The GVC analysis is built upon the previous GCC approach but extending it to non-commodity goods and widening some of its conceptualisations and analytical constructions in order to make it more universally applicable. Hence, six basic dimensions are explored by the GVC, some of which are based upon the previous GCC: (1) input-output structure of a GVC; (2) geographic scope; (3) governance structure: lead firms and industry organisations; (4) upgrading; (5) local institutional context; (6) industry stakeholders.

The Kaplinsky and Morris manual compiles many of the theoretical contributions of the studies of the GVC, whilst extending some conceptualisations and analytical constructions (governance, upgrading, critical success factors...). For each of these conceptualisations, the authors propose a detailed methodology that entails the researcher grasping the defining elements and the transformations of the value chain under study.

In a later piece of work, Kaplinsky (2006) defends the analytical framework of the GVC in the following terms: (a) an accounting framework to chart the accretion on costs as a product moves from conception to production, through use, and to recycling; (b) an analytical framework to explain who does what in the value chain, reflecting the dynamics of rent through the chain; (c) by focusing on governance and power, a framework to understand the drivers of allocation and distribution; (d) a corresponding analytical structure to explain the patterns of income

distribution that arise in the production-consumption chain; and (e) a framework for analysing different types of upgrading processes.

The studies on the GVC have led to an important predicament in recent years. In spite of the fact that they emerged as a methodology of analysis applied to chains of manufactured products (Gereffi, 1994, 1999, 2003, 2006; Barnes & Kaplinsky, 2000; Schmitz, 2006; Cammett, 2006), their capacity to be successfully adapted to many other areas of analysis has led to a proliferation of case studies in the fields of extractive industries and energy. For instance, for specific theoretical and case research see Gereffi and Dubay (2008), Aponte-Garcia (2011), Kayani (2015), and Gereffi, Guinn and Bamber (2014).

1.8 The concept of Global Production Network

Unlike the GCC/GVC approaches, the GPN concept becomes deliberately broader (Henderson et al., 2002). Indeed, all three frameworks intend to better assess the understanding of political economy of globalisation by examining how spatially distributed economic activity is functionally coordinated, but some stem from studies of international trade and take the commodity as their analytical unit (GCC); others emerge from industry studies and focus on issues of value chain management, innovation and sectoral management (GVC); while the last one highlights the dialectical interplay of territorial and network coherence, and allows for a broad range of actors beyond the firm (GPN) (Bridge & Bradshaw, 2017).

GPN is defined as “the globally organised nexus of interconnected functions and operations by firms and non-firm institutions through which goods and services are produced and distributed” (Coe et al., 2004: 471). The concept has been developed and refined by a number of scholars from the Manchester School (Dicken & Henderson, 2003; Coe et al., 2004; Hess & Yeung, 2006) and is the most inclusive framework of the three for the following reasons: (1) due to the explicit consideration of extra-firm networks by necessarily encompassing the broad range of non-firm organisations (i.e., supranational institutions, trade unions and consumer groups) that may shape firm activities; (2) GPN is innately multilevel, thus embedding the interactions between all spatial scales from the local, to the regional and to the global; (3) it moves beyond the limitation of the “chain” notion and avoids a linear interpretation of how production systems operate and generate value; (4) the governance structure in the GPN is taken to be much more complex and variable over time than the one suggested by the other two frameworks; (5) the GPN analysis

does not consider the network as an abstract object, but rather focuses on the dynamic developmental impacts that result for both firms and territories that they interconnect.

GPN analysis combines contributions from the previous GCC and GVC frameworks with influences from the actor-network theory²³ and it emphasises the multi-actor and multi-scalar characteristics of transnational production systems through intersecting notions of power and value (Coe et al., 2008). GPNs are, as Levy (2008) argues, “simultaneously economic and political phenomena... [they]... resemble contested organisational fields in which actors struggle over the construction of economic relationships, governance structure, institutional rules and norms, and discursive frames.” This profoundly relational view of the world is key to understanding the underlying nature of this theoretical framework to the extent that some of the authors believe that there are no “macro” and no “micro” levels as there are entities with separate and distinct essences that are then brought into external juxtaposition (Urry, 2003).

GPN has also not escaped controversy. Sunley (2008) suggests that this view of networks often includes everything and lacks analytical boundaries and clarity, while it makes it difficult to validate empirical findings. In addition, Bair (2008) also questions whether GPN empirical studies have been that different from GCC research.

In general terms, GPN analyses have tended to focus on agriculture, manufacturing and, to a certain extent, service sectors, at the expense of extractive industries. Nonetheless, recent work on the oil and gas industries (Bridge, 2008; Bridge & Wood, 2005; Steen & Underthun, 2011; Dicken, 2011; Bridge & Bradshaw, 2017) demonstrates that there is considerable potential unexploited under the lens of the GPN framework.

As we will see in Chapters 3 and 4, the use of such analytical frameworks (GCC/GVC/GPN) will become a useful mechanism to assess the relational nature of the domestic dimension of the Algerian gas vis-à-vis the gas sector in the Western Mediterranean region as a whole, with a view to juxtapose and relate these two heterogeneous spheres. By inferring how and to what extent the value is captured by the different agents along the chain we intend to determine the relations

²³ Developed by science and technology studies scholars Michel Callon and Bruno Latour, the sociologist John Law, and others, the actor-network theory is a theoretical and methodological approach to social theory where everything in the social and natural worlds exists in constantly shifting networks of relationship.

of power among them, which will eventually give us evidence to assess the impact the latter has in the rent accruing to the state.

1.9 Conclusions

This chapter proposed a critical review of the main theoretical frameworks and methodologies used in this research thesis. In some cases, such a review extends beyond what is deemed necessary for the scope of this research, but the author chose to give a comprehensive overview to provide a more robust historical backdrop.

In this vein, the first section of the chapter set out the evolution of the governance of the hydrocarbon industry worldwide, which is an important contextual setting for this research for two main reasons: first, because of the dominant role among hydrocarbons that crude oil has played on the world scene with the establishment of cartel organisations (like OPEC) – of which Algeria has been a member since 1969 –, and the emergence of a global oil market, which sets a global price thanks to which rents accrue to the producing states. Consequently, the fact that natural gas prices are usually indexed to those of crude oil enhances these rent schemes. The second reason has to do with the evolution of the business structure in the hydrocarbon industry, which has changed the regime and the power relations within the governance framework (Palazuelos, 2009) with the establishment of OPEC on the side of the producing countries and the IEA on the side of the consuming countries, and the NOCs in the first group and the IOCs in the second.

The next section discussed the so-called problem of hydrocarbon-rich economies or resource curse, which encompasses a very fertile and large body of literature within the discipline of development economics since the 1920s. Much of the empirical work carried out to show evidence on the resource curse is focused on countries that happen to be rich in natural resources, thus beyond the hydrocarbon sector, to conclude that there is a negative correlation between economic growth and resource-abundant economies. However, for the purposes of this research thesis, one of the most commonly used theoretical frameworks to exemplify the resource curse in the Arab countries appears as very relevant: the TRS, a concept initially coined by Mabro (1969) and Mahdavi (1970), but further developed by Beblawi and Luciani (1987).

In the most accepted definition of the rentier state (Beblawi & Luciani, 1987), there are three elements worthy of attention: the first one is that while rent is an economic concept, the author chooses to place this question in the background (Beblawi & Luciani, 1987: 49) and focuses on rentierism as a categorisation of a group that, without actively participating in the production tasks, receives a significant share of the production. Hence, he states that the basic characteristic of rentierism is defined by rentier behaviour – or lack of productive behaviour (Beblawi & Luciani, 1987: 50). That is why, in the later dissemination of the term, rentierism is related to [rentier] behaviours or mentalities of states, groups or individuals. However, this overlooks the fact that certain conditions are necessary for the rent to exist as a foundation of rentierism. This is precisely where this section critically reviews the orthodox views and proposes a new approach.

The TRS, albeit a useful description rather than explanation of a phenomenon (Mañé-Estrada & Albinyana, 2023), is reductionist (Talahite, 2012) as it tends to consider the totality of revenues redistributed by the state as a rent, assimilated to the hydrocarbon rent: it tends to mix the cause (rent generated in the international market) and the effects (rents generated in the domestic market), and it also considers the rents accruing from the international markets as “flows like manna from heaven” (Beblawi & Luciani, 1987: 9). As noted beforehand, the theory characterises rentierism by rentier behaviours undertaken by the elites of the rentier economies, when the international governance framework of the hydrocarbon industry limits, or even scraps, the decision-making power of these rentier economies.

It is precisely the understanding that power is being constrained by the international governance framework that brings this chapter to suggest the incorporation of other theoretical frameworks that are thoroughly explained in the following section as a way to complement the TRS and other literature referring to hydrocarbon-rich economies such as the Dutch disease. One of the schools of thought that has dared to question this absence of a relational articulation between the domestic political dynamics and the global economic dynamics is the Manchester School’s approach of GPN applied to the extractive sector (Bridge, 2008: 389-419). Henderson et al. (2002) define GPNs as the “globally organised nexus of interconnected functions and operations by firms and non-firm institutions through which goods and services are produced and distributed.” The concept has many predecessors, ranging from GCCs to GVCs.

In the next section, these three theoretical approaches were discussed at length. Starting with the concept of “value chain” (Porter, 1980) within the traditional theory of trade and how it has evolved into the concepts of GCC (Hopkins & Wallerstein, 1979; Gereffi & Korzeniewicz, 1994), GVC (Kaplinsky & Morris, 2002) and GPN (Henderson et al., 2002). The three approaches stem from production processes that can now be fragmented into several production segments, each corresponding to a particular slice. These fragments can be relocated, often across national borders, to locations whereby corporations can benefit from lower production costs and their tasks can be performed more efficiently. Hydrocarbon industries, and in particular natural gas, have not escaped this pattern through a surge of LNG trade, accompanied by a deeper process of integration associated with cross-border production chains and networks for making, selling, and transporting natural gas, what is commonly referred to as the gas supply chain. This process has transcended the boundaries of the nation-state and has become regional, and even global with the evolutionary dynamics of the LNG sector and pipeline gas. The possibility of embedding the trans-national nature of these frameworks in the methodology used by the author in this research thesis, specifically in Chapters 3 and 4, is particularly innovative.

CHAPTER 2: Dissecting the Historical Evolution of Algerian Natural Gas in the Construction of a Rentier Economy

CHAPTER 2: Dissecting the Historical Evolution of Algerian Natural Gas in the Construction of a Rentier Economy

2.1 Introduction

The previous chapter outlined a critical review of the main theoretical frameworks and methodologies underpinning this research thesis. It mostly explored the so-called problem of hydrocarbon-rich economies or resource curse within the discipline of development economics, and among them the Theory of Rentier States (TRS) that is often applied to hydrocarbon-rich Arab economies like Algeria. Moreover, the chapter suggested complementing the latter's theories with other schools of thought (Global Commodity Chain [GCC], Global Value Chain [GVC] and Global Production Network [GPN]) that aim to address the absence of a relational articulation between the domestic political dynamics and the global and regional economic dynamics, which is instrumental in this research thesis.

This chapter describes the historical evolution of Algeria's hydrocarbon sector and how it has been entangled with the economic development paths that the successive administrations have attempted to put in place since the country's independence was achieved in 1962. In this regard, Algeria has become the only meaningful and permanent producer and exporter of natural gas in the Western Mediterranean area since the 1960s. This chapter helps contextualise and understand the institutional evolution in Algeria that has shaped the structure of the country's natural gas industry and its integration into regional value chains, which is primarily the object of analysis in Chapter 3.

By the end of the period covered in the present thesis (as of 2015), Algeria was mainly a natural gas "producing country", the world's ninth largest and the largest by far in the African continent, whereas it was only the world's sixteenth largest oil producer. However, after the country's independence, and especially in the aftermath of the 1971 nationalisation of hydrocarbons, crude oil played a much more critical role, even though natural gas was being used for domestic purposes as the main energy source and proven natural gas reserves were higher than those of oil. As this chapter further elaborates, a number of external and internal factors during the 1970s triggered Algeria's primary choice for crude oil. Therefore, the prospect for further expansion of the natural gas sector did not thrive until the end of the 1970s and did not materialise until the 1990s and 2000s, when the natural gas industry gained momentum in Algeria as part of a

broader regional space, but always in a subordinated manner to the oil sector that contributed with higher amounts of rents accruing to the state.

Under these prior assumptions, the chapter, which is divided into three sections, describes the evolution of Algeria's hydrocarbons with a focus on natural gas, and how the former have influenced the shaping of successive development paths for the country's economy. The first section (section 2.2) briefly elucidates the foundations of the oil and gas industry before its nationalisation of 1971. The hydrocarbon sector started developing in 1956 when the largest oil and gas fields were discovered in the Saharan provinces and when the country was still under French colonisation before becoming independent in 1962. By the end of the 1960s oil was already the state's largest source of revenue, and the nationalisation of hydrocarbon assets was a turning point in the history of the country that cannot be disentangled from the emergence of a new international governance framework of the oil industry dominated by the view that the relationship between landlord states and International Oil Companies (IOCs) must be subordinated to the objective of national development. Neither can it be detached from the fundamental changes in the distribution of power and structures of ownership that were brought by the Algerian independence war (1954-1962) and the central role played by the National Liberation Front (FLN) as the single ruling-party in the country until other parties were legalised in 1989.

The following section (section 2.3), which is the core of the present chapter, explores the evolution of the hydrocarbon industry, and its role in the economic development of the country from the nationalisation of 1971 to 2015. It is precisely the nationalisation that places the hydrocarbon sector, and particularly the revenues generated by the external rents accruing to the state, at the core of the national development strategy. This strategy was not developed uniformly overtime. During the era of President Boumédiène (1965-1978) a "big-push" strategy was underpinned by the desire to promote a quick development of the country's industrial basis, while channelling hydrocarbon rents to promote this industrialisation process that would result in economic diversification. To this end, Algerian National Oil Company (NOC) Sonatrach adopted the first ever ambitious hydrocarbon strategy (*Valorisation des Hydrocarbures*, VALYDH), which triggered a major shift in energy policy, as this chapter shows.

The successor of Boumédiène, President Bendjedid (1979-1992), reduced investments in heavy industry, and promoted some “neoliberal” reforms after the oil “counter-shock” of 1986, while keeping tight control over the hydrocarbon sector that continued feeding the state with revenues generated by higher volumes of gas and oil exports. It is precisely this change of development path that asserts the rentier nature of the Algerian economy. This section also examines the first comprehensive hydrocarbon legislative package adopted in 1986 and amended in 1991, which relaxed the terms of access to the upstream phase of the gas value chain for international companies and further extended the transportation sector. In this context, this period also coincides with the entering into operation of the first international gas pipelines that connect Algeria with Italy first, and Spain later, and which secured long-term gas contracts with the main two clients of Algerian natural gas. By realising these physical interconnections and relations of dependency, a regional geo-energy area of natural gas emerges in the Western Mediterranean; one that places Algeria at its very centre as the only natural gas producer, and which is further developed in Chapter 3.

Finally, after the civil war that devastated the country for a decade with fighting between the army and various Islamist groups, the country experienced the fastest growth in the natural gas sector until the great recession of 2008. Under the administration of President Bouteflika (1999-2019), the country witnessed several failed attempts to open up and liberalise the economy. Indeed, the section assesses the policy changes undertaken with a driven attempt towards full liberalisation of the Algerian natural gas sector, a path that was partly achieved with a new legislative package in 2005, but which was reversed with the amended versions of the law of 2006 and 2013. Overall, this section helps explain why Algeria has become a rentier state in which the hydrocarbon sector plays a core role, and which has triggered several consequences for the development of the economy.

The next part in this chapter (section 2.4) describes the evolution on the pricing policies adopted by the Algerian NOC Sonatrach and mainly applied to natural gas from the nationalisation of 1971 until 2015. Precisely because hydrocarbon rents have always been channelled to the state through this company, pricing policies are key to better assess the evolution of Algeria as a rentier economy because they impact the flow of rents accruing to the state, as described in Chapter 1, and have helped perpetuate the rentier nature of the Algerian economy.

Finally, the last part (section 2.5) addresses a key question about taxation (and public revenues originated by hydrocarbon rents) as the main vehicle by which rent is transformed into national income, effectively converting foreign revenue from hydrocarbon (mainly oil) exports. This section explores the role that rents generated by the exploitation of Algeria's hydrocarbons have entailed for the public economy of the country and how taxation has been instrumental to this end.

2.1 The hydrocarbon foundation: oil and gas up to the nationalisation of Algerian hydrocarbons

The existence of petroleum in Algeria was known since the early Numidian Kingdom.²⁴ In some of his chronicles, Aristotle described the extraction of oil from this area. During the Roman rule, the Numidian used bitumen²⁵ to collect rain in cisterns. The collapse of the Roman Empire and the later invasion of Numidia by the Byzantines and the Vandals left the region stagnated until the first appearance of the Arabs in the 7th century. The evolution from the 7th century onwards facilitated the articulation of a relatively stable and prosperous Maghreb region, the term used by the Arabs to encompass those territories located in the west of the vast Arab domains, including what was later called Algeria.

One of the Arab-Amazigh unifying dynasties, the so-called Almohads, in the 12th century gave the name of Aïn Zeft to a bitumen spring, which centuries later (1877) would be recognised as Algeria's first oil well. Arabs mainly used the extracted bitumen for medical and illuminating purposes. When Algeria was under the rule of the Muslim Ottoman Caliphate, during the 16th and 17th centuries, the exploitation of bitumen was extended to the mining and (still) very rudimentary refining with the aim to produce gunpowder for the Algerian fleet in the Mediterranean and for the local arms industry utilised to repel the invasion of the French in 1830.

²⁴ Numidia (202 BC-40 BC) was an ancient Berber kingdom of the Numidians, located in what is now Algeria and a smaller part of Tunisia, Libya and Morocco.

²⁵ Bitumen is a sticky, black, and highly viscous liquid or semi-solid form of petroleum. It may be found in natural deposits or may be a refined product, and is classed as a pitch. The use of natural bitumen for waterproofing, and as an adhesive, dates at least to the fifth millennium BC.

French colonial rule in Algeria lasted from 1830 to 1962. The main feature that defines the Algerian economy during these 132 years of French colonisation is the predominance of agriculture to the point that before the Second World War there were no incentives to diversify the economy to sectors other than the agriculture, with the exception of those linked to rural development. There is a very fertile body of academic literature on the disruptive effects that the French colonisation entailed for the evolution of the country before its war on independence (1954-1962) and on the legacy of colonisation after independence (Fanon, 1961; Abbas, 1962; Camus, 1965; Bourdieu & Sayad, 1965; Benachenhou, 1977, 1985; Bourdieu, 1977; Benamrane, 1981; Benissad, 1982; Bennoune, 1988; De Villiers, 1989; Benamrouche, 1995; Bouzida, 1991; Chikhi, 1991; Droz & Lever, 1991; Stora, 1993, 1994; Goumeziane, 1994; Zoubir, 1993; Zouache, 2012).

It was in this very particular context that the first mining leases were granted under the Napoleonic Code in Algeria in 1851.²⁶ The concession was given to the French “Paix et Cie”²⁷ for an area at Aïn Zeft in the lowlands of Oued Chelif. As early as 1877, operations began in Aïn Zeft but technical difficulties impeded its continuation, and it was eventually abandoned.

In spite of the oil well in Aïn Zeft being earmarked as the beginning of contemporary hydrocarbon exploration in Algeria, more relevant were the concessions granted in 1916 and 1917 in the same region around Aïn Zeft and very close by in Tiliouanet to three UK companies operating under French law: *Société Co-intéressée des Pétroles Algériens* founded by Pearson, the *Société Algérienne des Pétroles de Tiliouanet*, which gave the highest profits, and the *Société d'Études, de Recherche et d'Exploitation des Pétroles en Algérie* (Tramerye, 1923). These concessions were not long-lasting due to the lack of capital involvement required in this sort of operations.

The First World War had confirmed the strategic importance of oil as a commodity and primary energy source, but also the shortages which France had been faced with during the war. Arguably, it was no surprise that France attempted to consolidate its position in the Middle East,

²⁶ The law was adopted in April 1810 and became applicable in Algeria in June 1851 (Aïssaoui, 2001).

²⁷ Established in 1863, “Paul Paix et Cie” was the first oil refinery in France. In 1905 it became “Paix et Cie”. In 1927 it changed its name to *Société Générale des Huiles de Pétrole* until 1954, when British Petroleum took it over, creating *Société Française des Pétroles BP*.

first through the Sykes-Picot Agreement²⁸ in 1916, and afterwards at the San Remo Conference²⁹ in 1920. Notwithstanding the obtainment of a relative share of future Iraqi oil the agreements clearly favoured the UK claims to the detriment of the French ones. In this vein, in 1924 the French government promoted the establishment of the jointly-owned *Compagnie Française des Pétroles*³⁰ (CFP) to take part in all the phases of extraction and development of Iraqi oil. In this context, before the Second World War, France had not been excessively concerned with the power of international US oil companies, partly because oil was still far behind coal as an energy source, and also because supplies had always been reliable (Musso, 2017). However, the French government envisaged the need to establish an instrument of national oil policy, and a year later it created the *Office National des Combustibles Liquides* (ONCL) as an entirely publicly-owned company. ONCL was tasked with the financing of oil explorations in all French colonies, including Algeria.

In the aftermath of the financial crisis of 1929, the exploration campaign carried on in Algeria by ONCL faced severe budgetary impediments due to the constraints imposed by the crisis on public budgets. These restrictions were only phased out in 1939 when a new institution, the *Régie Autonome des Pétroles* (RAP), was established to revive the exploration of hydrocarbon resources. The outbreak of the Second World War delayed the beginning of this campaign for some years.

The Second World War was a turning point in relations between Algeria and its ruler, France.³¹ As a result of the war, Algeria became isolated from its metropole France, which signalled the extreme vulnerability and dependence of the Algerian economy. The isolation was not the only

²⁸ The Sykes-Picot Agreement was a secret treaty between the United Kingdom and France, with assent from the Russian Empire and Italy, to define their mutually agreed spheres of influence and control in an eventual partition of the Ottoman Empire.

²⁹ The San Remo Conference was an international meeting of the post-First World War Allied Supreme Council with the UK, France, Italy and Japan being involved (US acted as observers). Resolutions passed at this conference determined the allocation of mandates for the administration of three Ottoman territories in the Middle East: Palestine, Syria and Mesopotamia. Whilst Syria and Mesopotamia were provisionally recognised as states to be granted Mandatory assistance, Palestine was designated to be administered by the Mandatory with the explicit obligation of implementing the Balfour Declaration. The boundaries of the three territories were to be determined by the Principal Allied Powers.

³⁰ Predeceasing company of the French IOC Total.

³¹ France declared war against Germany in September 1939. A few months later, France capitulated and the collaborationists took over the government of France. During a first phase, Algeria sided with the collaborationists, but soon after 1942 General Charles de Gaulle headed the resistance to the Third Reich and Algiers became the capital of the French Empire. The consequences of the war were extremely negative for the Algerian population, including its primary sector of agriculture, which suffered famines and devastating epidemics (Mañé-Estrada, 1997).

consequence of the war as other aspects that hindered the development of the colony were the financial and inflation crises triggered by the shortage of basic primary goods, alongside the under-financing of the colony. As a result, as explained by Nouschi (1995), not only did Algeria learn the costs of the economic and financial dependence on its metropole France, but the French also understood that it was not worth keeping a colony like Algeria without properly developing an industrialising base with a skilful labour force. Hence, one could argue that the war favoured the end of the traditional model solely based on the export of Algerian agricultural goods to the French metropole.

After the Second World War, France became the most active engaged European country in pursuing its own national oil industry (Musso, 2017). As the relevance of oil became increasingly important and it was heavily controlled by a cartel³² of Anglo-American companies, France, alongside other European countries, “became concerned by their double dependency on Middle Eastern supplies and Anglo-American control” (Musso, 2017: 67).

Against this backdrop, the French authorities under General de Gaulle, while maintaining international activity in oil development led by the CFP, decided to create a new public entity called *Bureau de Recherches des Pétroles* (BRP) with the aim of launching a national programme for oil exploration in France, Algeria and other French colonies.³³ In addition, other public instruments of intervention were established such as the SN Repal (*Société Nationale de Recherche et d'Exploitation des Pétroles en Algérie*) in 1946, a joint venture between BRP and the General Government in Algiers. With the setting up of all these instruments and strong incentives to advance in the exploration of the hydrocarbon resources in Algeria immediate results were achieved. It is worth mentioning that the French Petroleum Code at the time was very rigid and restricted the role that foreign companies could play in these new companies: the participation could only be channelled through joint ventures whereby no foreign companies could hold a majority share.

³² The hydrocarbon industry, in particular oil, became the world's largest globalised industry by value. It acted as a strong oligopoly of seven international companies, also known as the “Seven sisters”, namely Anglo-Iranian Oil Company (later, BP), Royal Dutch Shell, Standard Oil Company of California (later, Chevron), Gulf Oil (now merged into Chevron), Texaco (now merged into Chevron), Standard Oil Company of New Jersey (later, ExxonMobil) and Standard Oil Company of New York (later, ExxonMobil).

³³ Ordinance no. 45/2324 of October 1945 establishing a *Bureau de Recherches des Pétroles*. Official Journal of the French Republic.

For decades, France and Algeria had developed a traditional colonial economic relationship whereby France supplied industrial goods to the Algerian internal market, and, in its turn, Algeria exported agricultural goods to France, mainly wine.³⁴ However, the isolation that faced Algeria during the war prompted the development of an early improvised manufacturing activity (Nouschi, 1995), which did not respond to any previous public planning nor was able to compete with the previous established trade links between the metropole and the colony once those previous links were restored after the war. In spite of the abovementioned early industrialisation effort, industrial planning began as soon as the war was over. In this vein, in October 1946 a plan for the industrialisation of Algeria was adopted, and in 1947 African Industrialisation Zones were set up across the French colonies. Not only in terms of policy planning but also in terms of budgetary allocation there was an effort to kick start this process.³⁵

There were multiple underlying purposes behind France's decision to strive for the industrialisation of Algeria when for the preceding hundred years the French metropole had exclusively reserved an agricultural role to this land. Most importantly, the end of the Second World War opened the door to various movements of national liberation against colonialism. The French leadership was very much aware of this threat for their African colonies, in many of which an increasing sentiment of nationalism among the local citizens was flourishing to the extent that France had to soften its initial positions by granting progressive autonomy or by simply not opposing these decolonisation processes. However, Algeria was different.

Indeed, the importance of hydrocarbon resources within the Algerian economy evolved significantly. Until oil production started in 1957 from the giant oilfields of Hassi Messaoud and Edjeleh in the Saharan province,³⁶ oil output was quite negligible. From 1918 to 1949 there was a tiny production of sour oil from the Tliounet field in the Lower Chelif basin, where the highest

³⁴ Until the year 1963 exports of Algerian wine to France were more important than exports of hydrocarbons (Mazri, 1975).

³⁵ The allocation of the French budget to Algeria considerably mounted in this period of time. The average budget allocation in the timespan 1939-44 was 667.8 million French francs, whereas in the timespan 1945-47 it increased to 16,966 million French francs (Nouschi, 1995). Five-year plans were adopted in 1946 and in 1954, and they both took into account targets on industrialisation. In this respect, in 1954 the Algerian industry, supported by both public and private capital, accounted for more than 25 percent of Algerian GDP. The investment amounts targeting Algerian industry were 29,600 million French francs in the period 1947-48 and 357,800 million French francs in the period 1949-54.

³⁶ This subject will be developed at length in Chapter 3.

output was 66 barrels per day in 1929 (GGA, 1934). With the Saharan province, oil production reached another dimension as oil extracted from Algeria only represented 1.1 percent in 1958 but mounted to 32.2 percent in 1962 (Nouschi, 1995). The French authorities wanted to keep control over the exploitation of the discovered hydrocarbon fields and considered that an industrialisation process would help deter any secessionist process prompted by the local Muslim population.

As noted, the southern territories of the Sahara had been administered from Algiers as a separate entity, but soon after the first major natural gas and oil field discoveries in the 1950s Paris decided to directly administer the southern territory by establishing the *Organisation Commune des Régions Sahariennes* (O CRS)³⁷ in January 1957.

In fact, the explorations in the Sahara region began in 1952. In 1954 CREPS (French public capital and 35 percent of the Royal Dutch Shell company) announced the discovery of natural gas at Djebel Berga in the In Salah region. A few months later, in July 1956, SN Repal and CFP announced the discovery of the giant oilfield of Hassi Messaoud, which is one of the world's largest and has contributed half of the Algerian production since then. In 1956 the other super giant field (of natural gas) of Hassi R'Mel was also discovered by SN Repal and CFP in similar conditions to the oilfield of Hassi Messaoud. Therefore, these two major French companies were jointly granted the permits to exploit these two fields, which coupled with the operations of CREPS in the In Amenas region, accounted for more than two thirds of the whole Algerian production of gas and oil in the beginning of the 1960s.

The explorations leading to such discoveries were dominated by the French state even if the latter evolved rather quickly towards further liberalisation (Aïssaoui, 2001). Indeed, the Royal Dutch Shell company, which already participated in CREPS, was the first non-French company to benefit from a provision whereby the French state provided one third of the capital required for exploration, leaving the rest to other companies, either French or foreign. As soon as the aforementioned commercial discoveries were announced in 1956, a number of US, British, German and Italian companies sought a participation in the Saharan hydrocarbon ventures. As the French authorities feared a loss in the control of these new ventures, they finally limited the

³⁷ This new entity administered all the French territories bordering the Saharan desert, namely the southern territories of Algeria, Mauritania, Mali, Niger and Chad.

participation of foreign companies to 49 percent in these new projects, with the early exception of Shell, which had obtained a majority participation of 65 percent within CPA³⁸ (Devaux-Charbonnel, 1963).

Although Algeria was considered an integral part of France, and hence the legislation applicable to the exploitation of hydrocarbon resources was the French mining law of 1810 with reforms of 1919 that envisaged special provisions for the hydrocarbon sector, the Saharan territories were given a special regulation as soon as the OCRS was established in 1957 (Devaux-Charbonnel, 1975). To this end, the Saharan Petroleum Code provided the legal and fiscal umbrella for the exploration, exploitation and transportation by pipelines of the gas and oil produced in the Saharan provinces. In this regard, the first gas pipeline operational from 1961 transported natural gas from the giant gas field of Hassi R'Mel to the coast (Arzew-Algiers) and the first oil pipeline operational since 1957 from the Edjeleh and Hassi Messaoud oil fields to Tunisia.

The Algerian war of independence began in November 1954 and entailed several consequences of different magnitude. However, between 1954 and 1958, the French government invested 254 billion French francs³⁹ in the modernisation of the country, and since 1959 onwards with the adoption of the Constantine Plan, an investment of 19,530 billion French francs⁴⁰ was envisaged (Nouschi, 1995).

The Constantine Plan was promoted by French President Charles de Gaulle with the aim to massively transform the Algerian economy, and it appeared as a timely pretext to explicitly refer to the use of Algerian newly discovered hydrocarbon resources as an engine for economic growth and development.⁴¹ The French economist René Gendarme expressed it very bluntly in 1959 when he wrote: “The main orientations of an economic growth policy in Algeria should be

³⁸ The *Compagnie des Pétroles d'Algérie* (CPA) was established in 1953 and owned by Shell (65 percent), alongside Sogera (24 percent), BRP (4.5 percent) and the remaining capital by French investment companies. It was granted the upstream works of the Gassi Touil Est oil field in the Saharan provinces.

³⁹ Actual value in EUR adjusted to Consumer Price Index is 54,474,470,416.45 EUR.

⁴⁰ Actual value in EUR adjusted to Consumer Price Index is 4,124,686,503.54 EUR.

⁴¹ President Charles de Gaulle unveiled the plan in Constantine on 3 October 1958 (see the speech of the president to the general public: <https://fresques.ina.fr/de-gaulle/fiche-media/Gaulle00022/discours-du-plan-de-constantine-le-3-octobre-1958.html>).

underpinned by industrialisation. The findings of new energy sources offer an enormous potential to the industry.”

The Constantine Plan envisaged the use of revenues accrued from the exploitation of the oil resources and the potential use of natural gas as a source of energy and feedstock for iron-smelting works and petrochemical plants (Benachenhou, 1978). Nonetheless, contrary to its plans, the revenues accruing from the exploitation of oil and gas were little utilised for the plan as they were remitted to France (Benachenhou, 1980).

As noted, in 1958 the burgeoning hydrocarbon sector in Algeria became the main argument and incentive to preserve a “French Algeria” at any cost, even by annexing the Saharan provinces to France should Algeria become independent.⁴² This position was maintained by the French authorities until 18 March 1962, when the Évian Accords were signed.⁴³

In the aftermath of the independence war, the new political system and the nascent state were underpinned by the legitimacy entailed by the struggle for secession. These three first years after the independence under the presidency of the first Algerian President Ahmed Ben Bella gave birth to a new embryonic administrative apparatus that had to face the reality in very harsh conditions, with difficult decisions and very few financial resources. A state-building process was triggered, embedded in a populist discourse that appealed to national unity with the aim of pursuing a rapid industrialisation path based on a heavy-industry-priority development strategy and following the legacy that French colonists had left in the country. However, this strategy did not fully materialise until President Houari Boumédiène embarked resolutely from 1965 onwards

⁴² Excerpts from President de Gaulle’s speech quoted by Ben Kheda (1986): “All necessary measures to exploit, distribute and transport Saharan oil will be enforced regardless of what happens with Algeria, given that its mere existence belongs to France.”

⁴³ The Évian Accords comprised a treaty signed on 18 March 1962 in Évian-les-Bains (France) by the French government and the Provisional Government of the Algerian Republic, the government-in-exile of the FLN (Front de Libération Nationale), which sought Algeria's independence from France. The Accords ended the 1954-1962 Algerian independence war with a formal ceasefire proclaimed for 19 March and formalised the idea of a cooperative exchange between the two countries. The Accords acknowledged the result of the referendum held in France in January 1961 by which France recognised the right of the Algerian people to choose their future vis-à-vis France through a referendum of self-determination. The Accords were ratified in referendum by both France and Algeria, and President de Gaulle proclaimed the independence of Algeria on 3 July 1962. To read the extract of the Accords in the Official Journal of the French Republic:

https://www.legifrance.gouv.fr/jo_pdf.do?id=JPDF2003196200003019&pageCourante=03019

on a programme reflecting a clearer ideological orientation and hinging on central planning, greater state control of the economy, and industrialisation.

In the run-up to the war of independence, France, on the pretext of modernising agriculture first and developing local industry later, had already managed to wipe out the traditional sectors of the economy. Hence, as the country wanted to pursue economic and human development through a rapid industrialisation path, one could not expect the latter to be financed by the generated surplus of these traditional sectors of the economy, essentially because they no longer existed or could not sustain the costs of such a leap forward. An alternative based on reforming and modernising the agricultural sector to obtain the necessary surplus to finance these planned investments would have entailed heavy human and material costs, apart from delaying this process over time. Therefore, the authorities rapidly envisaged that the only realistic option to prompt a quick path towards industrialisation had to focus on the development of the hydrocarbon sector.

As reflected in Table 1, from 1963 onwards, hydrocarbon exports as a percentage of export earnings clearly surpassed those of the other goods combined, and this trend would be consolidated over time. Hence, the amount of revenues, and thus of hydrocarbon revenues as a percentage of government revenues, did also increase during the decade, as shown in Table 1, even if they still remained very low until the end of the second half of the 1960s and could hardly be channelled to cover capital expenditure. Therefore, it was not until 1971, when Algeria moved towards full nationalisation of the whole hydrocarbon industry, that the state was able to obtain a maximum of its revenues. It is precisely from the moment when the nationalisation became effective that we can refer to real progress on the Algerian development model. That is because it is from that very moment when the state fully controls its own resources (Mañé-Estrada, 1997). It was precisely after 1971 when hydrocarbon revenues as a percentage of government revenues sharply increased, reaching a peak of 58 percent in 1974 (IMF, 2011).

Table 1. Hydrocarbon exports and revenues in Algeria (1960-1971)

	Hydrocarbon exports as a percentage of export earnings	Government hydrocarbon revenues (in million USD)	Hydrocarbon revenues as a percentage of government revenues
1960	N/A	16.4	N/A
1961	45	33.6	N/A
1962	50	43.9	N/A
1963	58	49.5	11
1964	52	59	11
1965	61	89.4	16
1966	65	126	18
1967	73	176	23
1968	71	222.5	24
1969	71	280	25
1970	73	335	22
1971	78	405	30

Source: Compiled by the author based on data from the Algerian Ministry of National Economy and the IMF. Government tax revenues include income taxes, royalties, and pipeline transportation taxes.

As Algeria was poised to embrace socialism since independence as an antithetic ideology to capitalism and imperialism associated with the former colony France, there was a very vivid debate on whether the country could pursue socialism through a system of self-management of the agricultural domains, or rather through a centralised and statist model that would utilise the revenues accrued from the hydrocarbon sector as a catalyser to prompt rapid industrialisation. An orchestrated military coup on 19 June 1965 led by Colonel Houari Boumédiène, Minister of Defence at that time, showed that the second way was finally imposed. This second way earmarked an ideological rupture that embarked the government on an effective programme reflecting a clearer orientation: the establishment of a centrally-planned economy, the nationalisation of foreign capital, and the quick development of the country's industrial basis (Bennoune, 1988).

In this context, the state pursued the progressive control of those sectors of the economy managed under the self-management system through the establishment of a “socialist management of enterprises” (GSE), characterised by the placing under the administration of various ministries manufacturing and distribution companies called “national companies” in the sense that they were fully owned by the state. Given the role that hydrocarbons played in this

new phase of Algeria's development, we will assess the institutional evolution of such a sector since independence in the run-up to the nationalisation that culminated in 1971.

Three major events define this period of time from the developments that occurred in the hydrocarbon industry: the Évian Accords of 1962, the Franco-Algerian Agreement of 1965, and the nationalisation of the hydrocarbon industry that culminated in 1971. These developments cannot be disentangled from Algeria joining Organization of the Petroleum Exporting Countries (OPEC), which offered Algeria diplomatic backing during its disagreement with France over the hydrocarbon prices and the tax regime (Aïssoui, 2001), nor can they be disentangled from the role that the FLN played in the shaping of Algeria as a single-party system.

These three major events were contemporary to the establishment of *Société Nationale pour le Transport des Hydrocarbures* (Sonatrach)⁴⁴ in December 1963, as a classical NOC. It was conceived as an instrument of state intervention and eventually central control of the industry, although in 1963 the initial mission of the company was limited to transportation of hydrocarbons with the construction of a third oil pipeline from Hassi Messaoud to Arzew, given that the other two pipelines were operating at full capacity (Musso, 2018). Nevertheless, in 1966, its mandate was also extended to production and commercialisation. At that moment, in 1963, Algeria's equity production was limited to 12 percent, through SN Repal, against 71 percent for French companies, mainly through CFP, SN Repal, CREPS and SNPA, and 17 percent for other foreign companies, mainly Shell within CREPS. Therefore, Sonatrach was initially excluded from the roles of research and production.

The first of the three major events – the Évian Accords – set the principles of cooperation on the development of the Sahara's subsoil resources by stating that “Algeria and France will continue the efforts aimed at developing the resources of the Sahara's subsoil” and that “Algeria succeeds France in its rights, prerogatives, and obligations as a concession granting authority in the Sahara for the application of the mining and petroleum legislation” (Ben Khedda, 1997).

Particularly noteworthy is the last sentence of this declaration by which Algeria became bound by France's prior obligations and commitments to the foreign and French oil companies in the

⁴⁴ Later, in 1966, Sonatrach would become *Société Nationale pour la Recherche, la Production, le Transport, la Transformation et la Commercialisation des Hydrocarbures*, adding new functions to the role of the company. A brief historical overview of the company can be found as an Appendix.

Algerian territory under the provisions of the Saharan Petroleum Code. In addition, the Accords not only organised a joint Algerian-French formula of exploitation of the Saharan hydrocarbon resources, but also granted a preferential right for six years to French companies in obtaining new permits for exploration. It also set the conditions on which Algeria would be supplying oil and gas to France and the Franc zone in French francs with the aim of maintaining the viability of France's balance of payments (Aïssaoui, 2001), alongside the mechanisms to settle potential disputes.

The Évian Accords gave way to a restructuring of the institutional system that governed the hydrocarbon sector in Algeria. First, the *Organisation Commune des Régions Sahariennes* (O CRS) under the colonial regime was replaced by an *Organisme de mise en valeur des richesses du sous-sol saharien*, also known as *Organisme Saharien*, which became the body in charge of advising all petroleum legislation and regulation, along with the granting of new concession and transportation rights. This institution was governed by an equal representation of French and Algerian senior officials. Secondly, a *Direction de l'Energie et des Carburants* (DEC) was established in Order 62-029 of August 1962 by the Algerian Provisional Government as the political responsible body for the country's energy resources; while thirdly, under the authority of this directorate a state agency, a *Bureau Algérien des Pétroles* (BAP), was established in Order 62-030 of August 1962 to implement a specific programme to manage the prospection and exploitation of oil resources. The latter also took over the participation of the Algerian state in companies involved in the exploration and exploitation of hydrocarbons, such as the shares of SN Repal, among others.

Concurrently, the French ecosystem of public and private companies involved in the exploration and exploitation of Saharan hydrocarbon resources also underwent a restructuring. For instance, a *Bureau de Recherches des Pétroles* (BRP) and *Régie Autonome des Pétroles* (RAP), along with other companies, merged in 1966 originating *Entreprise de recherches et d'activités pétrolières* (Erap), which in 1967 became Elf-Erap. Equivalently, in 1985 CFP renamed itself Total-CFP.

In this context, the Algerian side aimed at renegotiating with the French side the fiscal regime applicable to the hydrocarbon industry, an increased participation in the hydrocarbon sector, as well as a special regime for the development of natural gas. These objectives were recalled by President Ben Bella during his speech at the first commercial natural gas liquefaction plant

worldwide in Arzew built by the company Camel⁴⁵ (*Compagnie algérienne du méthane liquid*) in September 1964 (Megateli, 1980). In addition, he also signalled the importance that natural gas should play in the “economic revival of the new Algeria.”⁴⁶

The renegotiations between Algeria and France lasted for nearly two years and the new agreement reflected an increase in Algeria’s participation in the hydrocarbon sector. For instance, the agreement set a transfer of French shares in SN Repal by increasing Algeria’s participation to 50 percent (from the previous 12 percent as noted). The agreement also ensured an increase of tax revenues accruing to the state up to 55 percent from 1968 onwards (they used to be below 50 percent before the agreement); and the depletion allowance, which was provisioned by the Saharan Petroleum Code, was annulled. Finally, the Algerian government also obtained a first right of disposal of natural gas, which entailed the possibility for the publicly-owned company Sonatrach to acquire the volume of natural gas it wished. As for future prospective operations in the scope of the hydrocarbon resources, the agreement envisaged the creation of the *Association Coopérative* (Ascoop).⁴⁷

The embroiled negotiations that lasted for two years did not impede the two sovereign nations from signing an agreement on 29 July 1965 with the inclusion of the major points reflected hereinabove. The agreement was firstly applied to French interests only, but was soon extended to all foreign nations’ interests. In spite of the agreement to be envisaged to continue in effect for a period of fifteen years until 1980, amendments were possible at the expiry of each five-year period at the request of either party.

The agreement was praised positively from both sides in the beginning, but the discontent mounted in the years to come from the Algerian side, particularly on the participation of the Algerian state in SN Repal to a higher 51 percent, which would have allowed the Algerians to control a majority of the company. Later, rivalries between the new Minister of Industry and

⁴⁵ The Camel plant was owned by Conch International Methane, the French CFP and SN Repal, alongside Sonatrach, in which the Algerian government secured 24 percent of participation (4 percent of which through SN Repal).

⁴⁶ Reported by the newspaper *Le Monde* (archive). Published in September 1964.

⁴⁷ Ascoop was a joint venture of the Algerian public company Sonatrach and the French Sopefal, which was an instrument of intervention owned by the public company Erap. This new association was granted the exclusive right to obtain new concessions on 180,000 km² of land, which represented nearly 20 percent of the whole Saharan territory.

Energy (and former Director General of Sonatrach) Belaïd Abdesselam and the President of SN Repal Belkacem Nabi on the role that both public companies were meant to play caused major strains within the leadership of hydrocarbon policy (Nabi, 1991). However, in 1966 Sonatrach's mission was extended to include all phases of the hydrocarbon industry, and one year later, President Boumédiène ended up dispatching Nabi (Nabi, 1991).

Moreover, following the agreement of 1965, Ascoop was established with the aim of boosting the investment in exploration of new hydrocarbon resources. In this regard, it was agreed that the French part of Ascoop would advance 60 percent of the investment costs to the Algerian part provided that the latter did not exceed the contribution of the French part. This provision was in fact very beneficial for French interests. It facilitated that 70 percent of the new production ended up in the hands of French companies and two thirds of the oil production was exported to France, but, on the other hand, it did not boost the number of discovered new oil fields, as the figures dropped from 67 percent in 1965 to 38 percent in 1970 (de Bernis, 1971). The main efforts in the field of exploration were undertaken by Sonatrach, alone or within Ascoop, whereas French companies justified the low level of investment by the prospect of increasing Algerian control over the exploitation companies or even eventual nationalisation (Elf, 1998).

Overall, by the end of the 1960s Algerian claims towards French companies became more pressing and dissatisfaction with French government economic and financial obligations mounted (Tariki, 1969), and consequently nationalisation became irreversible.

Although the agreement of 1965 gave Sonatrach the possibility to obtain a first right of disposal of natural gas, the reality was that oil continued to be at the core of the government's energy policy and international relations. A new governance structure of international oil was set up at the end of the 1960s and the beginning of the 1970s, in which oil-exporting countries accepted the view that the relationship between landlord states and IOCs must be subordinated to the objective of national development. Whereas the Algerian authorities were already aware that the country had much higher reserves of natural gas than of oil, they believed that oil was better positioned to facilitate the capture of higher hydrocarbon rents and larger foreign reserves to be channelled to the quick industrialisation process that they envisioned. In this regard, the development of the country's comparatively abundant gas resources would only be given full

consideration at the end of the 1970s. As a matter of fact, the amounts of exploitation of the giant gas field Hassi R'Mel demonstrate this, given that, with an annual capacity of 200 billion tonnes a year, the field only produced 300 million tonnes a year (Mañé-Estrada, 1997).

The year 1971 as the date on which nationalisation was effective is not meaningless as it was when the Algerian state was able to start allocating economic resources, mainly supplied by hydrocarbon exports and fiscal revenues, to the construction of the Algerian nation, particularly the industrialisation process through medium-term plans (de Bernis, 1971). After an initial plan in 1966 with a relatively low investment programme worth USD 1.8 billion in 1966, a second plan was launched in 1970 with an initial investment package worth USD 5.6 billion, and which could channel more economic resources into the industrialisation of the country. Thus, the underlying idea was to capture the largest possible portion of the rent generated by exports not as an inherent goal but as a means of boosting economic and social transformation. This is the reason why since the country became independent state control over the hydrocarbon resources had become paramount. In the words of Maurice Byé, quoted by de Bernis (1971: 575), “Algeria is the first Arab country that has decided to sow its own oil.”

The first step in gaining control over the hydrocarbon industry occurred in 1967 with US and British companies as a consequence of the Six Day War of 5 to 10 June 1967, which ended up in victory for Israel, but compromised the image of Americans and British vis-à-vis the Arab countries. A major number of interests⁴⁸ belonging to these two countries was nationalised in autumn 1967, yet leaving the foreign companies dealing with the upstream activity unaffected. Further on, in June 1970, a second move of nationalisation was triggered with the take-over of other foreign companies.⁴⁹

It was on 24 February 1971, on the occasion of the symbolic fifteenth anniversary of the establishment of the *Union Générale des Travailleurs Algériens* (UGTA), the main Algerian trade union, that the government adopted a number of decrees transferring all nationalised assets to

⁴⁸ Esso and Mobil subsidiaries dealing with refining and marketing.

⁴⁹ The US company Phillips Petroleum, the Royal Dutch Shell Group, the Italian-owned Amif and the West German Elwerath (*The New York Times*, 1970). The interests of Shell in Algeria were quite vast: 65 percent in CPA, 35 percent in the oil pipeline connecting Algeria with Tunisia, 35 percent in CREPS and 25 percent in the refinery in Algiers. In the end of 1970 with the nationalisation of the American Mobil, the only (non-French) foreign companies were El Paso Natural Gas and Getty, both of which had very recently signed important contract agreements with Sonatrach.

the publicly-owned utility Sonatrach. These decree packages established the full nationalisation of natural gas resources owned by concessionaries, along with the production installations. They also fully nationalised all foreign interests in the oil and gas pipeline companies. In this vein, the most drastic measure was the partial nationalisation of the concession holding French companies dealing with oil production to a minimum share of 51 percent, thus taking control over them. Finally, from the legal umbrella's point of view, the nationalisation entailed the evolution of the regime for hydrocarbons embedded in the Saharan Petroleum Code and in the agreements reached in the 1962 and 1965 negotiation processes with new laws⁵⁰ on the exploration and exploitation of hydrocarbons.

The new decision enacted in 1971 entailed the subordination of any operation in the scope of hydrocarbons to the control of Sonatrach. Hence, any foreign company willing to enter the Algerian hydrocarbon market would be subject to an association agreement with the latter in the form of an established joint venture under Algerian law. In this venture, Sonatrach would always take at least 51 percent of total shares, whereas, specifically for natural gas, all discoveries are fully transferred to Sonatrach. In terms of the fiscal regime, an expensed royalty of 12.5 percent of the value of the hydrocarbons produced and on tax profits of 55 percent was decided. Additionally, the posted price was to be decided by the government and communicated to the companies (Aïssaoui, 1997).

In this context, the role of OPEC in this process was rather meaningful and will be presented hereafter.

2.2.1 The National Liberation Front (FLN) as the Algerian single party

The Algerian war of independence that represented a major social upheaval triggered a radical shift in the way power was distributed within the country. The legitimacy obtained by the FLN thanks to the role played during the last years of French colonialism and the war of independence was key to ensuring the establishment of the postcolonial FLN one-party system (Roberts, 2003).

⁵⁰ Specifically, Ordinance 22/71 of April 1972, which regulates the activities of foreign companies in the field of exploration and development of hydrocarbons.

In this regard, the first Constitution⁵¹ adopted after the independence in 1963 legalised single-party rule by the FLN.

Indeed, with the aim of consolidating the foundations of the new Algerian state, both the uprising that led Algeria into independence and the control of the Sahara's hydrocarbon resources became the sources of legitimacy upon which the FLN based their domination of the Algerian state, and the latter its domination over Algerian society (Harbi, 1980). Nonetheless, this centre of power did not evolve as a monolithic block, given the existence of different ideological factions that competed to influence a body of doctrine enunciated in several texts, discussed and adopted by the party. Each of these texts was drafted to represent the widest possible consensus within the party (Aïssaoui, 2001), although neither the Tripoli Programme⁵² in June 1962 nor the Algiers Charter⁵³ in 1964 reached the broad consensus that the National Charter of 1976⁵⁴ did during President Boumédiène's term.

Until 1989, when the one-party system was abolished, the ruling FLN shaped the country's economic policies, whose agenda emphasised national unity, commitment to social justice and a rapid transition to modern industry economy (Aïssaoui, 2001). Hence, the adoption of the party's fundamental texts, as the ones reflected hereinabove, which defined the scope of the political, economic, social and cultural orientations for the country, were later translated into official legislation, either in newly-adopted Constitutions (e.g., 1963 and 1976) or in new legislative

⁵¹ The first Algerian Constitution after independence was adopted by a Constituent Assembly on 28 August 1963 by 139 votes against 231. It was submitted to a referendum on 8 September and ratified almost unanimously. The 1965 military coup suspended it, but it was not replaced until 1976 with a new Algerian Constitution.

⁵² The Tripoli Programme was adopted at the meeting that the FLN convened in Tripoli (Libya) before the establishment of the new government under President Ben Bella. It proposed a "socialist option" for Algeria's development, the request for democracy, and economic transformation. It projected the nationalisation of foreign interests, the establishment of an industrial economy, and the inauguration of agricultural cooperatives. The programme viewed the recently signed Évian Accords with France as neo-colonialist (Harbi, 1980).

⁵³ The Algiers Charter was adopted at the congress of the FLN in Algiers in April 1964. The processes of drafting and adoption were carefully managed by President Ben Bella. The Algiers Charter remained the official statement of Algeria's political and ideological orientation until 1976 when a new 1976 National Charter was adopted.

⁵⁴ The National Charter is a doctrinal text proposed in June 1975 by Algerian President Boumédiène, covering different aspects of the political, economic and social life of Algeria. It develops a historical vision of the foundations of Algerian society, paying special attention to the ideologies on which the nation must be grounded: socialism and Islam. On 19 June 1976, a draft of the National Charter was adopted by the National Conference, and on 27 June it was submitted to a referendum, which adopted the text by 98.36 percent of those who participated in favour. The National Charter was promulgated by the Ordinance 57/76 of 5 July and it is the basis for the drafting of the Algerian Constitution of 1976, also accepted in a referendum by the Algerian people on 19 November 1976, which replaced the Constitution of 1963 (suspended in 1965), before being replaced by the Constitution of 1989.

reforms, like those that regulated the exploitation of the hydrocarbon resources due to the key role they were meant to play in this transition to a modern industrial economy.

As noted, this process was not exempt from internal rivalries and purges. President Ben Bella's personality cult fuelled the 1965 military coup orchestrated by President Boumédiène and led to a purge of the late president's supporters in the FLN and the army, who could have challenged the power of the incoming president (McDougall, 2006). A new party's faction known as the Oujda clan, which was formed by military officers and politicians posted in Morocco during the war of independence, became the new dominant faction within the administration of President Boumédiène, the party and the military (Yefsah, 1992). This new coalition built around the FLN and military from the Oujda clan managed to centralise power to undertake the long-term economic reforms that the Boumédiène administration aimed at pursuing, while embedding them into a revolutionary, nationalist and egalitarian ideology (Entelis et al., 1992). The sudden decease of President Boumédiène in 1979 also triggered an evolution in the regime with the newly-elected President Bendjedid.

Alongside the coalition forged by the FLN and the military to rule the country, there was an attempt to forge a new capitalist class out of the former FLN combatants that were given preferential loans by the state to start a new business in exchange for remaining outside the political realm (Lowi, 2011). This new capitalist class lacked entrepreneurial skills and mostly focused on low value-added activities, such as construction and trade; and precisely because of the emergence of these loyal groups such as the new Algerian capitalist class, the ruling power during the Boumédiène era was hostile to the establishment of a truly independent and strong bourgeoisie that could have challenged them (Lowi, 2011). To this end, the ruling coalition financed these relations of loyalty and patronage with oil rents, and had no incentive to promote an independent private sector as the hydrocarbon industry became the engine for national revenue (Hadjseyed, 1986). Alongside this loyal capitalist class, an industrialist faction, also aligned with the FLN-military coalition, also emerged as the managers of the big conglomerates and state-owned enterprises.

In the context of these first thirty years of exercising power after Algeria's independence, Mohamed Harbi wrote (1994) that "in three decades, the political power in Algeria has witnessed some alterations, even if it has always been underpinned by authoritarianism. There are certainly

remarkable differences between Ben Bella, Boumédiène and Bendjedid, but those differences have never questioned that under their leadership the basic ideological, political and economic functions have come together.” In this regard, Harbi (1994) concludes that “until 1989 the Algerian system has been characterised by an unequivocal unity between the political and economic realms.”

2.2.2 The accession to the Organization of the Petroleum Exporting Countries (OPEC)

Another major process that helps explain the developments in the hydrocarbon industry in the run-up to the full nationalisation of 1971 is Algeria’s membership of OPEC. Already much earlier than independence, in 1958, the League of Arab States (LAS) had offered to the newly-established Provisional Government of the Algerian Republic⁵⁵ a platform to present the case of the Saharan hydrocarbon resources during the first Arab Oil Congress, which was finally held in April 1959 after several postponements. The goal of the latter was to promote knowledge of the hydrocarbon sector among Arab countries, and ultimately establish a coordination of their respective oil policies to be supervised by the LAS Political Committee.

In spite of the efforts exerted by the Algerian representatives to denounce French exploitation of Saharan oil,⁵⁶ the Congress diverted its attention to the measures imposed by the largest Western oil companies that pursued a decrease in posted prices with the consequence of increasing losses for the revenues of producing countries.⁵⁷ The consultations carried out behind the scenes by the official delegations represented at the Congress led to a first cooperation agreement between producing countries in the fields of production levels and fiscal policies,

⁵⁵ The *Gouvernement provisoire de la République Algérienne* (GPRA) was the government-in-exile of the FLN during the last part of the Algerian war of independence (1954-62). The GPRA was set up in Cairo (Egypt) by the FLN in September 1958. The purpose of the GPRA was to serve as a diplomatic and political tool for the FLN, while facilitating sympathetic governments to extend official recognition to it (namely including Morocco and Tunisia, as well as Egypt and other Arab countries). Its headquarters were located in Tunis, but diplomats were posted in most major world capitals to try to lobby governments and organise local support groups. After the war, in late 1962, the GPRA was disbanded, after Ahmed Ben Bella seized power by forming a rival institution (a Political Bureau of the FLN) with the backing of the Armée de Libération Nationale (ALN), controlled by Colonel Houari Boumédiène.

⁵⁶ Several references on the rejection of FLN to the French policy on the Saharan oil can be found in the *El Moudjahid* newspaper between 1956 and 1962.

⁵⁷ As noted in Chapter 1, “producing countries” like Algeria sought to take full control of the production as to revert the economic rents generated by the industry into the economic development and modernisation of their respective countries (Chevalier, 1974). In reality, the producing agent is not the country but very often a public National Oil Company (NOC).

which triggered the establishment of OPEC only eighteen months later in September 1960 (Pérez Alfonso, 1966). The ultimate goal was for producing countries to improve the revenues derived from oil.

Nonetheless, the influence of the Provisional Government of the Algerian Republic (GPRA) on this coordinating platform was not clearly manifested until the third Arab Oil Congress in 1961 in Alexandria (Egypt), where an important motion was adopted by the representatives at the Congress recalling the right of the Algerian Arab people to hold sovereignty over the Sahara and its sub-soil resources.⁵⁸ This motion illustrated the efforts exerted by the GPRA to use all diplomatic means to avoid any temptation from the French side to separate the Saharan territory from the rest of the emerging independent state, given that negotiations to put an end to the war were about to begin. A few months later, the Évian Accords secured the territorial integrity of the whole Algerian territory, including the Sahara and its sub-soil resources.

As stated, the main objective that led to the establishment of OPEC by oil producing countries was the cooperation to improve the revenues generated by oil accruing to the state. In contrast, Algeria aimed at increasing state participation in an industry dominated by French interests (even after the agreements of 1965 with France), and eventually take over full control of the industry. In fact, tax arrangements under the agreements of 1965 with France were not unsatisfactory for the Algerian authorities, and in any case, they could not be reviewed until 1969. In addition, Algeria's late membership of OPEC was also interpreted by the French government as a position to avoid any further collusion with French partners after the signing of the agreements of 1962 and 1965 (Nabi, 1991).

This dissociation of primary objectives between Algeria and OPEC triggered some discord between the two parties. Although Algeria already attended some high-level OPEC meetings in 1963, membership of the organisation was by then perceived as unlikely. The adoption by OPEC of a decisive declaration⁵⁹ in June 1968 paved the way for Algeria to join in July 1969.

⁵⁸ Extract from motion that can be read in the chronology from September to December 1961 of the *Middle East Journal* (1962): "All agreements covering prospecting for these resources and exploiting them, whether in Algeria or any Arab State, are considered invalid unless concluded with the respective national governments, which alone have the right to represent their countries."

⁵⁹ A "Declaratory Statement of Petroleum Policy in Member Countries", incorporated in Resolution No. XVI.90, was adopted. The Statement called on "Member Countries to undertake, as far as feasible, direct exploration for

Nevertheless, only one year later, Algeria tried to force OPEC to commit to further government participation in ownership of the concession holding companies, but failed. It did not mean much for Algeria as in 1971 the country moved towards full nationalisation of the hydrocarbon industry.

2.3 The role of hydrocarbons in Algeria's economic development and evolution of hydrocarbon's legislative framework

During the 1960s and most of the 1970s, Algeria was mainly focused on the exploitation of the oil industry in spite of Algeria's modest potential as producer in comparison with gas. The development of the country's comparatively abundant gas resources would only be given higher consideration at the end of the 1970s when suitable policies were incorporated into the National Charter of 1976 and a regional market started to emerge. For a country like Algeria, which represented in 2015 nearly 8 percent of the African surface area and 3.4 percent of the African population, its natural gas constituted a huge resource since production was intensified at the end of the 1970s.

When gas production began in 1960 from the super-giant field Hassi R'Mel, discovered in 1956 by SN Repal and CFP, the opportunities to utilise natural gas were very limited, given that it could only be used as fuel in lighting cities, heating appliances, and cooking equipment, while exports required further development in the transportation of this natural gas to Europe. Therefore, the immediate interest in commercialising natural gas was the extraction of the hydrocarbon liquids contained in the gas.

Similarly, additional domestic factors also hampered the expansion of natural gas immediately after independence. Both Ministers of Energy Belaïd Abdesselam (1965-77) under President Boumédiène and Belkacem Nabi (1979-88) under President Bendjedid, have argued (1991) that disagreements among the country's authorities prevented the shift from oil to natural gas from happening anytime soon. The reality was that in the aftermath of nationalisation in 1971 the new legislative scheme that was adopted allowed participation of IOCs in the upstream phase of oil exploitation, but any foreign company willing to enter the Algerian market would be subject to an association agreement with Sonatrach in the form of an established joint venture under

and development of hydrocarbon resources; to seek participation in the equity of existing concessions, and progressive and accelerated relinquishment of acreage of present contract areas..."

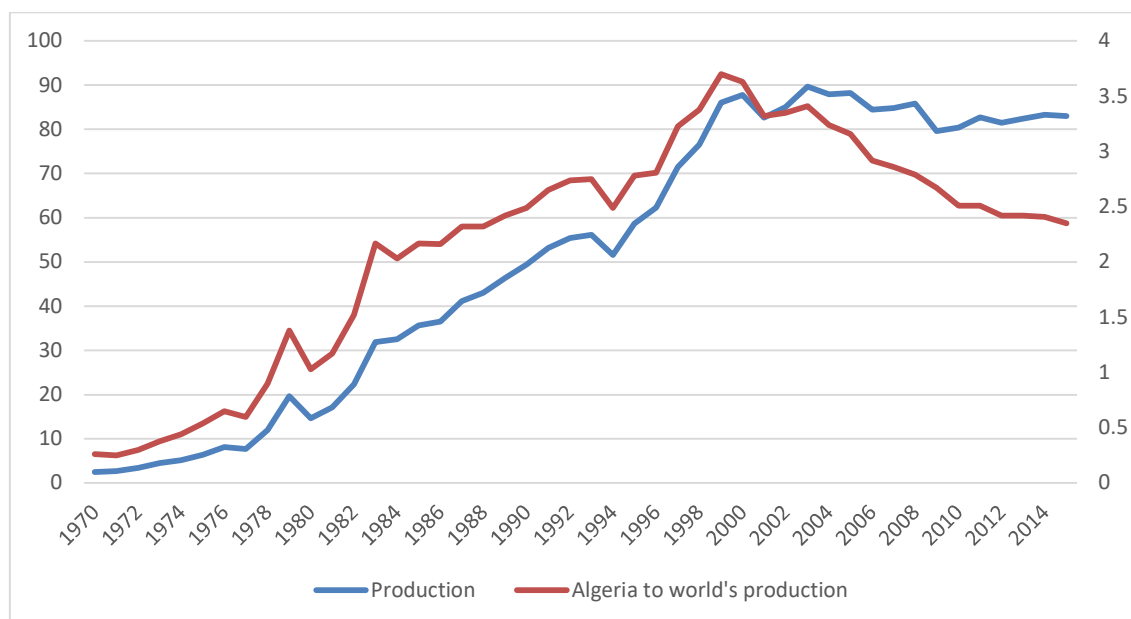
Algerian law. The latter delayed potential investors from committing the necessary funds and technology to bolster exploration and exploitation resources, which were precisely required in large amounts during these incipient times of the exploitation of the Algerian gas industry.

In this context, it is important to highlight that Algerian policies on hydrocarbons were strongly conditioned by external factors that did not solely depend on the country's legal evolution. The possibility of fully developing the Algerian gas sector was hindered by the failed attempts to commercialise Algeria's Liquefied Natural Gas (LNG) described in this section, the harsh competition on European markets from Dutch natural gas, which was by far the largest European gas producer, and the lack of proper infrastructure with midstream technology to export significant amounts of natural gas via pipeline. Although Algeria was a pioneer in the development of the necessary technology to export LNG with the operationalisation of the Camel liquefaction plant in 1964, the capacity of this plant was very limited (3 bcm per year) and could only fulfil the contracts signed with British Methane in 1963 and Gaz de France in 1965 (Malti, 2010).

These external and internal weaknesses were coupled with low revenues accruing to the state as compared with those generated by the export of crude oil that have been previously outlined.⁶⁰ However, the fact that crude oil has always been able to generate more rents in the global market does not mean that Algeria has not been exporting natural gas, in particular from the end of the 1970s. As reflected in Figure 3, production of natural gas in Algeria has increased quite considerably in the timespan 1971-2015 (2.9 percent increase), but only since the end of the 1970s, and also worldwide reaching record peaks at the end of the 1990s and the early 2000s, when Algeria's natural gas production rose to a historic maximum of 3.7 percent of world production in 1999 (BP Statistical Review of World Energy, 2016). Since 1999, Algeria's gas production as a proportion of world production slightly decreased to 2.4 percent in 2015 (BP Statistical Review of World Energy, 2016) due to the expansion of LNG worldwide and the surge of new very strong LNG producers like Qatar, along with the relative depletion of Algerian gas fields, as we will better explain in Chapter 3.

⁶⁰ See Figure 2.

Figure 3. Natural gas production in Algeria in bcm and share of Algeria to world's production in percentage (1971-2015)



Source: compiled by the author based on data retrieved from BP statistical review of world energy. Left axis is expressed in bcm; right axis is expressed in percentage

Against this background, this section examines how the evolution of the political and legal frameworks, coupled with external factors, some of which are beyond Algeria's control, have impacted the role of hydrocarbons in Algeria, and how the latter is closely intertwined with the economic development of the country, precisely due to the key role that hydrocarbon rents have played in the country's economy since the 1971 nationalisation. The combination of all these elements will enable us to better understand the way Algerian has integrated into natural gas value chains in the Western Mediterranean and beyond.

2.3.1 A hydrocarbon central planning policy for a "big push" development strategy

As we analysed in Chapter 1, one of the main features of hydrocarbon rents is that they are generated in the international markets, but redistribution takes place within the country. In the case of Algeria during Boumédiène's term, in which his administration embarked on a rapid industrialisation programme based on a heavy-industry-priority development strategy in line with the "big push" model developed by Rosenstein-Rodan (1943), this feature of the hydrocarbon policy was very conspicuous: the programme was financed by large windfall revenues from the

hydrocarbon exports accrued by the state with the aim of financing the costs of the industrialisation plans, which at the same time became a symbol of national independence.

Under this premise, President Boumédiène and his administration were influenced by proposals of economic policy from the 1960s like the “industrialising industries”, developed by the French economist Gérard Destanne de Bernis,⁶¹ even if a reference to this development model will not be found in any official document from the Algerian state. It is considered that, until the National Charter (FLN, 1976) spelled out Algeria’s economic development strategy, the officials and planners in the Algerian administration found a major source of inspiration in these proposals of economic policy (Mañé-Estrada, 1997; Aïssaoui, 2001).

In essence, such a proposal of economic policy advocated investing a significant amount of resources into large-scale industries to promote economies of scale and reduce costs, which would lead to the benefit of other economic sectors as the latter could buy input goods at lower prices, and thus obtain a larger surplus. Hence, large, heavy and capital-intensive industries would boost positive externalities in other sectors of the economy, generating a net increase of productivity in the whole economy, and therefore helping to develop the internal market of a developing economy.

Nonetheless, Algeria was not endowed with a strong internal market in the 1960-70s, but a number of large and heavy industries were identified as a result of the colonial legacy with big conglomerates in the areas of ferrous metallurgy and especially hydrocarbons, which could create the conditions that could spur other industries. In this context, manufactured and equipment

⁶¹ De Bernis’s model is underpinned by some of the political economy thought from the Soviet Union (Grigory Feldman) and from India (Prasanta Mahalanobis) in terms of a strategy of industrialisation, socialist management of productive forces and agrarian reform. The model follows the path of the developmental school of economic thought of the French-Egyptian Marxist economist and Third World activist Samir Amin (1976), which distinguished between the autocratic accumulation that takes place in advanced capitalist countries that promoted expanded reproduction of capital, and extraverted accumulation in the peripheral countries that did not promote it. De Bernis stemmed from his analysis on power relations and the existing asymmetries within an economy. Based upon the previous works of the French economist François Perroux on “growth poles” (1955) and the impact of strong input-output linkages associated with the industry of certain territories, de Bernis (1966) argued that certain large, heavy and capital-intensive industries have more chances to stimulate economic development than the export-oriented industries that produce consumer goods and services. Therefore, he believed that the most rapid route to industrialisation was through import substitution, and the most obvious vehicle to that end was the re-investment of revenues accruing from extractive resource projects, so that the agricultural sector could be modernised and reformed, while the economic base of the country diversified in the long run.

goods could be supplied to the agricultural sector, which had a very considerable weight⁶² in the Algerian economy, with the aim of achieving its rapid modernisation and increase its productivity. The latter would also raise living standards in the rural areas, which in its turn would also diversify and boost the demand for manufactured goods. The link between agriculture and industry was the key to a successful industrialisation process, as the former could offer more job places to the local population, especially in the poorer rural areas, and bring progress and prosperity.

The entire industrial economy can be understood as a network of streams connecting various activities. At the upper end of the stream lie natural resource extraction and heavy industries, which feed into refining, processed materials, and machinery production. At the lower end of the stream are the final consumer products. Algeria pursued a heavy-industry-focused strategy, emphasizing industries in the upstream and midstream stages of the industrial economy. These sectors were deemed strategic because they create significant “downstream” linkages, supplying affordable iron or steel to machinery and equipment manufacturers reduces their costs and promotes their development. Simultaneously, iron production fosters important “upstream” linkages by increasing demand for coal, iron ore, chemicals, and specialized machinery, thereby driving growth in those industries as well. In this way, growth driven by substantial investment in strategic sectors tends to become self-reinforcing but also self-contained. Heavy industrial sectors are developed to meet each other’s demands through government-directed investments, but this approach results in minimal spill-overs to broader market development. This is why such a strategy, as described by de Bernis, aligns well with a policy of national self-sufficiency and limited integration into international markets, which characterised Algeria at the time.

It has been admitted that this economic development strategy was not translated into official documents of the Algerian state, even if a parallelism can be drawn with the content of the National Charter of 1976. This document established nationalism as the predominant ideology among the Algerian population from which a socialist state emanated (Aïssaoui, 2001). Furthermore, the role of the hydrocarbon sector was poised to play a pioneering role in the development of other sectors of the Algerian economy as a means of increasing foreign reserves

⁶² In the period 1965-1974, agriculture represented more than 12 percent of the Algerian GDP (Office National des Statistiques, Statistiques no. 35).

but also of increasing the demand on supply contracts, which would trigger further industrialisation (Mazri, 1975).

Therefore, in accordance with the development strategy enshrined by the National Charter, hydrocarbon resources⁶³ played two major functions: the first one was financial in providing access to foreign capital accumulation, while the second was industrialising in boosting forward and backward linkage effects that could spur a more articulated national economy (Mañé-Estrada, 1997). Indeed, these two functions had been adequately reflected in the new mission of the most privileged policy instrument that the Algerian state had at its disposal, Sonatrach. In fact, the vice-president of the publicly-owned company spoke in 1973 on the three objectives assigned to Sonatrach: first, those activities aimed at accumulating capital in order to sustain the investment; second, those activities aimed at spurring industrialisation in the country; and third, those that could contribute to the social and economic progress of the country (Mazouni, 1973).

As a result of this policy reform, Sonatrach was encouraged to draft a new hydrocarbon strategy. This strategy for VALHYD was conceived as a pillar of the industrial programme of the government, which was poised to enhance an economic activity that could “enable the financing of economic development and the creation of a foundation for the state’s financial independence” (FLN, 1976). The goals of this new strategy were “to maximise the production of natural gas, crude oil and LPG,⁶⁴ consistent with obtaining the highest total recovery of hydrocarbons on an economic basis” (Sonatrach, 1977).

The hereinabove reference is very comprehensive regarding the use of hydrocarbons with the aim to finance economic development, as was the National Charter in formulating policies aimed at expanding the resource base, increasing the pace of production and promoting hydrocarbon valorisation (FLN, 1976). The VALHYD strategy established a long-term sustainable production plan, and estimated the domestic requirements and the export forecasts, along with the necessary

⁶³ Upon the request of the Minister of Industry and Energy Abdesselam, an important reference to bolster and reorient the energy policy was introduced in the National Charter of 1976 (Bennoune, 1990): “Natural gas resources represent one of Algeria’s most valuable assets. Proved reserves are among the biggest known in the world. Therefore, the valorisation of natural gas represents an important source of capital accumulation. Revenues generated by such an activity will enable the financing of economic development in the country and the creation of a foundation for the state’s financial independence.”

⁶⁴ Liquefied petroleum gas or liquid petroleum gas (LPG or LP gas) is a flammable mixture of hydrocarbon gases used as fuel in heating appliances, cooking equipment, and vehicles.

amounts of investment needed and the expected returns. Such a plan was finally financed by the foreign exchange earnings and was presented to the government only one year later, in 1977 (Khelil et al., 1979).

The VALHYD plan became a very evident cornerstone of the funding strategy within the Algerian development model, and also of the intention by the Algerian leadership to systematically pursue the international markets to fulfil their economic growth targets (Mañé-Estrada, 1997). This strategy was progressively abandoned in the 1980s under the presidency of Bendjedid, who replaced Boumédiène in 1979, but its implementation during the 1970s proved to what extent the Algerian leadership relied on the financing capacity of the hydrocarbon sector, a function that was meant to be temporary (de Bernis, 1971). In this vein, the contribution of the hydrocarbon sector to government budget revenues increased from less than 10 percent in the early 1960s to about 60 percent by the end of the 1970s (World Bank, 2015).

The main action promoted by VALHYD was that all proven reserves of crude oil and gas, including LPG, would be exploited between 1976 and 2005. Particularly the addition of domestic consumption of natural gas and export commitments, along with the required amounts for the liquefaction plants, would need a production of some 110 bcm per year between 1984 and 1998, and the plan estimated a reduction to 40 bcm from 2005 onwards. In terms of export commitments, it set up a target of 70 bcm per year of gas exports between 1984 and 1998, which means that the estimation was that while 64 percent of the production was meant for exports, the remaining 36 percent would be for domestic use (Khelil, 1979).

As we will elucidate thoroughly later in this research, targets set in the VALHYD plan were far higher than the realised figures. Indeed, for the timespan 1984-1998, marketed production never reached 100 bcm per year⁶⁵ as targeted, while the share of domestic consumption to marketed production decreased over time, and did not reach the one third target until 1995.

The underlying reason why this plan never worked out is simply because it was set aside by the new administration of President Bendjedid by pursuing a new policy of “keeping energy resources, establishing strategic reserves and rationalising energy demand within an energy

⁶⁵ Gross production of natural gas surpassed 100 bcm per year since 1990 (1990: 126.6 bcm; 1995: 143.1 bcm; 2000: 159; 2005: 193) (OPEC Annual Statistical Bulletin 1995, 2000, 2005).

consumption pattern” (FLN, 1980). As a point of fact, the change of leadership in the country in 1979 also included a new minister responsible for its energy policy, Belkacem Nabi, who struggled to sweep away part of the hydrocarbon policies enacted by his predecessor, Minister Abdesselam.⁶⁶ In particular, the FLN party revisited the Algerian energy policy by adopting a new programme⁶⁷ that aimed at guaranteeing long-term domestic requirements and preserving energy resources. From the rapid hydrocarbon depletion strategy underpinned by VALHYD, the new policy emphasised the sustainability and preservation of hydrocarbon resources. Ultimately, the new policy also sought the optimisation of export revenues, but instead of prioritising the export of a large number of resources, it prioritised the idea that greater revenues could be obtained from higher prices⁶⁸ while preserving the existing reserves to the largest possible extent.

This new policy encouraged by Minister Nabi was adopted at a moment in which crude oil prices soared as a consequence of the Iranian revolution of 1979, and therefore under the assumption that prices would continue increasing, or that OPEC would be able to keep them high. Similarly, such a policy was also endorsed in the context of a major controversy with the contract that had already been signed in 1969 with the American El Paso Natural Gas Company, and which did not deliver the expected results for Sonatrach in line with the commitments undertaken by the Americans. Indeed, an important contract to export LNG from Algeria to the US was signed in 1969 with the American El Paso Natural Gas Company. The contract supplied LNG for a total volume of 25 bcm over a period of 25 years (Malti, 2010). It was the first Algerian contract to deliver natural gas to the first world economy, and thus required an important investment to build a new liquefaction plant in Arzew, which could only become operational in 1978. In the early 1970s, a second contract with the American company (El Paso II) was negotiated to supply 20 bcm per year (Malti, 2010). Nevertheless, the Americans reacted to the oil embargo of 1973 by withdrawing its commitments to additional LNG imports from Algeria, which implied some

⁶⁶ The rivalry between the two strongmen dated back to the time when Nabi was the president of SN Repal and Abdesselam the first director general of Sonatrach, as has been previously explained.

⁶⁷ New guidelines for the country’s energy policy and the management of the hydrocarbon heritage (FLN, 1980).

⁶⁸ Minister Nabi was of the opinion that the price determined in natural gas contracts signed by Sonatrach during the Boumédiène era under the guidance of Abdesselam and Ghazali (they both had been CEOs of Sonatrach and Ministers of Energy under Boumédiène) had been too low (see the newspaper *El Moudjabid* on 21 May 1979 on Nabi’s statement about the price set in Sonatrach’s contract with El Paso Natural Gas of 1969). Consequently, one of the actions that he would undertake as minister was to revise all prices up.

significant losses for Sonatrach. As a result, part of the total commitments that Algeria had anticipated selling to the US market ended up in the European market or they could not simply find other buyers.

These two major events from Algeria's point of view (Ghozali, 1979) prompted the adoption of a new policy aimed at re-valorising prices of natural gas. The decision was taken by the National Popular Assembly – the legislative parliament – upon the decisive position of the ruling FLN party, and clearly outlines how two external factors strongly impacted the course of developments with regards to Algeria's hydrocarbon policy.

As stated by Nabi (1991), the objective of a price valorisation policy was to foster more equity in international economic relations. To that end, Algeria embarked on negotiations with all its clients with an aim of increasing the value of natural gas prices with the consequence that nobody accepted a price increase, preferring to change supplier and buy Dutch or even Soviet natural gas that kept prices down (Malti, 2010). In addition, demand for natural gas dropped in some Western European countries in a context of highly volatile patterns of energy demand with an economic recession, expansion of nuclear power, and a surge in coal utilisation, while gas demand was particularly hit in Spain and Belgium, and to a lesser extent in France. The adopted approach included two remarkable exceptions: the contracts with the French Gaz de France (GDF)⁶⁹ and with the Italian Eni.⁷⁰ Overall, the pursuit of the equivalence of natural gas prices with those of crude oil ended up with Sonatrach pulling out of international markets during the first half of the 1980s (Aïssaoui, 2001).

The LNG sector which had slightly expanded during the 1970s,⁷¹ lost its market in the US during the 1980s, and part of the market share in Europe. Obviously, the loss of Sonatrach's markets

⁶⁹ GDF was a French company which produced, transported and sold natural gas around the world, especially in France. It was created with its sister company *Électricité de France* (EDF) in 1946 by the French Government. EDF and GDF became two totally separate entities in 2006, with each controlling a distribution subsidiary responsible for running its distribution system. Some months earlier, the company had been partly privatised, but the French government continued to hold an approximate 80 percent stake in the company until the 2008 merger with Suez. On 24 April 2015, GDF Suez announced it was changing its name to "ENGIE", in an effort to further expand the company's international footprint (ENGIE 2015).

⁷⁰ The close relationship of Minister Nabi with the French companies and elite dated back to the time when Nabi was the President of SN Repal before the nationalisation of 1971. While in the case of Italy, there was a strategic interest to preserve the Transmed project, which would become operational in 1983 (Malti, 2010).

⁷¹ From 1970 onwards, the penetration of the Algerian gas into the US facilitated that in the following years other US companies (Olstrigas, Panhandle and Tenneco) became clients of Sonatrach, alongside the signing of many

negatively affected the maintenance of the LNG plants, which operated at less than half of their capacity throughout most of the 1980s, ultimately losing one-third of their nominal capacity by the end of the decade (Malti, 2010).

In spite of the hurdles that Algeria experienced in the aftermath of the second oil shock for the policy that President Boumédiène's successor tried to put in place, the truth is that, as explained, Boumédiène's administration enacted a "big push" development strategy that attempted to channel hydrocarbon revenues into investment with the aim to modernise the economy through rapid industrialisation. This was materialised using an instrument of central planning through multiannual investment plans. Given that investment plans were to become an instrument of centralised governance, an *Organ Central de Planification* (OCP)⁷² was established with the aim to develop the multiannual plans based on the indications given by the sectorial ministries, and was also responsible for the execution and monitoring of the plans.

However, unlike other centrally-planned economies, in Algeria planning was limited to a distribution of financial means for developing the economy, but did not encompass other elements such as production targets for private companies, distribution of goods and services, among others. In addition, it did not take into account all economic sectors: the private sector was totally excluded from the plans. In point of fact, there was a portion of the Algerian economy subject to planning, but in the absence of regulations on the relations between state-owned companies and the private sector, the market assured part of the distribution of human and material resources and played a very prominent role in the distribution of income and resources for the consumer goods sector (Mañé-Estrada, 2002).

The first initial plan for three years (1967-69) was followed by a more robust investment plan for the following four years (1970-73) with a dedicated overall amount significantly higher than before and worth USD 5.6 billion. In this second plan, the industrialisation process accelerated quite steeply, but as the world was going to witness the first oil shock in 1973, in the third investment plan, which covered again a period of four years (1974-77), the planned public

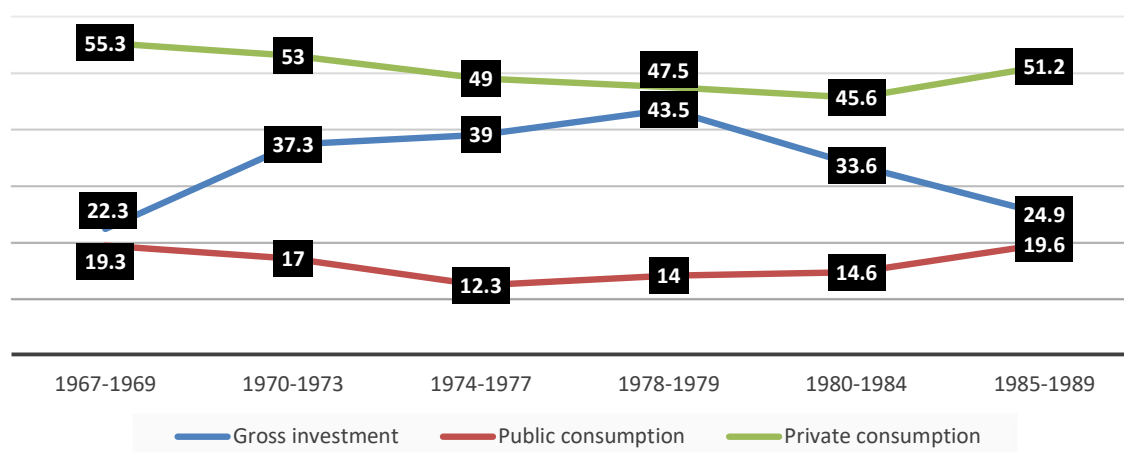
contracts with European customers (in Germany, Italy, Austria, Belgium...). Including American and European customers, some 60 bcm of Algerian gas were committed (Malti, 2010).

⁷² The *Organ Central de Planification* (OPC) was created in 1970, and in 1979 it was upgraded to Ministry of Planning.

investments soared to nearly USD 30 billion, partly due to large windfall revenues from the hydrocarbon sector.

As revealed in Figure 4, it is worth noting that an average investment of nearly 40 percent of the Algerian GDP is realised with the third plan (1974-77), which is partly thanks to a surge in hydrocarbon rents accruing to the Algerian state taking place after the first oil shock in 1973. In addition, this rapid increase in the level of investments was at the expense of the levels of consumption, both public and private, which saw a decline during this period until 1980, when the trend changed. The government dominated most of the economy and leveraged this control to channel resources into it. Despite investment rates worldwide rose since the 1950s, it is not very common for developing countries to invest more than 20 percent of GDP (Naughton, 2007). Algeria, by 1978, had pushed its investment rate up to 43 percent of GDP (see Figure 4, which shows gross capital formation – the sum of new investment in physical assets, replacement investment and accumulation of inventories). This figure of gross investment as a share of GDP is extraordinarily high and only comparable to a few developing countries like the People’s Republic of China, when in 1959 the gross investment rate reached 43 percent of GDP. China was then channelling resources into their “big push” industrialisation strategy.

Figure 4. Allocation of resources in the Algerian economy as a percentage of GDP (1967-1989)



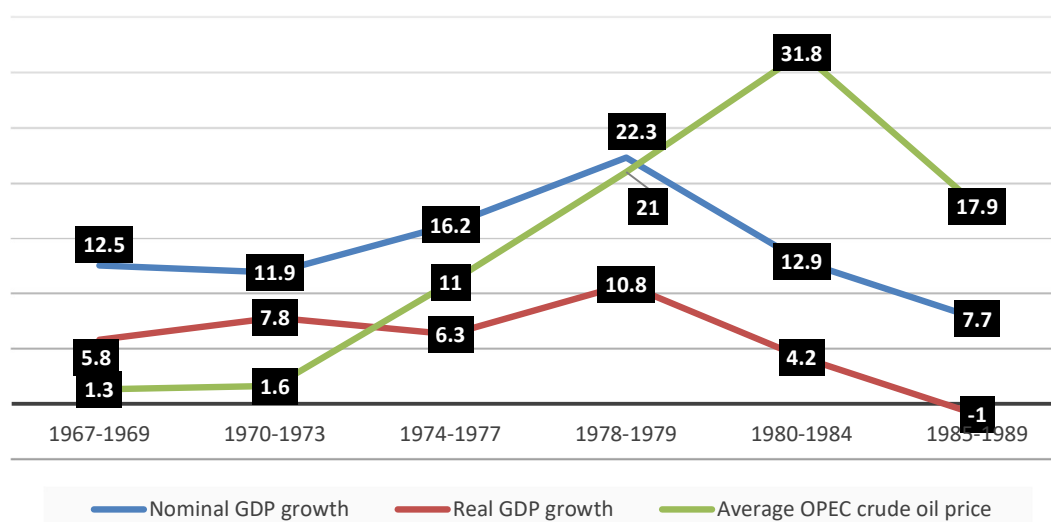
Source: Compiled by the author based on data from the World Bank and the Algerian Ministry of Planning

With the first three plans being deployed, the Boumédiène regime decided to conduct an assessment of the results and paralysed the investment plans for two years (1978-79).

Immediately after this assessment, one can observe a declining trend in terms of gross investment in relation with GDP (see Figure 4). Indeed, it will be highlighted thereafter that the subsequent investment plan (1980-1984), under the leadership of President Chadli Bendjedid, will aim at tackling some of the shortages and distortions in the Algerian economy by scaling down industrial and hydrocarbon investments, as also reflected in Figure 4, whereby the level of investments achieved in the interim period 1978-79 will deescalate in the subsequent planning periods.

As shown in Figure 5, the evolution of both the nominal and real GDP was very high in the timespan 1967-1979. In fact, average annual real growth had been even higher prior to the first oil shock of 1973 (7.8 percent on average for the period 1970-73 versus 6.3 percent on average for the period 1974-1977). Overall, the evolution of the GDP growth in this whole period can be partly observed by the evolution of crude oil prices as shown in Figure 5 and by how oil rents provided a comfortable financial base to the state to prompt massive investments in heavy industry (El Kadi, 2020).

Figure 5. Nominal and real GDP (1967-1989), and average OPEC crude oil prices in relation with Algeria's investment plans



Source: Compiled by the author based on data from the IMF and OPEC. As a percentage of GDP growth for nominal and real GDP growth; in USD per barrel for crude oil prices

Although the Algerian economy grew considerably during the years of Boumédiène's planning strategy, as shown in Figure 5, and managed to diversify its economic production, by the end of the 1970s, it became very apparent that the country's rapid industrialisation had resulted in inefficiencies and imbalances (Entelis et al., 1992: 15). There is a large body of literature that argues the reasons behind the failure of the Algerian "big push" development strategy. In this vein, Goumeziane (1994), Benachenhouch (1993) and Hadjseyd (1996) suggest that such a development strategy was not sustainable due to the structural imbalances caused by state intervention in the economy and price distortions that encouraged rent-seeking behaviour. On the other hand, Abdesselam (1991) and Bennoune (1990) argue that the instrument of central planning through multiannual investment plans did not secure the high amounts of investment in heavy industry, in particular during the time of President Boumédiène's successor, which reduced investments before the industry had the chance to reach maturity, thus preventing the country from garnering the economic growth benefits of these industries. These authors equally argue that the collapse of the oil price of 1986 impacted GDP growth, as shown in Figure 5. Finally, other authors (Dillman, 2000) emphasise that the failure of the development strategy is related to the absence of a truly competitive private sector that could compete in international markets and diversify the country's exports, given that the private sector was essentially part of the state.

One might conclude that during this period of time Algeria did not really implement a strategy model aimed at spurring social and economic development through rapid industrialisation. Instead, Algeria implemented a model of economic growth underpinned by boosting the industrial sector, and in particular the hydrocarbon sector, which paved the way to consolidate a rentier economy. As Caroline Ardouin wrote (1995): "Algeria never conceived an economic strategy other than an economy based on a single source of hydrocarbons."

2.3.2 The corrective policies that did not avert the enfeeblement of the hydrocarbon model

On 27 December 1978, President Boumédiène passed away, forcing a succession ahead of the country's presidency and the leadership of the FLN.⁷³ This is how Chadli Bendjedid was appointed secretary general of FLN at the end of December 1978, and two months later, in February 1979, elected president of the country. In spite of this apparent continuity in the political regime, the truth is that the administration of President Bendjedid prompted some corrective policies that were aimed at giving a response to some of the demographic transformations that the country was undergoing and to some of the imbalances that the previous administration's policies had caused to the economy.

However, there was an unambiguous continuity from the logics of how the political power was exerted. To start with, President Boumédiène managed to preserve an “unstable equilibrium” among the different rival factions of Algerian political power, an achievement which was the result of his undeniable charisma as political and military leader.

As described, during President Boumédiène's administration, the legitimacy of the state power was underpinned by a process of rapid industrialisation that ought to be financed by those sectors that could supply foreign reserves, namely through hydrocarbon exports and fiscal revenues. Unlike his predecessor, President Bendjedid was no longer pursuing legitimacy underpinned by the industrialisation process, but particularly focused on preserving the role of the hydrocarbon sector in the economy of providing fiscal revenues. To that end, in 1986 he promoted a new doctrinal exercise in the drafting of a new National Charter,⁷⁴ which technically speaking was an enrichment of the 1976 National Charter.

Bendjedid's first cabinet decided to extend from 1978 to 1979 the break that had been adopted by Boumédiène in an attempt to assess the results of the three previous investment plans and prepare for a longer five-year plan that would be launched in 1980. In this period of reflection, the government recognised the underinvestment in the agricultural sector and the over-

⁷³ Algeria has witnessed successive power struggles to cope with the succession of a late country and party (FLN) leader. It also happened in late 1978 when President Boumédiène passed away and the leadership of the party sought to avert any struggle that could trigger popular uprisings (Harbi, 1994).

⁷⁴ A referendum on the enrichment of the National Charter (first approved in a 1976 referendum) was held in Algeria on 16 January 1986. The changes were approved by 98.3 percent of voters with a turnout of 95.9 percent.

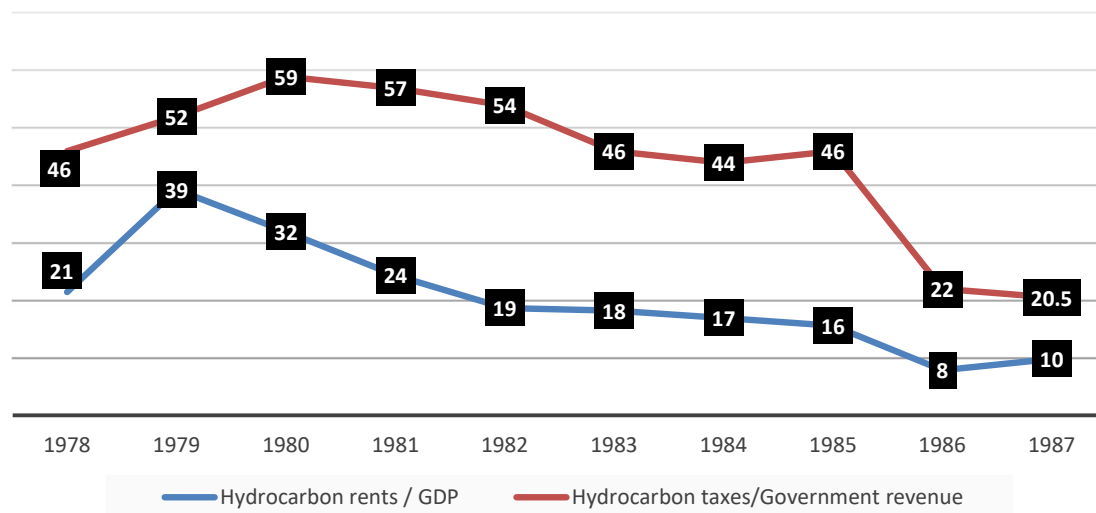
concentration of resources in the heavy industries and hydrocarbon sector, while they also acknowledged a very high rate of food imports as a result of existing shortages caused by the underinvestment, delays in project execution and excessive estimation of costs, as identified in the previous section, along with a deficit of skilled workers causing low productivity rates.

Two five-year plans were implemented from 1980-1984 and 1985-1989, while the international context changed dramatically. The first plan was prepared immediately after the second oil shock of 1979 when oil prices soared, and thus fiscal revenues reached a maximum point for both hydrocarbon rents and taxes in Algeria from a historical perspective (see Figure 6). The year in which the plan was launched, the price of Algerian oil reached USD 37 per barrel, and the export revenues rose by more than 50 percent in the timespan 1979-80.⁷⁵ The trend of sustained high oil prices gave wrong expectations to the Algerian planners who believed that oil prices would remain high in the years to come around some USD 30 per barrel, a pattern that was foreshortened by the oil price collapse of 1986,⁷⁶ the year after the second investment plan (1985-89) started its implementation. Although oil prices had come under increasing pressure since 1981, prices remained relatively high until 1985, but in Figure 6 one can observe a declining trend in both hydrocarbon rents and taxes from 1981, when hydrocarbon prices began to plunge, which impacted both hydrocarbon rents and taxes accrued to the state: from a peak in 1979 of 39 percent of GDP °from hydrocarbon rents to a low of 8 percent in 1986.

⁷⁵ In the timespan 1979-1980, foreign reserves in Algeria increased from USD 1.8 billion to 3.4 billion (Benissad, 1994).

⁷⁶ Average prices of Algerian oil since 1982: USD 35.86 per barrel (1982), USD 30.52 per barrel (1983), USD 29.69 per barrel (1984), USD 29.03 per barrel (1985), and the Sharp decline in 1986 of USD 14.85 per barrel in 1986 (Brahimi, 1991).

Figure 6. Hydrocarbon rents as a percentage of GDP and hydrocarbon taxes as a percentage of government revenues in Algeria (1978-1987)



Source: Compiled by the author based on data from World Bank and IMF

The first five-year plan (1980-84)⁷⁷ aimed at correcting some of the anomalies and distortions as a result of the previous investment plans (Brahimi, 1991). With an investment programme of USD 100 billion, the main difference of this plan compared with previous ones was that industrial and hydrocarbon investments were scaled down from 55 percent in the previous plans (1976-77) to 35 percent in the present plan, and from 26 to 16 percent respectively. These figures responded to the will of President Bendjedid's administration to moderate and shrink the power of industrialists and redirect the bulk of resources towards agriculture, water resources, infrastructures, housing, and social and community programmes, which received nearly 12 percent of the investment, with the aim of compensating its absence from previous periods. Similarly, the priorities of the present plan sparked a decline in the amount of resources allocated to gross capital formation from 66.7 percent in 1978 to 47.9 percent in 1980 and 3.3 percent in 1988.

In addition to the identified distortions that the government was poised to correct, Bendjedid's administration also had to face a change in the demographic distribution of the country as the

⁷⁷ With the resumption of the FLN's party congresses, the first five-year plan results from the recommendations of the third party congress in 1979 and the extraordinary party congress of 1980 (Brahimi, 1991).

population growth rate had increased from 3 percent to 3.4 percent during the 1970s, which triggered rural to urban migratory movements (from inland to coastal areas) and further the difficulties the government had to cope with. Such difficulties were aggravated by a steady decline of the real GDP during this period as reflected in Figure 5, which grew by 4.2 percent on average (and not 7.1 percent as forecasted) as a result of the deterioration of the country's current account balance, reflected in a decrease of hydrocarbon revenues (as oil prices had been plunging since 1981), coupled with an increase of imports of industrial raw materials and capital equipment needed to comply with the plan's targets.

Notwithstanding the foregoing, the second five-year plan (1985-89) offered a much more cautious approach with an investment programme worth USD 110 billion, which envisaged an investment rate of 40 percent with continuity in the patterns observed in the previous five-year plan (1980-84) regarding the amounts invested in heavy industry and hydrocarbons. However, international events⁷⁸ worsened in 1986 when oil prices fell sharply, only one year after the start of the plan. Figure 6 clearly illustrates this gloomy picture with the level of hydrocarbon rents (to GDP) falling below that of 1968. Similarly, hydrocarbon export revenues, for both gas and oil, dropped drastically⁷⁹ to USD 7.3 billion in 1986, which proved to be detrimental to the execution of the plan. Indeed, from a forecasted investment worth USD 110 billion, the effective realised investment was lowered to USD 42 billion, meaning an investment ratio below 25 percent of GDP, by far the lowest ratio of all previous plans (Mañé-Estrada, 1997). This occurred in an adverse and unfavourable economic environment where the average real GDP growth rate contracted by 1 percent during the period covered (1985-89).

The attempt to reform the economy by President Bendjedid's administration was contended by external factors that hindered the capacity of the Algerian state to fully take its own decisions, as happened during the term of President Boumédiène. In fact, in the midst of the collapse of oil prices in 1986, Sonatrach's loss of natural gas markets as a result of the move in prices, and ultimately the end of positive effects of Algeria's fiscal revenues driven by the two oil shocks of

⁷⁸ The oil price counter-shock of 1986 was caused by a period of sustained oversupply, while aggravated by Saudi Arabia's decision to boost output in order to retain and recapture market share.

⁷⁹ The evolution of the export rates of Sonatrach will be analysed more in detail in a coming section. Export revenues marked a low record since the peak of 1981 with nearly USD 15 billion.

the 1970s, triggered a change with the enactment of a new hydrocarbon law⁸⁰ in August 1986, which superseded the post-nationalisation legislation. Domestically, the fall in oil revenues fuelled a severe crisis, as outlined earlier. Externally, the world energy landscape evolved and entered a phase marked by a slow but steady gradual substitution of gas for oil, prompted by a sharp drop in the price of crude oil, in nominal and real value, and finally by a loss of influence of producing countries on the international oil scene.

Hence, the new hydrocarbon law aimed at giving a response to this change of scenario. It took several years for legislators in successive administrations to prepare the draft law, and its adoption was not preceded by an easy debate. Indeed, confusion about the new conceptions over oil ownership triggered strong opposition from the Parliament's economic commission (Malti, 2010). The draft bill opened the door to foreign companies sharing the production over a long contractual period of 25 years, the so-called production sharing contracts,⁸¹ along with the joint venture form of partnership that already existed under the previous scheme (post-nationalisation). However, it kept the share of equity of foreign companies at a maximum of 49 percent like the previous scheme, and it also restricted the participation of foreign companies in the natural gas sector, including the midstream phase (transport and commercialisation in Algeria), which remained a Sonatrach monopoly. It also ruled out any possible association of foreign companies in any hydrocarbon deposits before August 1986, the date the law came into force (Mañé-Estrada, 2009).

The fiscal regime was also modified in order to relax it with regards to the previous scheme. In the hydrocarbon law of 1986, income tax rates and royalties became functions of exploration and production conditions (Aïssaoui, 2001), which basically means that the regular rates of 85 percent tax and 20 percent royalty could be reduced if the new fields were in areas less accessible

⁸⁰ Law no. 86-14 of 19 August 1986.

⁸¹ Production sharing agreements (PSAs) or production sharing contracts (PSCs) are a common type of contract signed between a government and a resource extraction company (or group of companies) concerning how much of the resource (usually hydrocarbons) extracted from the country each will receive. Under a PSA, the state as the owner of mineral resources engages a foreign oil company as a contractor to provide technical and financial services for exploration and development operations. The state is traditionally represented by the government or its NOC. The foreign company acquires an entitlement to a stipulated share of the oil produced as a reward for the risk taken and services rendered. The state, however, remains the owner of the hydrocarbons produced subject only to the contractor's entitlement to its share of production. The government or its NOC usually has the option to participate in different aspects of the exploration and development process. In addition, PSAs frequently provide for the establishment of a joint committee where both parties are represented and which monitors the operations.

in terms of exploitation or extraction conditions. The reduction amounted to a maximum of 42 percent for tax and 10 percent for royalty.

With regards to natural gas developments, it should be added that the post-nationalisation regime envisaged that any discovery of gas by an IOC was immediately transferred to Sonatrach, which would then develop it without granting any form of compensation to the foreign company. Against this background, the hydrocarbon law of 1986 provided compensation for IOCs when a commercial discovery was made by allowing reimbursements on their exploration investments and by granting a bonus as remuneration. In addition, foreign companies could also be required to form joint marketing companies to export the gas discovered. Nevertheless, as IOCs had no rights to any share of natural gas production, which remained in the hands of Sonatrach, these provisions remained quite unattractive to foreign companies; and as vertical re-integration spurred the international oil scene,⁸² IOCs were more interested in acquiring the right of production than being solely involved in the marketing ventures. Moreover, Sonatrach had to bear the investment costs for developing any exploitation of a new gas discovery alone at a moment when its own funds were very limited and with a lack of appropriate technical and human resources.

By the end of the 1980s and early 1990s, Algeria had gone through a change in the structure of hydrocarbon production and exports, as reflected in Table 2. Indeed, the share of gas production and natural gas exports over the overall energy exports increased considerably and even exceeded that of crude oil from 2000 onwards (BP Statistical Review of World Energy, 2016). While the proportion of energy exports over energy production remained rather stable, the share of natural gas production and exports as compared with that of crude oil changed drastically. Consequently, since then, Algeria can be labelled as a natural gas producing country, given that its primary hydrocarbon resource that the country extracts and exports is natural gas rather than crude oil. However, as noted in Chapter 1, this has never been the case for the export values and rents

⁸² Throughout the 1970s and early 1980s, the structure of the hydrocarbon industry experienced a process of de-verticalisation as a result of the loss of control over pricing combined with nationalisations and takeovers. Reserves and a large share of the upstream phase of the industry came under the control of NOCs, whereas the downstream phase (product marketing in the main consumer areas) remained largely in the hands of the IOCs. From 1986 onwards, the conditions for resuming the path of vertical re-integration of the sector (global control of the extraction, transport, production and marketing of energy goods) were progressively being met by the large IOCs (Mañé-Estrada, 2009).

accruing to the state as most of these hydrocarbon rents (85 percent) are generated by oil rather than natural gas (OPEC statistical bulletins & World Bank database, 2016).

Table 2. Exports of primary energy in Algeria (1980-2005)

	1980	1990	2000	2005
Exports (in bcm)	62.6	93.3	137.9	161.1
Crude oil and condensate (in percentage)	77.5	41.2	33.08	44.12
Natural gas (in percentage)	12.26	40.53	54.96	48
Exports / production (in percentage)	79.82	78.26	81.01	80.22

Source: Compiled by the author based on data retrieved from the Algerian Ministry of Energy and Mines

Such a structural change was the result of decisions adopted in 1989, when under mounting economic and social pressure triggered by the crisis of 1988, the new reform-minded administration of Prime Minister Hamrouche decided to return to the earlier expansionary policy with the aim of doubling natural gas exports before the end of the 1990s (Malti, 2010). In this context, the discarded VALHYD plan, the simulations included in it, and the portfolio of identified gas projects were re-used in order to devise the new policy.

Against this background, it also incorporated the 1980 basic requirement of the FLN to guarantee long-term domestic needs through the appropriation of strategic gas reserves (FLN, 1980), and thus mitigate the controversial depletion policy of the Boumédiène era. It is worth noting that under the new estimates of the Hamrouche administration 70 percent of the hydrocarbon reserves corresponded to natural gas, as against 15 percent for oil (Malti, 2010), which meant that proven gas reserves accounted for the immense bulk of hydrocarbon reserves, but also that proven gas reserves were the least depleted primary source of energy.⁸³ Hence, the new estimations stressed the difference between natural gas and oil to such an extent that the government embraced this new policy. To that end, Sonatrach significantly adjusted its marketing and pricing policy to recover lost market share during the 1980s (Aïssaoui, 2001), and steered a major investment programme to restore the original LNG capacity, expand and

⁸³ The reserve to production ratio was 60 years for natural gas as against 20 years for oil (Malti, 2010).

diversify pipeline routes, and make natural gas the main resource activity in the hydrocarbon sector.

In this context, one of the driving factors that increased the demand for Algerian natural gas and helped transform the latter into a primarily gas-producing country was the intensification of cooperation with the closest neighbours in the north-western Mediterranean area,⁸⁴ namely Italy from the 1980s and Spain from the 1990s. This relationship significantly shaped the developments in the gas sector due to the following reasons: first, because the growing share of Algerian natural gas in Europe's energy consumption facilitated the emergence of a regional geo-energy area of natural gas. Indeed, contrary to what happens with crude oil, in the case of natural gas the transportation costs are a critical factor, and its storage poses significant challenges; second, because national energy policies implemented in Italy and Spain encouraged alliances between gas and electricity companies.

While the whole strategy of rapid industrialisation was slowed down during President Bendjedid's term, and thus reflected in the investment allocated to the two five-year plans, an accurate analysis shows the difficulties encountered by the government to offer an alternative economic policy to the existing one under President Boumédiène. Such an economic policy was often limited to accruing more revenues to the state from the export of hydrocarbons, and consequently this economic policy was very much dependent on the evolution of hydrocarbon prices at the international level. This took place in an adverse context of continuous decline of fiscal revenues since 1981, as shown in Figure 6, and a downfall in the value of the US dollar that triggered a weakening of the purchasing power of export revenues. By that time, Algeria had already consolidated its rentier economy.

⁸⁴ The growing relations in the natural gas field between Algeria and the other Western Mediterranean countries will be assessed in Chapter 3.

2.3.3 The collapse of the political and economic systems that triggered the reforms of 1991: unleashing the potential of natural gas

The oil price collapse of 1986 illustrated the inefficiencies of the economic system that the administration was forging based on central planning, state control, and hydrocarbon revenues. This strategy failed to deliver long-term economic growth as we have shown in Figure 5, and although the last two plans introduced new programmes to support social infrastructure, such as housing and public services, the strategy also failed to create sustainable employment, and thus reduce income inequalities. In point of fact, to offset part of the supply shortages during the 1980s, imports increased quite substantially, while exports of non-hydrocarbon goods⁸⁵ continued to be almost non-existent due to high costs of factors of production⁸⁶ and the absence of a developed competitive private sector (El Kadi, 2020). In the meantime, the sharp decline in hydrocarbon fiscal revenues was much more acute than the drop in hydrocarbon exports over total exports, which caught the government unprepared and placed it in severe difficulties for cutting public expenditure.

Indeed, governments, including the Algerian government, had three sources to finance government expenditure: budget surplus (as a result of increasing taxation or decreasing current expenditures), international borrowing, and money creation. Up to 1986, the successive investment plans enacted by the Algerian government had been mainly financed by using hydrocarbon fiscal revenues (Baba-Ahmed, 1999), as shown in Figure 6. The latter were mostly generated from a royalty⁸⁷ of 20 percent and a tax on corporate hydrocarbon income of 85 percent. Given that the domestic demand on hydrocarbons was relatively low, the total amount of revenues was strongly correlated with export revenues. Hence, the tax rate was mainly a function of international oil prices and production costs, considering that exchange rates were

⁸⁵ Already from 1979 onwards the rate of hydrocarbon exports over total exports exceeded 90 percent and kept fluctuating with the low record of 90 percent in 1986.

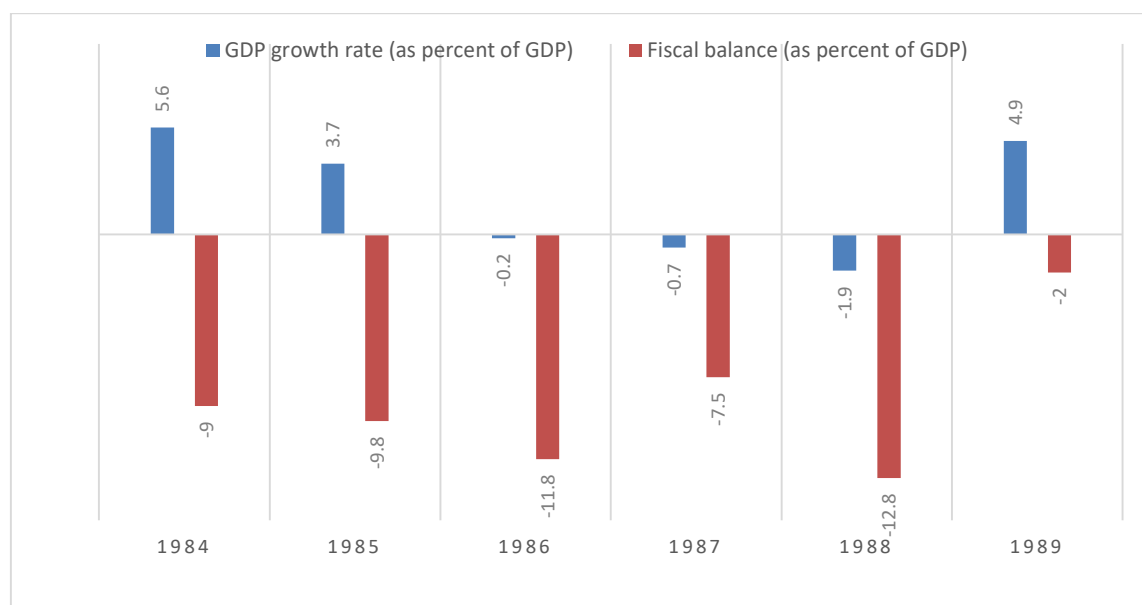
⁸⁶ See references in Chapter 1 to literature by Corden and Neary (1982), Gelb (1988) and Gylfason (2004). In addition, for the specific case of Algeria, Gasmî and Laourari (2017) conclude that there is no “empirical evidence of a robust long-run relationship between real oil prices and real effective exchange rate of the Algerian dinar,” while adding that “the Dutch disease is a possible explanation to understand the Algerian economy’s deindustrialization puzzle, but it is far from being the only one.”

⁸⁷ It is calculated on the value of the hydrocarbons produced, depending on the location of the contract perimeter (fields in areas less accessible in terms of exploitation or in terms of conditions of extraction were charged at a lower rate).

kept relatively constant, and thus had no effects. At a time when oil prices suddenly dropped and production costs⁸⁸ rose, as noted earlier, the effects over fiscal revenues were severe (see Figure 6), which made a fiscal adjustment unavoidable, in spite of the political costs.

As the government did not anticipate nor react to this drastic situation by cutting the budget expenditure accordingly, it degenerated into a high budget deficit, which reached a record level of 12.8 percent of GDP in 1988, as reflected in Figure 7, in a context of further deterioration of the economy with a negative GDP growth rate for the years 1986, 1987 and 1998.

Figure 7. Algeria's GDP growth rate and fiscal balance (1984-1989)



Source: Compiled by the author with data retrieved from the report *Algeria's Country Economic Memorandum: The Transition to a Market Economy*, World Bank Statistical Annex, May 25, 1994

In order to continue financing both investment and consumption, Algeria had to borrow from international markets, thus increasing the ratio of external debt to GDP. From 1985 to 1988 the total debt service as a percentage of export of goods, services and primary income increased from 36.68 to 80.26 percent, as reflected in Table 3. Similarly, the current account balance also

⁸⁸ Production costs of Sonatrach increased by five times in the timespan 1973-1986, from about USD 0.7 per barrel of oil equivalent (boe) in 1973 to USD 3.2 per boe in 1986 (Baba-Ahmed, 1999).

deteriorated immediately after 1985 as a consequence of the decline in export revenues due to lower oil and gas prices.

Table 3. Algeria's current account balance and total debt service (1984-1989)

	Current account balance (in percentage of GDP)	Total debt service (in percentage of exports and services)
1984	-0.2	37.71
1985	1.2	36.36
1986	-5.4	58.8
1987	0.1	56.22
1988	-3.2	80.26
1989	-1.9	69.1

Source: Compiled by the author based on data retrieved from World Bank Development Indicators Database

The collapse of the hydrocarbon rent we have been explained triggered dissatisfaction toward the political and economic systems that had been in place since the country's independence. Hence, the FLN under President Bendjedid was increasingly vulnerable to social unrest. Indeed, the so-called oil price "counter-shock" of 1986 was so acute for Algerian public finances that it triggered a socioeconomic crisis characterised by soaring inflation, mounting youth unemployment, and widespread shortages in essential consumer goods (El Kadi, 2020). As a result, in October 1988 large anti-government demonstrations ended up in riots⁸⁹ that were violently repressed by the military (Zoubir, 2006). Following the riots, the government promised political and institutional reforms with greater democratisation, and to that end a new Constitution⁹⁰ was promulgated in February 1989, which brought some important changes to the fundamental law of the country by scrapping the single party system and any references to

⁸⁹ The uprising of October 1988 remains imbued with a very strong symbolic charge. The army declared a state of emergency, enforcing a military curfew and banning all demonstrations. They were given free rein to shoot, arrest and torture those involved, which completely re-shaped the image of the army among Algerians after the war of independence. For many Algerians, this date is a turning point in the history of the Algerian political system, given that the popular protest triggered the drafting and adoption of a new Constitution that established party-political pluralism.

⁹⁰ This new Constitution replaced the Constitution of 1976, which was promulgated after the adoption of the National Charter of 1976.

socialism in line with demands of the capitalist class. Hence, the long-time ruling FLN was then separated from state institutions leading to the setting up of a formal pluralist party system.

One of the direct consequences of the approval of such a new Constitution was the implementation of an economic reform agenda aimed at transforming the system from a state-controlled and hydrocarbon-dependent economy to a diversified and market-oriented one (Hidouci, 1995). Indeed, the economic recession and the macroeconomic imbalances (i.e., the subsequent external debt crisis) forced the Algerian authorities to accept economic stabilisation and market-oriented reforms, albeit reluctantly. Central planning was abandoned, and several micro-economic reforms were implemented, such as gradual internal and external liberalisation, and even some institutional reforms like increasing Central Bank independence (Escribano, 2016). The path of reforms also tackled the non-state sphere by encouraging an active civil society and an independent media, but the crisis of 1992 and the beginning of a civil war in the country jeopardised any attempts to pursue this liberalisation.

The path of political and economic reforms was initiated by the government headed by Mouloud Hamrouche,⁹¹ who is considered to have opened most areas of freedom in independent Algeria (Zoubir et al., 2009). Succeeding Kasdi Merbah, former chief of services intelligence, Hamrouche launched a policy of political and economic openness in all directions: the government adopted a law on money and credit, a central piece of the management of the economy, and attempted to end the administered exchange rates.

Policies aimed at the restructuring of public debt were at the core of the plans of the successive governments that acted in the very unstable period of 1988-1992. The government led by Hamrouche implemented two International Monetary Fund (IMF) programmes that pursued tighter fiscal and monetary policies (Nashashibi et al., 1998), but the situation generated after the Gulf War of 1990 gave a margin to increase the amount of hydrocarbon fiscal revenues, which triggered the abortion of the orthodox debt restructuring programme dictated by the IMF.

⁹¹ Prime Minister of Algeria between September 1989 and June 1991. He headed a reform-minded government.

After Hamrouche's term, two successive governments headed by Ahmed Ghozali⁹² and Belaid Abdesselam,⁹³ both former directors general of Sonatrach and former Ministers of Energy, reasserted the role of hydrocarbon resources in countering the effects of the macroeconomic imbalances that the Algerian economy had experienced in an aggravated manner since 1986 following the upward trends of the 1990 Gulf War. In particular, Ghozali managed to reform the hydrocarbon sector by passing a legislative package⁹⁴ in the Parliament in 1991 that amended the hydrocarbon law of 1986 with the aim to further open the sector.

In this vein, since 1971, when nationalisation occurred, the mere possibility of opening the natural gas sector had always encountered fierce opposition from within the FLN and sectors of the government, but in 1991 support was found to promote a reform that would make it feasible. Then Minister of Energy Nordine Aït Laoussine introduced the changes with an aim to "denationalise" Algeria's gas reserves: "Twenty years ago foreign companies had a lot of control over Algeria's natural resources [...] Our national company was not experienced enough to play in the league of IOCs. Thus, nationalisation seemed the proper course. Now the situation has changed. Algeria has ownership and Sonatrach has become a major player, but we recognise that we lack the financial means and we do not have the sort of technical and human resources required to fulfil our ambitious plan" (Aït Laoussine, 1992).

In fact, at the beginning of the 1990s, it became obvious that the legislation was no longer in line with the reality of the sector, that it was no longer adapted either to the time or to the deep economic crisis in Algeria. With deteriorating economic and social conditions⁹⁵ and major political uncertainties caused by the first multi-party legislative elections,⁹⁶ the Parliament managed to adopt this package of amendments one month before it was dissolved. This new

⁹² Prime Minister of Algeria between June 1991 and July 1992. His government was in charge of organising the first pluralist legislative elections on 26 December 1991.

⁹³ Prime Minister of Algeria between July 1992 and August 1993.

⁹⁴ Law 91-24.

⁹⁵ The collapse of the hydrocarbon rent as of 1986 (see Figure 6) exacerbated dissatisfaction with the political and economic systems that had been in place since independence, and especially since the 1971 nationalisation.

⁹⁶ By opening the country to a multi-party system, local and regional elections were called in June 1990, and legislative elections in December 1991.

legislation and the evolution of the world energy scene⁹⁷ considerably modified the Algerian energy landscape at the end of the century.

This change can be explained not so much by the new tax cuts, but rather by three elements contained in the new law: a) the right for IOCs to participate in discovered or producing fields, and especially the right to share in natural gas discoveries; ii) under the authorisation of Sonatrach, foreign companies acquired the possibility to operate in the transportation of hydrocarbons (midstream phase, in particular); iii) in the event of a dispute, foreign companies could seek international arbitration for the settlement of disputes between the NOC and its partners. These three modifications, which significantly strengthened Algeria's position as the main producer of natural gas in the Western Mediterranean, came at a time when two neighbouring countries, Spain and Italy, were starting to transform their primary energy consumption model (Mañé-Estrada, 2009).

The fiscal package encompassed in the new law also made investments more attractive in the sector. The law allowed IOCs to benefit from a fiscal credit in their country of origin, thus avoiding double taxation. Considering the number of undeveloped natural gas fields apart from Hassi R'Mel in the vast Saharan region, the amendments introduced in 1991 to the hydrocarbon law of 1986 attracted investment in the upstream phase of the natural gas sector.

This reform of the hydrocarbon law of 1986 provided a very timely pretext to develop a new comprehensive hydrocarbon strategy aimed at designing the deployment of technological and financial resources of foreign companies (Aït Laoussine, 1991), especially in the gas upstream sector at a moment when the lack of funds, coupled with limited technical and human resources, hindered the challenging gas export programme (Aïssaoui, 2001) in place since 1989. The outcome of this new strategy materialised in three new objectives: first, enhancing the oil recovery of existing fields within a re-development programme; secondly, increasing the hydrocarbon resources by boosting the exploration and development activities; and thirdly, promoting the development of existing natural gas fields, which had not yet been exploited.

⁹⁷ As explained, there was a process of vertical re-integration of the industry worldwide. In this context, IOCs were more interested in acquiring the right to production than being solely involved in trading ventures (Aïssaoui, 2001).

With regards to the first objective, Sonatrach facilitated IOCs bidding with the aim of participating in the exploitation of the 10 most important oil fields (Aït Laoussine, 1991). The second objective prompted the award by Sonatrach of some 45 exploration contracts, involving companies from 20 different countries⁹⁸ in the timespan 1987-2004. Some of these contracts tackled the crude oil sector, but others natural gas. The main conditions of these contracts encompassed a five-year exploration programme to drill a number of exploration wells. Between 1987 and 2004, a total budget of USD 1.7 billion was invested in the drilling of nearly 200 wells (Malti, 2010). As a result of such a policy, more than 30 new discoveries were possible, totalling in reserves more than 145 bcm of natural gas, as well as 7 billion barrels of crude oil (El Wattan, 2004), which had a significant impact worldwide in terms of new discoveries, only behind Angola (HIS Energy Group, 2004). Most of these new discoveries happened within the boundaries of the Berkine basin in the south-eastern part of Algeria.

More specifically in the natural gas sector and responding to the third objective of the new hydrocarbon strategy envisaged in the aftermath of the legislative changes of 1991, Sonatrach was poised to establish new forms of partnership to expand the gas business. Let us recall that before the changes introduced in 1991, the right to share in Algeria's gas activities (from upstream to downstream) was limited to Sonatrach. This notwithstanding, some pioneering agreements had been brokered before 1991, in particular the first one in 1989 in the form of a gas cooperation agreement that the public company had signed with Royal Dutch Shell to explore possible joint venture prospects in the gas industry, and later in May 1991, an agreement with the French company Total to jointly develop the gas field of Hamra. In order to circumvent the restrictions imposed by the hydrocarbon law of 1986, Total was asked to provide two thirds of the total necessary investment in return for exclusive rights to all condensate and LPG, thus leaving natural gas entirely to Sonatrach.

Already under the new legal regime established in 1991, Sonatrach developed different forms of partnership with IOCs. For example, the agreement of 1996 with the Spanish and French companies Repsol and Total to exploit Tin Fouye Tabenkort, as well as the agreement of 1998 with British Petroleum (BP) on In Amenas entailed the joint development of the fields under a

⁹⁸ A more detailed description and further references will form part of Chapter 3, but awarded companies were mainly from Italy, France, Spain, the United States, the Netherlands, the United Kingdom, Libya, Australia, Finland, Japan, Germany, Canada, Argentina, and Malaysia, among others.

revenue sharing scheme⁹⁹ by which the reimbursements of Total's, Repsol's and BP's costs and their share of profits included shares in the revenues obtained from the gas sold by Sonatrach (Derman & Yassine, 1997). Another example in terms of exploitation of natural gas was the one developed under the agreement of 1995 with BP on In Salah whereby the agreement covered the whole gas chain, meaning joint development and production, exploitation of pipelines, along with the marketing of the gas produced. Indeed, the joint marketing company (In Salah Gas Services) allocated revenues from the sale of gas to each associate as reimbursement for their investments and profits, after deduction of royalties (Aïssaoui, 2001). In fact, in most of these operations, the construction of pipelines to the Hassi R'Mel field was needed in order to continue transporting the gas to either liquefaction plants for LNG exports or abroad by other sub-sea pipelines.

In summary, the first hydrocarbon law of 1986, and the successive reforms of 1991, favoured the transformation of Algeria into a primarily gas producing country, the participation of foreign investors to exploit the natural gas fields and join forces with Sonatrach for transportation outside the Algerian territory (the law of 1986 as amended by the law of 1991). Finally, they also increased the juridical security of foreign investors by allowing them to access international arbitration in case of dispute (the law of 1991), thus attracting to the country smaller foreign companies in the energy and electricity sector that aimed at ensuring a primary energy supply without intermediaries (Mañé-Estrada, 2009).

As noted, the first round of the legislative elections of December 1991, which were the first pluralist national legislative elections,¹⁰⁰ gave a landslide victory to the Islamic Front of Salvation (FIS), which triggered the forced resignation of President Bendjedid in January 1992 after dissolving the Parliament. Immediately after, with a vacuum of power in the presidency of the

⁹⁹ Unlike in the production sharing contracts or agreements that were based on the concept of profit sharing between the government and the resource extraction company (the contractor) after recovery of costs, in the revenue sharing scheme the government will profit from the flow of revenues from the very first day of production. Therefore, under this scheme, there is a significant reduction in administrative discretion while granting greater freedom to the contractor, and the government needs to audit only the production and revenue by the extraction company, and there is no need for micro-management or control over budget and expenditure of the company.

¹⁰⁰ Eighteen months before, in June 1990, Algeria had held its first local and regional pluralist elections and the Islamist political party FIS had obtained a large majority, and the government reacted by arresting the most prominent party leaders following their call for a national strike, civil disobedience and actions against the hydrocarbon sector.

country, the Higher Security Council¹⁰¹ cancelled the second round of the legislative elections and co-opted Mohammed Boudiaf¹⁰² for the post of president of the Higher State Council, who took over the functions of the Algerian presidency. This turn of events precipitated the ban on the Islamist FIS, the detention of its members and the declaration of the state of emergency. These events fuelled armed insurgency by the Islamists, and the civil strife began.

In a context of a worsening civil war, in 1994 Algeria found itself with aggravated problems due to an inflexion of hydrocarbon exports and downward pressure on crude oil prices. Indeed, in response to the sharp fall in oil prices in late 1993 (which generated severe pressure on the balance of payments and led to the accumulation of substantial arrears over the first quarter of 1994), with a decreasing amount of foreign exchange earnings, being absorbed by the foreign debt service at a moment when hydrocarbon revenues plummeted, the only solution was to request a debt relief after working out a stabilisation and structural adjustment programme with the IMF (Nashashibi et al., 1998). By taking such a decision, the new head of state, General Liamine Zérroual,¹⁰³ managed to temporarily relax the external constraints and allow the government to implement a near term structural programme, which focused on restoring growth and containing inflation. This was planned to be accomplished by alleviating the external debt service burden, pursuing liberalisation of the exchange and trade regime, reducing macroeconomic imbalances, and freeing prices. In addition, a series of measures to stimulate employment and cushion the impact of the programme on vulnerable groups were planned (IMF, 1994), while accelerating the government's withdrawal from microeconomic management of public enterprises and preparing for their privatisation.

All these measures put Algeria on a relatively more stable path by the end of the 1990s thanks to the significant progress achieved in terms of restoring macroeconomic stability. Further, hydrocarbon export volumes increased considerably in a context of higher oil prices in 1996 and

¹⁰¹ A constitutional advisory body on national security.

¹⁰² Boudiaf had opposed the single party regime in 1963 as a founding member and leader of FLN and decided to distance from that party and established a new one in exile (Morocco) where he resided during the following 27 years until the Algerian military asked him in 1992 to accept the post of president of the Higher State Council, which he accepted and therefore moved back to Algiers. In June 1992, he was assassinated.

¹⁰³ In January 1994, he was promoted to head of the Higher State Council and, in November 1995, he was elected President of Algeria, a post that he retained until the following elections in 1999.

1997¹⁰⁴ and the country was better prepared to face the oil price crisis of 1998 as compared with the oil “counter-shock” of 1993 and 1994. It is worth noting that the programme on which the government embarked did not deliver the results in the scope of privatisation and financial sector liberalisation (Bisat, 1999). Social imbalances continued to grow as a result of the low growth rate in the non-hydrocarbon sector, which was not capable of creating enough jobs, particularly among young people, in a country that had experienced a very high fertility rate since the 1960s, thus contributing to steady growth in the labour force by 3 percent annually. Hence, the unemployment rate reached the gloomy figure of 30 percent by the end of the 1990s (Aïssaoui, 2001).

By assessing the evolution of GDP between 1992 and 1996, one can observe a critical loss in the manufacturing sector considering that in this four-year period the industrial production index declined by 20 points. Therefore, the most visible result of the reforms was the destruction of the productive sector (Mañé-Estrada, 2002), which ended up causing more dependence of the state on hydrocarbon rents, thus enduring the rentier state.

2.3.4 The failure of the hydrocarbon sector’s liberalisation in a globalised economy

General Zérroual, in his capacity as President of the Higher State Council and President of Algeria,¹⁰⁵ pursued a comprehensive political settlement that could end the crisis and tried to restore the representative institutions. Although the elections in November 1995, which elected Zérroual as president, did not follow the same pluralist pattern as the previous elections after the constitutional reform of 1989, the truth is that he attempted to build his legitimacy as president of the Republic by promoting a number of constitutional and political reforms. To this end, President Zérroual promoted some constitutional amendments to ensure that Algeria could

¹⁰⁴ Algerian authorities developed balance of payments projections in collaboration with the IMF for the period 1996-1998. These projections were broadly consistent with the macroeconomic objectives outlined above. The total projections indicated a steady improvement in the current account balance. The gradual slowdown in import growth over the period was largely a reflection of an anticipated reduction in hydrocarbon investment. These investments underpinned a projected increase in gas exports. Total gas exports (consisting of LNG, piped gas, and LPGs) were projected to increase from USD 3 billion in 1994 to about USD 5.5 billion by 1998. Total hydrocarbon exports were projected to reach USD 11.7 billion by 1998. Non-hydrocarbon exports and private transfers were also projected to increase in response to the stabilisation programme (Nashashibi et al., 1998).

¹⁰⁵ The Higher State Council was chaired by Mohammed Boudiaf who was assassinated in June 1992, then succeeded by Ali Kafi, who resigned in January 1994, and was replaced by General Zérroual, who was one year later, in November 1995, elected president of the Republic. The country had remained leaderless since the resignation of President Bendjedid in January 1992.

benefit from a democratic system underpinned by multi-partisanship, provided that neither Islamist nor secessionist political parties could participate in the system.¹⁰⁶

The constitutional reform also established a bicameral system with an upper chamber (called the Council of the Nation), alongside the existing lower chamber (the National Popular Assembly), and it also helped President Zéroual to establish his own political base with the launch of a new political party, the National Democratic Rally (RND),¹⁰⁷ conformed by former members of the long-ruling FLN, which continued to exist. The attempt by President Zéroual to stay in power did not last for too long, as he decided not to run for re-election in the early presidential elections convened in April 1999 following the outbreak of violence that occurred during 1997 and 1998. Abdelaziz Bouteflika was elected president with more than 70 percent of electoral votes as an independent candidate.

President Bouteflika has been the longest serving president of independent Algeria as he took over on 27 April 1999 and was consecutively elected four times until he stepped down on 2 April 2019. He had mainly served as Minister of Foreign Affairs during part of the 1960s and 1970s. With the civil war about to end, President Bouteflika could address his agenda of economic reforms. His election had been backed by the army, with which he did not have any apparent organic links, but which gave him a margin of manoeuvre to negotiate a *modus governandi*, even if it took him eight months to form his first government (The Economist, 2000). Indeed, Abdelaziz Bouteflika was the candidate chosen because he held the historical legitimacy of belonging to the “revolutionary family”, those who had fought for independence, but he held no ties with the previous administrations of Bendjedid and those during the civil war in the 1990s. Moreover, he was well equipped with a promising international agenda of contacts from his time as Minister

¹⁰⁶ In particular, the adopted amendments to the Constitution barred from the system those political parties pursuing the exploitation of religion, language or territory.

¹⁰⁷ The party-political history of Algeria since 1995 lies in the complex relationship and not always legible between these two actors on the Algerian political scene: the long-ruling FLN and the RND. Ideologically, the RND appeared rather as an eradicator of radical Islamism while the FLN portrayed an image of seeking the dialogue from the very beginning. Eradicator must be included in the Algerian context as a supporter of the security option, therefore repressive of the most radical violent Islamists. With the passing of time, the RND has emerged as the main defender of the rights of patriots, those armed groups, established in 1994, as part of the struggle against Islamist terrorism. In addition, the RND in the beginning pretended to be representative of a new era, that of a multiparty system, liberalism and ideological pragmatism, facing a FLN definitely linked to doctrinal rigidity and the one-party system. In this context, for the long-ruling FLN the electoral defeats of 1990 and 1991 were the direct consequence of its unpopularity and the logical sanction of four decades of disastrous exercise of power and repressive monopoly (Zoubir et al., 2009).

of Foreign Affairs under President Boumédiène, which he utilised intensively to restore the credibility of Algeria vis-à-vis the United States and the European Union after the civil strife.

Pursuant to this, Algeria embarked first on the global war against terror that was enhanced after the 2001 terrorist attacks perpetrated in the US, and elsewhere in Europe, by showing results after the Algerian civil war against the Jihadist insurgency. By exploiting this know-how, the Algerian leadership managed to restore its credibility vis-à-vis the international community and started leveraging its stake in the regional (Maghreb), continental (Africa) and international spheres. This process came along with a reinforcement of the internal security to fight against terror activities, which has seen terrorist incidents reducing from a record peak in 1998 with nearly 360 terrorist incidents to less than half in 2007 (Global Terrorism Database, 2015). Yet, new actors such as Al Qaeda in the Islamic Maghreb (AQIM) emerged in 2007 prompting new security threats to the country, while daring to attack not only the official and civilian population but also strategic oil and gas assets as was the case with the 2013 terrorist attack in the In Amenas gas field. The emergence of these new threats was accompanied by a growing regional insecurity and instability landscape. Apart from the protracted conflict with Morocco, the number of regional conflicts started to mount, especially after the 2011 revolts that affected the Arab countries. Neighbouring countries like Libya, Mali and Tunisia entered into conflict zones of a very different nature and degree, with the consequent spilling over into Algeria.

A second vital strategic axis during these first years of Bouteflika's long mandate was to enhance a power conglomerate that could benefit from the support of the state and the traditional networks of hydrocarbon rent allocation (de Larramendi et al., 2016), and thus reinforce the patron-client relationships that the distribution of hydrocarbon rents entail for rentier economies. It is certain that the latter had existed since nationalisation of the hydrocarbon industry, but they were intensified during the first years of Bouteflika's mandate.

This second strategy was complemented by an agenda of intended bold economic reforms, also in the sector of hydrocarbons. In 1999, President Bouteflika chose Chakib Khelil¹⁰⁸ as Minister

¹⁰⁸ A long-experienced professional in the field of management of hydrocarbon resources, Khelil joined Sonatrach in 1971 as head of its reservoir engineering department while being President of Alcore, a joint venture between Corelaboratories and Sonatrach. Then he became technical adviser in the presidency of Algeria from 1973 to 1975, followed as coordinator in the hydrocarbon vice-presidency of Sonatrach. In 1980, he joined the World Bank, working on petroleum-related projects in Africa, Latin America and Asia; he retired from it as its petroleum adviser

of Energy to initiate a liberalisation of the hydrocarbon sector. The social and economic situation that President Bouteflika inherited in these first years of the 2000s was considered to be socially explosive. Hence, the government was in urgent need of promoting a long-term reform encompassing all the sectors of the economy. In particular, the debate about the energy sector reform dates back to the beginning of the 2000s, when several licensing rounds opened the country for IOCs, and new infrastructure was planned to enhance the natural gas export sector, such as the third cross-Mediterranean pipeline (Medgaz) and the LNG facility in Arzew.¹⁰⁹

The Algerian hydrocarbon sector entered the 21st century under conditions very different from those of 30 years before. After the reforms of 1991, the presence of foreign companies, mainly of IOCs,¹¹⁰ significantly grew in the exploration and development of natural gas in Algeria, thus helping expand the export revenues of these companies and boosting their volume of rent captured along the gas value chain. In 1995, IOCs participated in only 0.87 percent of natural gas production, whereas in 2000 it was 8.57 percent and in 2005 18.5 percent. Similarly, export revenues of partners were negligible in 1995: 5.5 percent in 2000 and 10.4 percent in 2005 (Mañé-Estrada, 2009). As the participation of foreign companies in the development of oil fields started earlier than that of natural gas, the share of foreign participants was also higher in the first case than in the second. Furthermore, as already noted, the legislative framework applicable to the natural gas sector had always been more restrictive to foreign participation than the one applicable to the oil sector.

In essence, the will to continue attracting investors triggered the adoption of a new hydrocarbon law¹¹¹ on 28 April 2005 with a view to liberalise the hydrocarbon sector. In fact, Minister Khelil, who had previously served in the World Bank, wanted to promote a full liberalisation of the hydrocarbon industry through the very first reformist hydrocarbons law, which was drafted by the Minister himself in 2001, but which had to be withdrawn soon after, and was blocked by the harsh opposition of the closest faction to the Algerian military that feared the consequences that

in 1999, only to join President Bouteflika's cabinet on 1 November 1999, becoming Minister for Energy and Mines on 26 December 1999 until 2010.

¹⁰⁹ An in-depth analysis of the natural gas midstream infrastructure is provided in Chapter 3.

¹¹⁰ Lists of IOCs and projects are provided in Chapter 3 when assessing the evolution of the upstream segment of the natural gas chain.

¹¹¹ Law no. 05-07.

such a process could entail for Sonatrach. In fact, the process of developing the law was surrounded by rumours on the privatisation of Sonatrach, a decision that was first announced but later withdrawn following a hostile mobilisation from the hydrocarbon sector, as well as certain parliamentary circles (Benchikh, 2007).

The new hydrocarbon law of 2005 was substantially amended in 2006.¹¹² Meanwhile the text adopted in 2005 initially revoked the requirement that Sonatrach should hold a minimum stake of 51 percent in any oil and gas projects, the 2006 amendment reintroduced this condition. This provision had been in force since the nationalisation of 1971 for the oil industry and it had been extended to the natural gas industry since the 1991 reform on the hydrocarbon law of 1986. Further, the new hydrocarbon law of 2005 was also amended for a second time in 2013.¹¹³

In fact, since 2010 Algeria experienced limited interest from investors in undertaking new oil and gas projects due to repeated project delay resulting from slow government approval, difficulties attracting investment partners, technical problems, and legal restrictions concerning foreign investment in Algeria (EIA, 2015). Furthermore, the country's security was evoked especially after the 2013 militant attack on the In Amenas gas facility.¹¹⁴ Therefore, in order to attract more foreign investment to new projects, the government enacted in 2013 new contractual and fiscal provisions and increased security presence at all of its oil and gas facilities by amending the 2005 hydrocarbon law. The hydrocarbon law of 2005, as amended in 2006 and 2013, governs the oil and gas sector in Algeria.¹¹⁵

¹¹² Ordinance no. 06-10 of 29 July 2006 amending and supplementing Law no. 05-07 of 28 April.

¹¹³ Law no. 13-01 of 20 February 2013, amending and supplementing Law no. 05-07 of 28 April 2005 regarding hydrocarbons.

¹¹⁴ The In Amenas hostage crisis began on 16 January 2013 when the Maghreb branch of the terrorist group Al Qaeda took expatriate hostages at the Tigtourine gas facility near In Amenas. Although the true figure is not known, at least 39 foreign hostages were killed along with an Algerian security guard, as well as 29 terrorists.

¹¹⁵ While developing the research thesis, Algeria adopted a new hydrocarbon law on 2 October 2019 with a vote by the National Assembly on 14 November 2019. The new law came into force in January 2020. The new hydrocarbon law is aimed at stimulating foreign investment in Algeria's oil and gas sector and abolishes value-added tax on professional activities within the oil and gas sector. It also exempts imported goods, equipment, material and products used in exploration activities and/or the exploitation of hydrocarbon fields from all customs duties, taxes and other charges. Taxes and other duties have been abolished where the entity is established for the benefit of the state and local authorities. Tariffs for pipeline transportation are also exempt from VAT. This includes connected goods and services with hydrocarbons and customs duties, duties and royalties on the importation of material and products. In addition, the hydrocarbon law has defined unconventional hydrocarbons as coming from rock geological formations and shale. The duration of a hydrocarbon contract includes a 30-year exploration and exploitation period and may be extended for a maximum period of 10 years. The oil and gas supply chain must

The Ministry of Energy and Mines became the central player in policy and strategic development of the hydrocarbon sector under the new law,¹¹⁶ although it was not until 2007 when its strategic role was further clarified.¹¹⁷

The new hydrocarbon law established two agencies under the remit of the Ministry of Energy and Mines that since then have been in charge of the hydrocarbon sector: the *Agence nationale pour la valorisation des ressources en hydrocarbures* (ALNAFT), and a national agency for the control and regulation of activities in the hydrocarbon sector, the *Autorité de régulation des hydrocarbures* (ARH).

The ARH¹¹⁸ is tasked with ensuring compliance with technical regulations governing hydrocarbon activities, including rules related to tariff application and the principle of free access to pipeline transportation and storage infrastructure. Its oversight extends to regulations on hygiene, industrial safety, environmental protection, and the management and prevention of major risks, with particular emphasis on safeguarding groundwater and aquifers during hydrocarbon-related operations. The ARH also regulates the use of chemicals, especially in hydraulic fracturing, oversees carbon dioxide regulations, and sets standards for the construction of pipeline, transportation, and storage infrastructure. Additionally, it determines and communicates the domestic market prices for petroleum products and natural gas. The agency

include provisions that give preference to Algerian companies for the supply of goods and services produced in Algeria, subject to their competitiveness. The new hydrocarbon law reintroduces production sharing agreements and reduces the complexity of the previous petroleum framework by simplifying the structure of the fiscal terms. Also, royalty/tax participation contracts or risk service agreements will be available. Foreign countries' interest will continue to be limited to a 49 percent participation stake and foreign entities will need to pay surface tax, royalty, hydrocarbon revenue tax, and additional income tax.

¹¹⁶ Article 11 of law 05-07 states that "the ministry in charge of hydrocarbons ensures the optimal development of national hydrocarbon resources."

¹¹⁷ Executive Decree 07-266 of 9 September 2007 asserts that the Ministry of Energy and Mines in Algeria is tasked with developing policy and strategy for the exploration, production and valorisation of petroleum, mining and energy resources, and their related industries in general. This process of reassertion was not meaningless in light of the role that this Ministry had been playing since the 1960s. In the aftermath of independence, the Energy and Fuels Directorate, the central directorate of the Ministry, played a fairly important role of reflection, control, supervision and of drawing up the basics of hydrocarbon regulations. However, the creation in 1963 of Sonatrach, a public enterprise responsible first of all for the construction of a transport pipeline and the marketing of a small part of the hydrocarbons, went progressively with the extension of its research activities, operations and distribution, thus moving into the central space of decision-making in the field of hydrocarbon policy. Successive ministers of energy tended to turn to Sonatrach rather than to the Ministry's hydrocarbon department to prepare political decisions. With the new hydrocarbon law, the Ministry gained importance in policy and strategic decision-making.

¹¹⁸ See: <http://arh.gov.dz/index.php/fr/>

is responsible for reviewing applications for pipeline transportation concessions and provides recommendations to the Minister of Energy and Mines regarding the issuance of permits for these activities.

In contrast, ALNAFT¹¹⁹ focuses on upstream activities and closely oversees the progress of exploration and production projects. Its responsibilities include evaluating natural gas and oil resources, encouraging investment, issuing prospecting permits, launching competitive bidding processes, and reviewing bids for exploration and production operations. ALNAFT is also responsible for entering into exploration and production agreements with Sonatrach and foreign companies, as well as monitoring and inspecting the execution of these contracts in its role as a signatory. It approves development programs and manages financial responsibilities, such as determining, collecting, and transferring royalties to the Treasury. This includes ensuring that operators fulfill their obligations to pay petroleum revenue taxes, surface taxes, and, where applicable, fees for gas flaring and water usage. In essence, ALNAFT handles the contractual and financial aspects of upstream activities, from approving annual development plans to collecting royalties for each field on behalf of the Treasury.

ALNAFT is also responsible for maintaining and updating a national registry detailing the status of gas reserves, domestic gas needs, and the volumes available for export. It ensures that contracting parties, including Sonatrach and foreign companies, meet their obligations to supply gas to the domestic market. Additionally, ALNAFT determines the domestic gas price, which is published following approval by a decree from the Minister of Energy and Mines.

The legislative regime established by the hydrocarbon law of 2005,¹²⁰ as amended in 2006 and 2013, including the main features of the legislative framework and rules such as contracting policy and tax regime, is depicted in Annex I.

It is worth noting that law 13-01, which amended and supplemented the hydrocarbon law 05-07, introduced the notion of “unconventional hydrocarbons” for the first time, while establishing a more favourable legal regime for the exploration and production of unconventional hydrocarbons than that of conventional hydrocarbons (African Upstream Oil

¹¹⁹ See: <http://www.alnaft.gov.dz/>

¹²⁰ This law of 2005, as amended in 2006 and 2013, has been governing the hydrocarbon sector in Algeria up to date, notwithstanding the entry into force of a new law in January 2020.

and Gas, 2015). By unconventional hydrocarbons the law refers to shale gas, tight gas, shale oil and coal bed methane, which can be extracted from high-pressure and high-temperature reservoirs (IEA, 2012). In accordance with the International Energy Agency (IEA) (2012), unconventional hydrocarbons “require greater investment to carry on exploration and production activities than conventional oil and gas fields”. To this end, law 13-01 not only defines the conditions under which contracts for prospection, exploration and production¹²¹ can be fostered, but also the tax regime applicable to this kind of activity, which sets more advantageous conditions considering its capital-intensive nature.¹²² Finally, law 13-01 also envisaged precautionary measures on the environmental risk that exploitation of unconventional hydrocarbon resources entails. Given that unconventional hydrocarbons require more extraction wells than conventional hydrocarbons, as well as the use of hydraulic fracturing, which is a procedure very intensive in the use of water and chemicals, the law foresaw stricter rules in the development of these activities.

In spite of the adoption of law 13-01 that sought to increase the attractiveness of investment in the country’s conventional and unconventional resources, Algeria’s investment climate has remained relatively poor, among other things. From the perspective of IOCs, one of the largest issues is Sonatrach’s mandatory 51 percent equity stake in all upstream projects (BMI Research, 2016). In addition, Sonatrach’s institutional inefficiencies also drag on development and raise production costs, on top of a 2010 corruption scandal bringing additional risks.¹²³ The weak business environment has also weighed on Algeria’s attractiveness for foreign investors as the bureaucracy can be burdensome, regulation has been often opaque and the tax system highly convoluted. Indeed, the calculation of the hydrocarbons tax means that small changes in production or revenue can trigger major swings in after-tax profits. Tax rates also remain prohibitively high, for both conventional and unconventional output.

¹²¹ The duration of the exploration phase in contracts for unconventional hydrocarbons is extended to 11 years (as opposed to the 7 years offered for normal contracts) and of the production phase is extended to 40 years for shale gas (as opposed to the 25 years offered for normal contracts).

¹²² The royalties are subject to a lower rate of up to 5 percent (as opposed to the 5-20 percent rates for conventional hydrocarbons).

¹²³ See article Algeria starts Sonatrach corruption probe by the *Financial Times*’s global edition on 17 January 2010.

The lack of bold reforms in Algeria's hydrocarbon sector has been coupled with mounting institutional instability as a result of the so-called "Arab revolts" that have also hit Algeria since 2011. Although President Bouteflika's first reaction was to pledge a deepening of the democratic process by lifting the state of emergency in place since 1992 and the presentation of a roadmap for political reform, the reality is that the response of the regime fell short of what had been promised. The change encompassed a number of cosmetic reforms that catalysed in a constitutional reform promulgated in 2016,¹²⁴ selective repression, neutralisation of civil society activism, and enhancement of the mechanisms of rent allocation through direct subsidies to the population (de Larramendi et al., 2016). In spite of the strategies reinstated by the regime to neutralise the emergence of new poles of political and social dissent, there have been new social movements that have emerged since then, specifically in the field of hydrocarbon production, such as those against the development of shale gas in the south of the country (de Larramendi et al., 2016).

As explained throughout this section, the role that hydrocarbons, and more increasingly natural gas among them, have played since the end of the 1960s is critical to understand the economic development of Algeria and its consolidation as a rentier economy. In the next section, we will be looking into the evolution of hydrocarbon pricing policies, particularly those that have been applied to the exploitation of natural gas in Algeria since the country's natural resources became fully nationalised in 1971, and which have determined the evolution of the natural gas industry, including the role of the state and of foreign companies in the sector, among others. Better understanding of pricing policies is key to assessing the evolution of Algeria as a rentier economy, which will be discussed later, because pricing policies impact the flow of rents accruing to the state, as described in Chapter 1, and have helped perpetuate the rentier nature of the Algerian economy.

¹²⁴ After a specific constitutional reform in 2008 to the 1996 Constitution, this second constitutional reform of 2016 constituted an attempt to respond to the 2011 "Arab revolts". The constitutional amendments were discussed for more than two years and adopted by two Chambers of the Parliament in February 2016. Among the changes introduced by the reform, there is a new limitation of up to two terms for the president of the Republic, a provision that had been modified in 2008 with the first constitutional reform, as well as new powers of the Parliament when appointing the new prime minister.

2.4 Evolution of pricing policies of natural gas in Algeria

Both in the LNG sector and pipeline gas Algerian sales of natural gas have been undertaken under the formula of long-term, oil-indexed, “take-or-pay” contracts for European buyers. However, in the early 1960s the mechanism utilised was still embryonic: the prices in the early contracts of Camel and El Paso I of 1964 and 1969 respectively mainly reflected the cost of capital through an estimation (for almost 80 percent of the price) and they were fixed for the entire duration of the contracts, thus there was no price re-opening clause in the contracts. The remaining part of the price (some 20 percent) reflected the operating costs, and therefore subject to a partial indexation (15 to 20 percent) to steel product prices and wages in the UK and US economies, the two destination economies to which natural gas was shipped under the abovementioned two contracts.

With the 1971 nationalisation process and the OPEC price adjustment¹²⁵ of 1973, the pricing system for Algerian natural gas had to adapt considerably. As from the mid-1970s, with new long-term LNG contracts to supply Europe, and not only the US and the UK markets, gas prices were then set proportional to the evolution of the prices of fuel oil with a minimum price of USD 1.30 per MBtu.¹²⁶ This minimum price, indexed to a basket of currencies, was meant to cover Sonatrach’s capital costs should oil prices fall severely. Unlike the previous formula imposed since the mid-1960s when the country started exporting natural gas, a strict “take-or-pay” clause was introduced with the aim of preserving the revenues of the company, and by extension of the country, against potential speculative behaviour from the buying company. In addition, a clause to review every four years the base price or the price scheme as a response to foreseeable fundamental changes in the energy landscape was introduced.

Nonetheless, in light of the 1979 second oil shock, the new Algerian administration led by President Bendjedid rejected the price arrangements with the El Paso contract of 1969 and urged

¹²⁵ Following the oil embargo of 1973, the 44th meeting of the conference of OPEC was held in Libreville (Gabon), from 9 to 11 June 1975, and the conference decided to coordinate gas-pricing policies of member countries in such a manner as to be in line with OPEC oil-pricing policy, considering the premium attributable to natural gas due to its specific advantages (*New York Times*, 1975). Algeria did not concur initially with the views that posted prices should be established for gas exports, as it wanted to consolidate its portfolio of long-term contracts to support the ambitious programme of enhancing the valorisation of the natural gas industry. As a leading LNG exporter at that time, Algeria aimed at gaining a competitive position in the global market, and thus needed more flexibility in setting up the prices for gas.

¹²⁶ The MBtu unit is used in the natural gas to indicate 1,000,000 British thermal units (Btu), which is defined as the amount of heat required to raise the temperature of one pound of water by one-degree Fahrenheit.

Sonatrach to reconsider the price scheme implemented in the 1970s. The underlying idea was to fully equal the natural gas prices to those of crude oil as determined by OPEC official prices to increase the amount of gas rent accruing to the Algerian state, taking advantage of the crude oil price that rose as a direct consequence of the Iranian revolution and the second oil shock. To this end, Sonatrach negotiated a new scheme with an average price of USD 4.8 per MBtu fully indexed to a basket of crude oil at OPEC official prices. In addition, the existing minimum price set up at USD 1.30 per MBtu was scrapped. As stated by former Minister Aït Laoussine (1990), the price formula that Sonatrach devised in the early 1980s was very risky as it could benefit from a situation in which crude oil prices were high (see the year 1979 in Figure 2 with absolute record of hydrocarbon rents as a percentage of GDP), but which did not consider the possibility that oil prices could fall as actually happened from 1982 onwards. Moreover, due to the major reconfigurations¹²⁷ in the main industrialised consuming countries during the first half of the 1980s and the new higher prices of Algeria's exported natural gas, Sonatrach lost its American market to Canada, and important market shares in Western Europe to Soviet and Norwegian gas (Aïssaoui, 2001).

The oil counter-shock of 1986 triggered major changes in the pricing policy of natural gas, with a renegotiated new base price of USD 2.30 per MBtu, lower than the previous one as a consequence of the decline of oil prices, which was also fully indexed to a basket of crude oil prices, but no longer in accordance with OPEC official prices but with netback values.¹²⁸ Finally, the new pricing scheme also reintroduced the minimum price of USD 1.30 per MBtu in order to avoid a negative price of natural gas, as a consequence of applying the previous formula to the prices of crude oil in 1986. This new scheme allowed Sonatrach to broker new agreements in 1988 with its European clients from France, Italy, Spain and Belgium using the new pricing scheme.

¹²⁷ As noted, while Algeria was battling for an oil-natural gas price parity after the administration of President Bendjedid took over, there was a major shift in the pattern of energy demand of the main consuming countries. In a context of economic crisis, the expansion of nuclear power and a further utilisation of coal, gas demand in Western Europe and the US plunged.

¹²⁸ The netback value was a pricing formula introduced by the Dutch in 1962 when they started exploiting their gas fields in the northern part of the country. In order to generate maximum revenue for the state, the "market-value" or netback value principle was introduced as the basis for natural gas marketing. Netback pricing begins with the "market value" of natural gas in inter-fuel competition (in each market sector) and deducts the costs of transport services and overheads and profit margin to arrive at the "netback value" at the point of sale.

In this vein, Sonatrach was poised to capture additional market share in Italy and Spain, the two northern Mediterranean countries with the highest potential for further development of the domestic gas market. To this end, Sonatrach devised a new price formula that would encompass the specificities of EU markets in which gas prices tended to reflect the value of gas for consumers. This value had to derive from the prices of oil products, weighted to reflect the share of the different segments of the market, and netted back to the export border (Aïssaoui, 1999). Hence, the base price was fully indexed to gasoil and fuel oil prices with a minimum price of USD 1 per MBtu and a price re-opening clause every three years. As a result of this new pricing scheme, new long-term contracts of pipeline gas were reached in 1990 and 1992 with Snam, Enel and Enagas to supply natural gas via the Trans-Mediterranean and the Maghreb-Europe Gas Pipelines. Given that Sonatrach's gas export markets were mostly oriented towards the EU, a relatively higher flexibility on the supply volumes was applied to the new contracts by relaxing the high take clauses (Aïssaoui, 2001). Indeed, the principle became that purchasers would commit to pay for a minimum annual quantity of at least 80 percent of the agreed annual contract quantity, and not the 100 percent as had been the case until then.

On a different scale, the liberalisation of European gas markets began in 1986 in the UK. British Gas was privatised and moved steadily toward the opening of end-user markets, third party access to infrastructure, the unbundling of the incumbent gas company, and the development of traded gas markets (Melling, 2010). Shortly afterwards, in the late 1980s, the European Community triggered Article 86 of the establishing treaty in order to begin the liberalisation process. The European gas market began to open with the 1991 Gas Transit Directive, which obliged gas transmission companies to allow third-party access to their pipeline networks. In practice, the legislation was weak and ineffective, particularly where incumbent gas companies resisted strongly, and sovereign governments chose to incorporate only the minimum obligations of the legislation. This weakness called for progressively tougher legislation in the First EU Gas Directive (98/30/EC), the Second EU Gas Directive (2003/55/EC), and the Third Energy Package approved in 2009, effective March 2011. Since 1991, there has been enormous progress in the development of competition and liberalisation in European gas markets.

As this process was embedded in a greater emphasis on security of supply, liberalisation of EU gas markets did not entail the end of long-term contracts, which would have severely impacted

the export sector of Algerian natural gas. Nonetheless, in light of a greater liberalisation in EU markets, Sonatrach had to progressively make its contracting policy more flexible. In this regard, liberalisation in the US gas market during the 1980s prompted the development of a widespread spot market, followed since the 1990s by a futures market. The same happened with the UK gas market after its liberalisation process at the end of the 1980s.

Hence, the emergence of spot and future markets opened a new battlefield throughout the 2000s between the spot and long-term oil-indexed contracts, being this last option the one in which Algerian gas marketing was and is clearly positioned. Market conditions have evolved in the European Union ever since and can be summarised in these three possible scenarios: the first scenario happens when natural gas is scarce, and thus spot prices increase above prices of long-term contracts as demand for gas outpaces supply; a second scenario happens when a supply-demand balance can be maintained by the actions of the large gas downstream companies utilising the daily and annual flexibility built into their long-term gas purchase agreements; a third scenario is generated when there comes a point where the oversupply becomes so excessive as to breach the second scenario and send spot prices into a downward spiral.

In these circumstances, Sonatrach's interests lay in the second scenario, as the first scenario would inevitably trigger price re-opener clauses that would undermine its long-term oil-indexed gas sales; while the third scenario would trigger downward price renegotiations unless the gas industry incumbents in Europe take exceptional measures to restore market balance and go back to the second scenario. In fact, during the great recession of 2008-2009, gas domestic demand in Europe began to decline noticeably around September 2008 and resulted in a downturn in demand of around 7 percent across Europe, which especially hit oil-indexed pipeline supplies that were down dramatically as a result of reduced demand from their consumers due to recession and sourcing of a cheaper spot alternative.

In this context, with most Algerian exports going to Italy and Spain, and Algeria's two key customers being Eni and Gas Natural,¹²⁹ pipeline exports contracted by 10 percent (Melling, 2010). Algeria expressed its negotiating position that it expected long-term contracts to be honoured, in terms of take-or-pay, pricing, and future volumes. However, both Eni and Gas

¹²⁹ In June 2018, the general shareholders meeting of Gas Natural approved the change of name of the company to Naturgy Energy Group.

Natural were reported to have serious take-or-pay problems in the timespan 2009-2010 by a problem of oversupply. Gas contract negotiations took place, and Sonatrach was reported to have made concessions on volume (Melling, 2010), which also encouraged Sonatrach to announce its intention to offer customers short-term natural gas contracts.

The evolution of Sonatrach overtime has been subject to legal, administrative and financial control by the state and the political power, be it the government and/or the long ruling FLN (at least, until 1988 when the political party-political system was changed). This had led to a varying degree of control from the political apparatus, and pricing policies have been a determinant tool to exert this power. In principle, when hydrocarbon prices have been low, Algeria has sought to attract foreign investments, and thus improve the performance, and even the autonomy, of Sonatrach. However, when hydrocarbon prices have returned to higher prices, Algeria has sought to block these very same reforms and renegotiate the contracts that it had with foreign companies to favour Sonatrach's interests. In this context, the Algerian state has since the beginning dominated Sonatrach and has relied on its revenues to garner power.

In this vein, what has always been at stake in the complex relationship between the government and Sonatrach is the competition for hydrocarbon revenues. During the 1980s and 1990s, there are many examples that prove such competition to capture the largest portion of hydrocarbon rents. For instance, during the timespan 1980-1994 when hydrocarbon rents plummeted, the split of export revenues was 67 percent for the government and 33 percent for Sonatrach. Later, when rents recovered the split stabilised into 60 percent for the government and 40 percent for the company (Aïssaoui, 1999).

We will now look into an important area that impacts the development of Algeria as a rentier economy: the impact of hydrocarbons in the public economy, and how rent accrues domestically like national income as a result of taxation¹³⁰ that somehow turns foreign income from hydrocarbon (mainly oil) exports – accrued by the owners of the resource (the Algerian state) – into Algerian rent.

¹³⁰ See other case studies in Davis, Ossowski and Fedelino (2003).

2.5 Algeria as a rentier economy: the role of hydrocarbons in the public economy

As noted in Chapter 1, hydrocarbons rent is a type of rent of mines. The description of this concept is attributed to David Ricardo (1772-1823) and, therefore, the term Ricardian rent is sometimes used as a synonym. There are four key components of rent: to be a product of the land, which one owns; the inequality in the “productivity” of different mines; the scarcity of the product, which would make it necessary to exploit less productive mines (less profitable, with higher extraction costs...); and, when all this occurs, the existence of a unified market (great pool) or single price, which compels the product of the highly productive mines to be paid for at the same price of those of “low quality”, with the latter fixing the market price, and the difference between the two production costs generating what we call a hydrocarbon rent.

If we adapt this principle to the case of oil, this would mean that insofar as the oil of productive fields becomes scarce (good quality oil, easy to extract as it is in abundant and low depth fields and with low extraction costs), the “frontier” or less “productive” fields would have to be exploited: the less productive ones, having greater extraction difficulties and, in many cases, being more land-intensive.

In this context, data from Figure 2 in Chapter 1 shows the evolution of Algerian hydrocarbon rents as a percentage of Algeria GDP from 1971, when the Algerian state reclaimed full control over the hydrocarbon sector, to 2015. Hydrocarbon rents in Algeria represent nearly the totality of natural resources rents generated by the country.

In line with the thorough dissertation in this Chapter, throughout this period (1971-2015) four different trends can be differentiated:

- The first period goes from the nationalisation of the hydrocarbon sector to the end of the second oil shock of 1979, in which oil rent mounts very quickly, picking up the rapid increase of crude oil prices worldwide. Prior to this period, since the discovery of the main hydrocarbon fields in Algeria in the 1950s, still under French colonial rule, the structure of Algerian hydrocarbon exports mostly consisted of crude oil in the 1950s and extended to small quantities of condensate from the Hassi R'Mel gas field in the 1960s. In 1964, natural gas exports started from Camel, the first LNG terminal in the world. However, as the prospects for further expansion of the gas exports were frustrated due to harsh competition from Dutch and Libyan

gas and the absence of transport infrastructure to the only viable markets in Europe, the structure of exports remained anchored to crude oil that had a strong governance umbrella with OPEC. Hence, rents generated by natural gas were still very scarce, as Figure 2 in Chapter 1 reflects.

- A second period goes from the aftermath of the second oil shock to the great oil counter-shock of 1986, which plunges its prices worldwide, and triggers a severe economic and political crisis in Algeria. Despite the collapse of oil prices, this period will witness as from 1983 the commissioning of the first cross-border Mediterranean natural gas pipeline that will permanently supply Algerian natural gas to Italy via Tunisia, thus increasing natural gas rents.

- The third period covers the timespan of 1986 to the great recession of 2008-2010, which saw a steady increase of hydrocarbon rents of both oil and natural gas. This period boosts the country's hydrocarbon exports to the highest volume and value to mainly European markets. It also triggers new physical interconnections across the regional natural gas market in a very changing environment with dramatic changes on the European scene (collapse of the Soviet Union, establishment of the Arab Maghreb Union and new impetus to the relationship between the EU and its southern neighbours, including Algeria, among many others).

- The last period shows a declining trend in rent capturing from 2011 onwards characterised by lower production levels of hydrocarbons, lower demand from consuming countries – mainly from Southern Europe –, higher domestic consuming demand, oil price volatility, and geopolitical turmoil in the region.

Throughout the entire period, 85 percent of hydrocarbon rents are mostly generated by oil rather than natural gas, which can be explained by the commodity prices (of crude oil vs. natural gas) rather than by export values, particularly since the second half of the 1990s when natural gas export volumes considerably increase. Whereas export values between one commodity and the other do not differ much, in the case of Algeria, crude oil operates in the international market with a unified commodity price while natural gas mainly operates in a regional market with different prices set in accordance with long-term contracts signed by Sonatrach and Southern and Western European companies. In the first case, it is the higher commodity price in relation to the cost of production that increases the rent. Indeed, in the 1990s, both gas production and export shares were like those of crude oil (Mañé-Estrada, 2009) but the year 2000 (BP Statistical

Review of World Energy, 2020) was a turning point, insofar as volumes of natural gas exports became higher than those of crude oil exports. However, this has never been the case of the export values and rents accruing to the state (OPEC statistical bulletins & World Bank database, 2020).

It seems obvious that the natural gas market does not fulfil the requirements for generating rent (scarcity, deposits of different qualities and a set international price), while the oil market does meet them. From this point of view, it is legitimate to consider that the Algerian state has been behaving like a rentier state, since rents were generated in the international market, in which its oil commodity was integrated into a wider institutional arrangement because of Algeria's membership of OPEC.

In other words, one of the conditions for Algeria to become a rentier state was that its crude oil, within the framework of the rationale of OPEC's cartel, was integrated into an international market, with a unified commodity price. Since the 1970s, this price is both the result of the power relations that interplay within the dual OPEC-IEA international structure of governance and performs a very concrete role within the capitalist system.

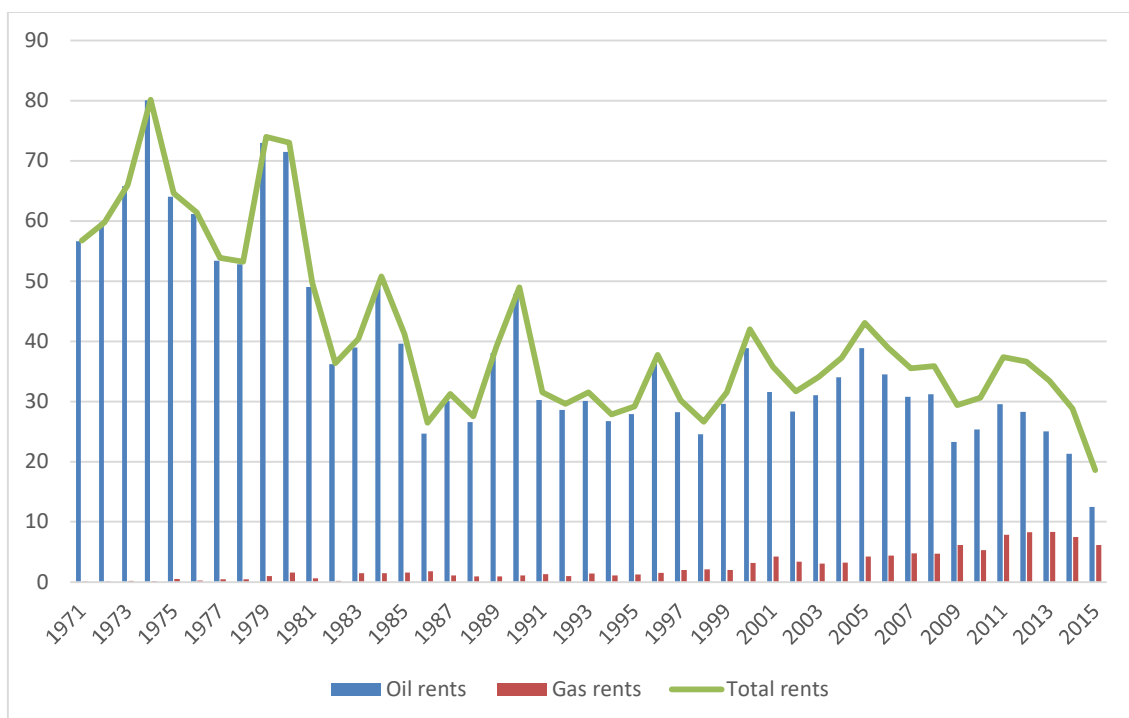
It is worth noting that the different behaviour between oil and gas rents may be explained by the fact that, up to now, Algerian gas has been mainly traded bilaterally with different prices set in accordance with long-term contracts signed by Sonatrach and Southern and Western European companies. Indeed, this type of contract that primarily responds to the bilateral interests of the Algerian state rent is almost never generated.

Let us compare the behaviour of both crude oil and natural gas sectors when it comes to rent generation in Algeria with parallel realities in two other major natural gas exporting countries such as Qatar and Norway. The first one being the largest LNG exporter worldwide in the timespan 2006-2015, while the latter being the second country from which the EU has been importing pipeline natural gas since the mid-1970s.

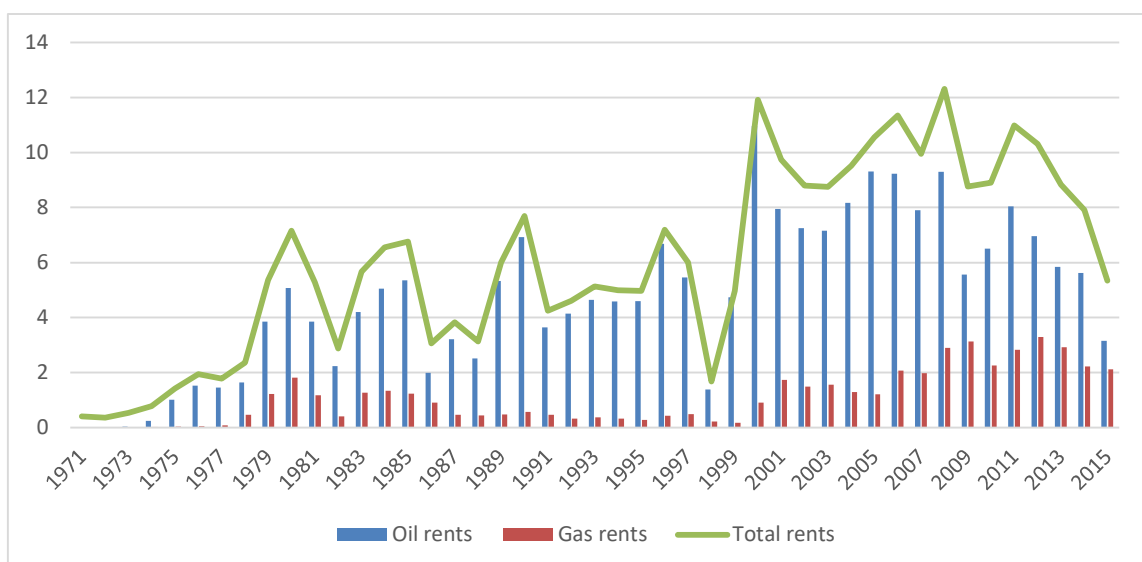
Figure 8 illustrates on different scales the magnitude of the amount of rent obtained from the exploitation of oil, natural gas and total natural resources in relation with the countries' GDP for Qatar and Norway. In both examples, most of the rents accrued to the state originate from crude oil rather than natural gas, which corroborates the pattern observed in the case of Algeria.

Figure 8. Hydrocarbon, oil and natural gas rents as a percentage of Qatar's and Norway's GDP (1971-2015)

Qatar



Norway



Source: Compiled by the author based on data retrieved from the World Bank and IMF databases

However, there is a stark difference between the two examples in terms of scale and economic model. Qatar is a GCC style rentier economy (Akkas, 2020) that has slightly diversified its economy to moderate the oil and gas centrality in its economic model, while it has used the hydrocarbon rents as a source to invest in other industries such as telecommunication and transportation. Figure 8 reflects the decreasing trend of the export generated rents from the 80 percent of the country's GDP reached in 1974 to the 20 percent in 2014. In contrast, Norway¹³¹ represents one of the very few hydrocarbon-rich economies that has built an alternative model to rentierism by limiting to only 4 percent the hydrocarbon revenues that can be invested or spent in public (government) projects (Norouzi, 2022). That means that the largest portion of the revenues generated by the hydrocarbon exports are saved in a government pension fund that can only be utilised, under very strict conditions set by the Parliament, to invest abroad. This also means that the state relies on taxes other than hydrocarbon revenue to finance its current expenditure, and a whole set of non-oil economic activities contribute to the development of the economy.

In both cases, we observe an increasing share of the natural gas rents in comparison with those of oil that can be explained by the rise in volumes exported of natural gas, especially at the turn of the 21st century.

As noted in Chapter 1, any government that accounts for 42 percent or more of its total foreign rental income is considered a rentier government (Beblawi & Luciani, 1987). Given the above characteristics, most hydrocarbon-producing and exporting countries can be called rentier states because foreign rents in these countries flow directly to the state treasury and its share in

¹³¹ Norway is an example of a thriving economic system that has managed to diversify as a combination of a market-based economy and a state-owned economy. The government has a significant presence in key sectors such as the oil and gas industry. However, in terms of non-hydrocarbon resources such as mines, forests, fishing, and energy from water resources, it also has shipbuilding industries. Moreover, revenues from hydrocarbon exports account for 35 percent of the country's exports. In addition, by international standards, Norway has a high employment rate, low unemployment (4.62 percent), and a high education level (with a science score of 500). Also, the country enjoys low Gini indices on income and wealth inequality (0.25), a very high general governmental wealth (USD 1.3 trillion), while the country's green policies also lead to very low GHG emissions (43.4 million tonnes) (Puertas & Marti, 2021). Regarding the Legatum prosperity index, Norway is behind Denmark as the most prosperous country, while Arab Middle East countries rank below 42 (Budsaratagoon & Jitmaneeroj, 2021). Almost 83 percent of people report having confidence in the national government (Puertas & Marti, 2021). Also, in the rule of law, Norway was ranked 2 with a score of 0.89 in 2020 (Subkhonov, 2021). Norway is among the lowest in OECD countries, with a lower 40 percent of GDP as general government debt (Puertas & Marti, 2021). Also, the EPI index suggests that Norway is among the 20 most environmentally-friendly countries, and even Robeco ranked Norway's the most environmentally-friendly country (Cöster et al., 2020).

government revenues is more than 42 percent (Yousefi, 1997). This is certainly the case of Algeria and Qatar as shown before, but not of Norway.

2.5.1 Hydrocarbon taxation as a tool to assert the rentier economy

As we have thoroughly explained, the rent is simply defined as revenues above industry costs and normal profits. It is captured by the state through taxation, which is normally made up of an average royalty on total production and an average tax on profits, obtained through calibration to the most recent trends. Throughout the recent history of Algeria, the hydrocarbon legislative framework has been evolving, as has been presented in depth in this chapter. Therefore, the percentages at which both production and profits have been taxed have been subject to an evolution, as has the amount of revenue from hydrocarbons accruing to the state. To fully understand how the Algerian government has designed its hydrocarbon taxation policies, there are few additional elements that need to be taken into account when determining the prospects for export-generated rent, and thus the taxation set forth herein: 1) hydrocarbons' reserves and their expected life, which help incorporate the main assumptions concerning the allocation of reserves and the associated government depletion policy; 2) depletion policy and exports structure, which help define how quick reserves must be brought into production and how the produced hydrocarbons need to be exported, as well as what the balance is between oil and gas exports; 3) as explained in the previous section, price structure, often determined at the global stage, but which is subject to major uncertainty given the usual fluctuations of the price.

Since the 1971 nationalisation, but later with the first hydrocarbon law of 1986, the shares and progressivity of these hydrocarbon taxes have been the result of the relationship between Sonatrach and its foreign partners. Those laws have legalised the monopoly situation of the NOC, but above all they became the rules that determine the relationship between the in-border hydrocarbon sector and its foreign partners. They also fix the hydrocarbon tax system and whether arbitration, in the event of a dispute, were to be national or international. Furthermore, they have also established the share of the value of total net production between the government and the industry (including Sonatrach) to 60:40, and later to 70:30 (Aïssaoui, 2001), which has nurtured the Algerian state with a considerable portion of the hydrocarbon revenue, as will be shown in this sub-section.

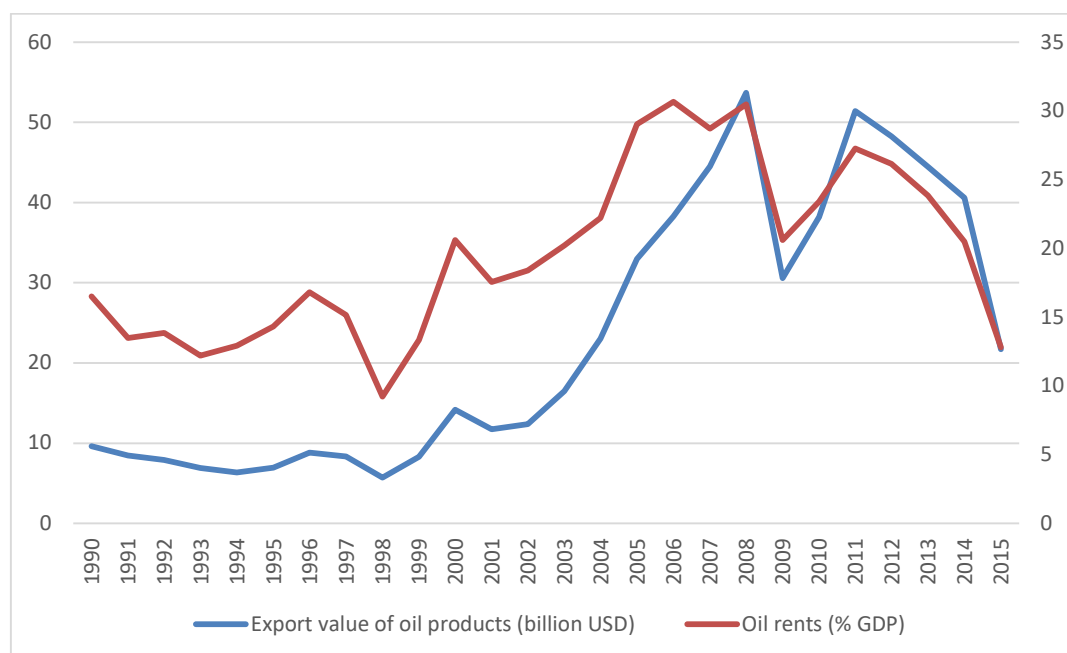
In order to better understand how relevant taxation is to ensure that the state is properly endowed with revenues, Figure 9 shows a correlating trend between export value of oil products and oil rents accruing to the Algerian state. It reveals a possible coincidence between the wave of legislative reforms that hesitantly began in 2001 and capped in 2005 and 2006. Following this wave of reforms, there was a drop of more than 20 percent¹³² in the relative oil tax (ROT), which relates the weight of the hydrocarbons in GDP to its taxation: in 1991, at the very beginning of the assessed period, such ROT was about 2.21, but in 2008 this figure already dropped to 1.74. New reforms were launched in 2013 and 2019. They have notably established a fixed rate (30 percent) of income tax and abolished the “tax on exceptional profits” in order to attract foreign investment.

Whether or not such a relationship exists, since other factors could also be considered, such as the greater weight of gas in the structure of exports or the commissioning of more expensive deposits, the truth is that the figure does not seem to suggest a correlation between the volume of hydrocarbon exports and the rent that flows into Algeria. As illustrated in Figure 9, for the last few years the trend has been for the amount of rent to become lower than the income from exports.

In any case, whatever the relationship was, if the trend spotted in recent years continues, data from Figure 9 suggests a reduction in the Algerian state's capacity to capture and generate income within the country and therefore reflects for the state a growing inability to act as a rentier state.

¹³² Tableaux statistiques, Banque d'Algérie.

Figure 9. Export value of oil products and oil rents from Algeria (1990-2015)

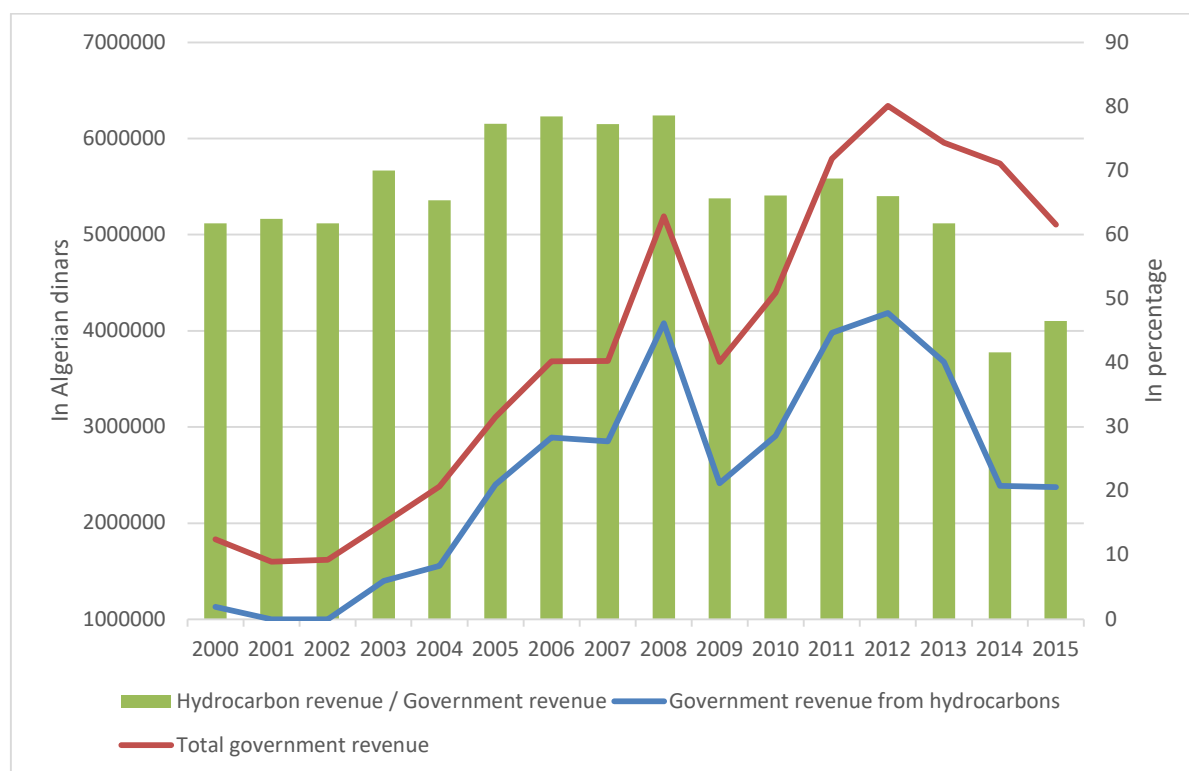


Source: Compiled by the author based on data retrieved from OPEC statistical bulletins and the World Bank database. Left axis is in billion USD and right axis is in percentage of the GDP

Furthermore, in order to understand the magnitude of the rents captured through the hydrocarbon taxation, Figure 10 illustrates the evolution of the revenue accruing to the government in the timespan 2000-2015, as well as the share of this revenue over the total government revenue in order to better assert the relevance of hydrocarbons in the Algerian public economy and the functioning of the state. The period observed coincides with the mandate of President Bouteflika, which was characterised in its early stages by partial attempts by his administration to open up the hydrocarbon sector to foreign investment and boost hydrocarbon exports. This period until the beginning of the great recession of 2008-2010 witnessed the highest rise of hydrocarbon exports – particularly of natural gas – in Algeria’s history, and so of revenues accruing to the government, which also triggered an expansion of the total expenditure of the government, mostly financed with hydrocarbon revenues. In the history of Algeria, this period is indeed dominated by the highest dependence on hydrocarbon revenues in public expenditure with a ratio of nearly 80 percent in 2008. Later, with the great recession and the drop of export value of oil products (see Figure 9), rents accruing to the government partly fell and recovered, but after 2012 they declined along with the total

government expenditure partly due to the sharp drop in oil prices in mid-2014. In that second period one can observe a decline of such dependence on hydrocarbon revenues.

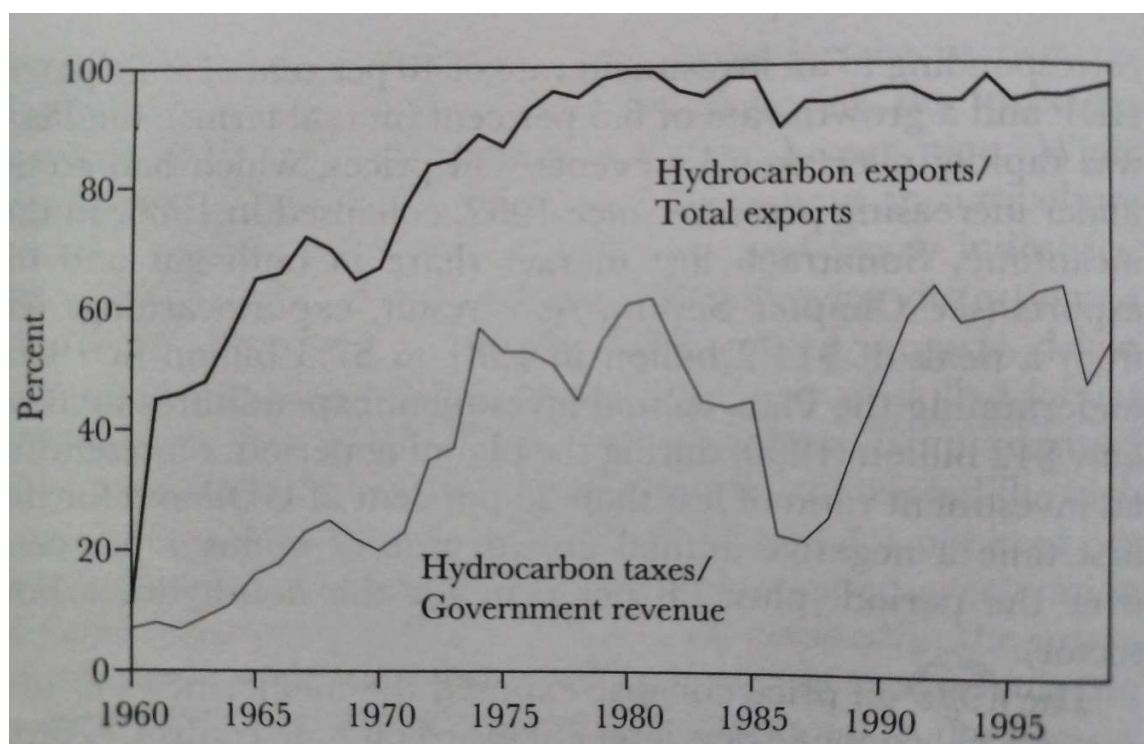
Figure 10. Role of hydrocarbons in the Algerian public economy (2000-2015)



Source: Ministry of Finance, Algeria; Central Bank of Algeria. Left axis relates to government revenue in Algerian dinars; right axis relates to hydrocarbon revenue to total government revenue in percentage

Similarly, before the year 2000, Algerian history was also characterised by a high contribution of the hydrocarbon sector to government budget revenues, as shown in Figure 11, in which one can see that the pattern displayed in Figure 10 becomes a reality from the mid-1970s. Hydrocarbon exports, which accounted for less than 50 percent of the overall exports in the early 1960s, increased rapidly to more than 95 percent by the end of the 1970s, while the contribution of that sector to the public economy rapidly increased from less than 10 percent in the early 1960s to about 60 percent by the mid-1970s. The drastic fall by the mid-1980s is related to the oil counter-shock, in spite of a very clear pattern that has followed from the year 2000 until 2008. In this regard, any government that accounts for 42 percent or more of its total foreign rental income is considered a rentier government (Beblawi & Luciani, 1987).

Figure 11. Role of hydrocarbons in the Algerian public economy (1960-1995)



Source: Aïssaoui, 2001: 232. Data extracted from the Ministry of Planning, IMF, World Bank

It is worth recalling that, as shown in Figure 2 in Chapter 1, hydrocarbon rents accruing to the government mainly originate from crude oil exports and not from natural gas, even though the latter has become the dominating commodity exported from Algeria since the beginning of this century. The reason for that is while gas has become the main export commodity, the Algerian economic model has remained tied to a system of decisions introduced in July 1969 when the country joined OPEC and progressively became a rentier economy. Its public economy has been highly reliant on the contribution of the hydrocarbon sector – mainly of crude oil – to government budget revenues, which has entailed direct consequences for the entire economy, including the natural gas sector, and the capacity of this public industry, and thus of the whole economy, to better manage the relations of power with other regional stakeholders along the natural gas value chain.

In other words, while the gas market has not been able to fulfil the requirements for generating sufficient rent (scarcity, deposits of different qualities and a set international price), the oil market has met them. From this point of view, it is legitimate to consider that the Algerian state has

been behaving as a rentier state, given that rents were generated in the international market, in which its oil commodity was integrated into a wider institutional arrangement due to Algeria's OPEC membership. One of the conditions for Algeria to become a rentier state was that its crude oil, within the framework of the rationale of OPEC's cartel, was integrated into an international market, with a unified commodity price.

2.6 Conclusions

This chapter has analysed the historical evolution of the Algerian hydrocarbon sector and how the latter helped assert a rentier model for its economy. Given the centrality that hydrocarbons have played in the development model of the country's economy, and with the aim of dissecting the evolution of Algerian hydrocarbons, in particular the natural gas sector, the research has focused on the political economy of the hydrocarbon industry by understanding the evolution of the public policies enacted by the successive administrations since the country's independence, and especially since the nationalisation of the hydrocarbon industry in 1971.

In this context, it is worth considering two preliminary points: first, the constraining context in terms of decision-making in which successive Algerian administrations have enacted various development policies, sometimes contradictory. As noted in Chapter 1, this is a consequence of the role that hydrocarbons play in the economy, and thus in the policy-making of the country, and the fact that this hydrocarbon industry is subject to an international governance framework that takes decisions that directly constrain the domestic decisions in Algeria. Secondly, in the assertion of this rentier model of the economy, crude oil has historically played a much more relevant role in the economy than natural gas, especially during the 1960s, 1970s and part of the 1980s, even though the country is much better endowed with natural gas, and, as noted in Chapter 1, the year 2000 was a turning point, insofar as volumes of natural gas exports became higher than those of crude oil exports (BP Statistical Review of World Energy, 2016)

The first section of the chapter focused on the nascent hydrocarbon industry before the 1971 nationalisation. For decades, France and Algeria had developed a traditional colonial economic relationship whereby France supplied industrial goods to the Algerian internal market, and, in its turn, Algeria exported agricultural goods to France, mainly wine (Mazri, 1975). However, soon after the first important hydrocarbon discoveries in 1956 in the Saharan provinces, namely the giant oil field of Hassi Messaoud and the giant gas field of Hassi R'Mel, this pattern changed

to the extent that from 1963 onwards hydrocarbon exports as a percentage of export earnings clearly surpassed those of the other goods combined.

After the war of independence (1954-1962), the first Algerian administration led by President Ben Bella (1962-65) aimed at pursuing a rapid industrialisation based on a heavy-industry-priority development strategy, but the latter was not fully materialised until President Houari Boumédiène took over in 1965, embarking on a programme reflecting a clearer ideological orientation and hinging on a centrally planned economy and the development of the country's oriental basis (Bennoune, 1998). Three major events defined this period of time from the developments in the hydrocarbon industry: the Évian Accords of 1962, the Franco-Algerian Agreement of 1965, and the nationalisation of the hydrocarbon industry that culminated in 1971. These developments cannot be disentangled from Algeria's membership of OPEC in 1969, which offered Algeria diplomatic backing during its disagreement with France over the hydrocarbon prices and the tax regime (Aïssoui, 2001), but which conditioned since then the public policy-making of the country, nor can they be disentangled from the role that the FLN played in the shaping of Algeria as a single-party system. These major events were contemporary to the establishment of Sonatrach in December 1963 as a classical NOC, which was conceived as an instrument of state intervention and eventually central control of the industry.

The next section in the chapter provided an in-depth analysis on the role of hydrocarbons in the models of economic development that successive administrations have attempted to put in place from 1971 until 2015, which is the period covered by this research. The reality of this period was that, until the end of the 1970s and the first half of the 1980s, natural gas would not be given an adequate consideration for various reasons, both external and internal. On the external flank, one must consider the failed attempts to commercialise Algeria's LNG, the harsh competition on European markets from Dutch natural gas, which was by far the largest European gas producer, and the lack of proper infrastructure with midstream technology to export significant amounts of natural gas via pipeline. On the internal flank, there is the very limited domestic use of natural gas as fuel in lighting cities, heating appliances and cooking equipment, as well as the legislative framework governing the natural gas sector that delayed potential foreign investors from committing the necessary funds and technology to bolster exploration and exploitation resources until it was changed in 1991. These external and internal weaknesses were coupled with low revenues accruing to the state as compared with those generated by the export of crude

oil, but all of that happened in spite of Algeria inaugurating in 1964 the world's first large-scale LNG plant (Camel Liquefaction Plant) with an initial capacity to liquefy about 1 bcm per year.

This context that favoured the surge of Algeria's natural gas sector took place in a period with at least three very distinct programmes for economic development: the first one under the leadership of President Boumédiène, characterised by central planning for a "big push" development strategy, whose objective was the deployment of hydrocarbon rents by the government to force the pace of a rapid industrialisation process, and which ended with the oil "counter-shock" of 1986 that considerably lowered hydrocarbon rents. The central planning influenced by proposals of economic policy like the "industrialising industries" of de Bernis had plans renovated every three, four or five years, but which turned the rapid industrialisation process into inefficiencies and imbalances (Entelis et al., 1992) in spite of the gross government investment rates that reached 43.5 percent in 1979. In the realm of hydrocarbons, public policies pursued a strategy for VALYDH, which aimed at maximising the production of crude oil, natural gas and LPG, consistent with obtaining the highest total recovery of hydrocarbons on an economic basis. Considering that crude oil was deploying more rents than natural gas, the former was prioritised over the latter at a time when the world faced the oil shocks of the 1970s that provided the largest windfall in rents accruing to Algerian state.

The second period extends from the oil counter-shock of 1986 until the turn of the new century and covers the second part of the presidency of Bendjedid, the prolonged strife of civil war until the election of President Bouteflika. This period was characterised by political and economic turmoil and instability, with an enduring civil war, and a policy that reflected neo-classical influences and various attempts of liberalisation and economic restructuring backed by the IMF reform programmes in the country. The severe deterioration of economic and social conditions triggered the adoption of a first hydrocarbon law in 1986 that was reformed in 1991 in order to open up the natural gas sector by granting the right for IOCs to participate in discovered or producing fields, and especially the right to share in natural gas discoveries. The amended law also gave foreign companies the possibility to operate in the transportation of hydrocarbons (midstream phase, in particular). These modifications, which significantly strengthened Algeria's position as the main producer of natural gas in the Western Mediterranean, came at a time when two neighbouring countries, Spain and Italy, were starting to transform their primary energy consumption model (Mañé-Estrada, 2009).

The third period, which entirely covered the presidency of Bouteflika, witnessed a failed attempt to fully liberalise the hydrocarbon sector in 2005, but that was soon reverted in 2006. It enhanced a power conglomerate that could benefit from the support of the state and the traditional networks of hydrocarbon rent allocation (de Larramendi et al., 2016), and thus to reinforce the patron-client relationships that the distribution of hydrocarbon rents deploys in rentier economies. But, above all, this period delivered a quick increase in the production and exports of natural gas until 2009 with a slight deterioration since then, and a reinforcement of the rentier nature of the Algerian economy. On the world stage, this period was earmarked by a surge of the LNG sector with leading trading countries like Qatar and Australia.

The next section focused on the evolution of pricing policies of natural gas, which in the case of Algeria, as a reliable supplier, have been mainly undertaken under the formula of long-term, oil-indexed, “take or-pay” contracts to European buyers, even though there is a trend imposed by the surge of the LNG sector that favours spot market pricing over long-term pricing. This is further analysed in Chapter 3 when looking into the long-term contracts of Sonatrach of both pipeline gas and LNG.

Finally, the last section of the chapter discussed the role of hydrocarbons in the public Algerian economy by illustrating how important hydrocarbon rents have been throughout the research period (1971-2015). There are four identifiable periods in which hydrocarbon rents accruing to the state fluctuate following certain upward or downward trends, but throughout the entire period 85 percent of rents were mostly generated by oil rather than gas, which can be explained by commodity prices rather than by export values. Therefore, it seems obvious that the natural gas market does not fulfil the requirements for generating rent (scarcity, deposits of different qualities and a set international price), while the oil market does meet them. From this point of view, it is legitimate to consider that the Algerian state has been behaving like a rentier state, since rents were generated in the international market, in which its oil commodity was integrated into a wider institutional arrangement because of Algeria’s membership of OPEC, and because any government that accounts for 42 percent or more of its total foreign rental income is considered a rentier government (Beblawi & Luciani, 1987). Nevertheless, data provided in the chapter reveals that since 2008 oil rents as a percentage of GDP are dropping, as is the relative oil tax that has been reduced since then. This suggests that if the trend spotted in recent years

continues, there will be a reduction in the Algerian state's capacity to capture and generate income within the country and therefore reflects a growing inability for it to act as a rentier state.

CHAPTER 3: A Comprehensive Overview and Understanding of the Natural Gas Value Chain in the Western Mediterranean

CHAPTER 3: A Comprehensive Overview and Understanding of the Natural Gas Value Chain in the Western Mediterranean

3.1 Introduction

In the previous chapter we explored the historical evolution of the Algerian hydrocarbon industry and its role in the economic development as a rentier country. In spite of the fact that the year 2000 was a turning point, insofar as volumes of natural gas exports became higher than those of crude oil, the reality is that most hydrocarbon rents accruing to the Algerian state were generated by crude oil exports rather than natural gas. In this vein, at the end of the period covered by this research thesis, Algeria was primarily considered a natural gas exporting economy, when the political economy of the country, including the natural gas industry, can be fundamentally explained by the role that oil and its rents have played in the country's economy, as set out in Chapter 2. Hence, it is now necessary to better understand the distributions of value and power underpinned by various public and private agents along the regional natural gas value chains. But before we assess these relations of power and dependence, we need to properly describe the surge of the natural gas value chain.

As noted in the previous chapter, Algeria's natural gas industry did not fully thrive during the 1960s and most of the 1970s. Indeed, after the nationalisation of 1971, Algeria took advantage of its membership of the Organization of the Petroleum Exporting Countries (OPEC) and increasing the revenues generated by oil exports to channel them into the industrialisation process. It was not until the prospects for further expansion of natural gas exports materialised by the late 1970s and especially during the 1980s that the Algerian natural gas industry fully developed. Although the first natural gas discoveries happened in 1956, during the 1960s and most of the 1970s, Algeria faced harsh competition in European markets from Dutch natural gas, which was by far the largest European gas producer, and it was not yet equipped with the midstream technology to export significant amounts of natural gas. Although Algeria was a pioneer in the development of the necessary technology to export liquefied natural gas (LNG) with the operationalisation of the Camel liquefaction plant in 1964, the capacity of this plan was very limited (about 1 bcm per year) and in the 1960s could only fulfil the contracts signed with British Methane in 1963 and Gaz de France in 1965 (Malti, 2010).

Against this backdrop, the turning point for Algeria's natural gas industry was the possibility to increase its gas exports, and eventually integrate into natural gas value chains, based on higher demand from consuming countries located in Europe. The way this integration happened in the natural gas sector was by enhancing relevant schemes of LNG and cross-border pipelines to Europe, something that did not occur until the end of the 1970s and the first half of the 1980s. In fact, the first cross-border Mediterranean pipeline permanently supplying Algerian gas to Italy via Tunisia did not become operational until 1983, as we assess in detail in this chapter. These changes, coupled with Europe's appetite to diversify its natural gas supplies within broader geopolitical and economic frameworks, as well as the boost of gas demand amongst European markets, was an opportunity for Algeria to exploit emerging gas markets.¹³³ All these opportunities, which we analyse in this chapter, benefitted from the surge of a natural gas value chain in the Western Mediterranean, which mainly acquired a regional dimension encompassing the countries with which Algeria developed cross-border physical interconnections and more intense gas sale agreements.

In this vein, such a natural gas value chain prompted Algeria to become the only production stage (or segment in the chain), and also with Western Mediterranean economies like Italy, Spain and France to become the main distribution and final sale stage (or segment in the chain). This is explained in detail in section 3.3. Hence, the value chain underpins a rather stable governance framework with the Algerian National Oil Company (NOC) Sonatrach, which is in charge, alone or in joint venture with International Oil Companies (IOCs) and ROCs), of the upstream activities, and then a number of IOCs and ROCs that are in charge of developing the downstream activities.

In the following three sections we describe the historical development of the natural gas value chain in the three segments involved: the upstream, the midstream and the downstream. By way of introduction, the chapter looks in broad terms at how Algeria's natural gas industry shifted from the position acquired after the 1971 hydrocarbon nationalisation to the end point of the research covered by this thesis in 2015. The latter gives us some basic general and descriptive

¹³³ The underlying idea that Algeria explored was not limited to supplying natural gas to the most obvious Southern European countries (i.e., Italy, France, Spain), but also to move to Central and Eastern European countries. Several discussions, at ministerial and expert level, were held with representatives of the so-called "Pentagonal Energy Group", which comprised Austria, Czechoslovakia, Hungary, Yugoslavia, as well as Italy.

elements to explore in the core of this chapter, which is the deep understanding of the natural gas value chain in the Western Mediterranean. To this end, the second section (section 3.4) focuses on the upstream segment of the value chain by examining the evolution in the production of natural gas since the nationalisation of 1971, in which natural gas production and trade were not important, to the point when Algeria becomes the world's ninth largest natural gas producer and the largest by far in the African continent (EIA, 2015). This section presents and explains a comprehensive list of the main natural gas upstream projects from 1991 to 2015, beyond the Hassi R'Mel mega-giant field, which is the largest gas reservoir in Algeria. The following section (section 3.5) looks into the development of the two activities linked to the midstream segment of the GVC, namely the LNG industry and the cross-border gas pipelines across the Western Mediterranean area, while examining the evolution of Algeria's natural gas exports. In addition, a comprehensive and detailed list of long-term contracts to export LNG and pipeline gas signed by Sonatrach and foreign IOCs and ROCs is described and examined in detail. Finally, the last of these three sections (section 3.6) describing the development of the natural gas value chain explores the surge and evolution of the downstream segment in the three countries integrated into the Western Mediterranean's GVC, apart from Algeria, which are Italy, Spain and France, as well as their natural gas trade relations.

As a corollary to the present chapter, a qualitative exercise (section 3.7) is conducted and presented with the aim of finding ways to categorise the type of intervention of Algerian, as well as Italian, French and Spanish, companies in the natural gas value chain. The methodology applied in this exercise stems from the Global Communication Chain (GCC) approach and is based on the previous works found in Mañé-Estrada et al. (2012). To this end, the goal is to categorise existing NOCs, IOCs and ROCs of a certain energy chain to identify the power exerted by the latter along the value chain and determine the power position that their background countries maintain. The resulting outcome may prove to be consistent enough to determine how the existing linkage between the domestic and regional sides helps to explain the relations of power along the natural gas value chain. Over the last 40 years strong trade linkages of natural gas have been established between Algeria and the other three Western Mediterranean countries. Understanding how these linkages have been formed and evolved is crucial to conduct more in-depth quantitative analyses, which are carried out in Chapter 4.

3.2 Hydrocarbon production, reserves and transportation in retrospect

As of 2015, by the adoption of the European Union (EU)'s Energy Union Strategy that marks the end of the period covered in the present research thesis, Algeria was primarily a natural gas producing country and the world's ninth largest natural gas producer and the largest by far in the African continent (EIA, 2015). In addition, Algeria's marketed natural gas production totaled 83.04 billion cubic meters (OPEC 2016). In comparison, Algeria ranked as the world's sixteenth-largest oil producer, with an estimated average output of 1.2 million barrels per day of crude oil, along with an additional 600,000 barrels per day of non-crude oil liquids (OPEC 2016).

Regarding the country's reserves, estimates from the Oil & Gas Journal released in January 2015 indicated that Algeria possessed 4,502.38 billion cubic meters of proven natural gas reserves, ranking it as the world's tenth-largest holder of such reserves. Additionally, Algeria was estimated to have 12.2 billion barrels of proven crude oil reserves, making it one of the top three African nations with the largest oil reserves, following Libya and Nigeria.

A study by the EIA (2014) estimated that Algeria's technically recoverable shale gas reserves could reach 20,020 billion cubic meters, making them the third largest globally, behind China and Argentina. These reserves are believed to account for nearly 10 percent of the world's total technically recoverable shale gas reserves. Algeria's own estimates of its unconventional gas reserves align with the figures reported by the EIA. However, the exploration and production of unconventional resources, primarily shale gas, remain in their early stages in Algeria, making it challenging to predict the potential impact of these resources or even whether they will ultimately be extracted.

In 2015, Algeria had over 200 oil and gas fields in production, primarily situated in the southern and eastern regions. Nearly half of the country's oil and gas output was derived from a handful of large fields. The largest and oldest oilfield, Hassi Messaoud, located in the eastern region near the Libyan border, accounted for approximately 40 percent of Algeria's total crude oil production that year (EIA, 2015). According to Sonatrach, the Hassi Messaoud-Dahar region contains around 71 percent of Algeria's proven, probable, and possible oil reserves. Algeria's largest natural gas field, Hassi R'Mel, situated in the central part of the country, holds proven reserves of approximately 2,406.83 billion cubic meters, more than half of the nation's total

proven natural gas reserves, as reported by the EIA. Furthermore, all producing fields are currently located onshore, primarily in the Saharan desert, with offshore exploration still limited.

As noted in previous chapters, hydrocarbon revenues have long been the foundation of the country's economy. In 2015, revenue generated from hydrocarbons made up 36 percent of Algeria's GDP (African Economic Outlook, 2015), over 95 percent of export earnings, and 60 percent of budget revenue (IMF Data, 2015).

Figures 12, 13 and 14 reflect the profound evolution of the landscape of hydrocarbon production and transportation within the Algerian territory from 1962, when Algeria declared its independence from France, to 2015. In particular, Figures 12 and 13 show the state of play in 1962, whereas Figure 14 refers to 2015. In 1962, there were numerous natural gas deposits but far less geographically concentrated than oil deposits.¹³⁴ Prospection was yielding new discoveries every year but most of these deposits attracted little interest from prospection companies and public authorities with the exception of the mega giant field of Hassi R'Mel. Those deposits were abandoned as soon as discovered if they were not endowed with crude oil, as there was no means to export this natural gas to the European consuming markets, far away from Algeria. Not only was there a deficit of infrastructures to export natural gas given the very limited capacity of the first and only liquefaction plant Camel (Malti, 2010), but the potential consuming countries like Italy, France and Spain were not yet poised to import natural gas given that their domestic natural gas markets were not sufficiently developed. As noted in Chapter 2, European markets with the capacity to absorb part of Algeria's natural gas did not develop until the late 1970s and early 1980s.

The Hassi R'Mel field was of global importance due to its size in 1962: 80 km by 45 km, and especially due to its reserves estimated at 2,000 bcm for probable reserves and 450 bcm for proven reserves with a low production cost. In 1962, the authorities estimated that production could be pushed up to 25 bcm per year (Fosset, 1962).

¹³⁴ Robert Fosset (1962) underscores the importance of oil discoveries in the Sahara for the development of Algeria's hydrocarbon industry. In fact, the year 1960 marked a turning point in the development of reserves of hydrocarbons from the Sahara. Oil production reached 8,627,000 tonnes in 1960 and they were approximately doubled in 1961. The plan in 1961 was to boost oil production with the aim of reaching 30 to 45 million tonnes of production, depending on the world market situation and developments in oil recovery techniques. In contrast, exploitation of natural gas started in May 1961, but production remained very limited, not exceeding 500 million m³ in 1962.

Figure 12. Location and relevance of hydrocarbon fields in Algeria in 1962



Source: Fosset, R. (1962). Pétrole et gaz naturel au Sahara. In: *Annales de Géographie*, 71 (385): 279-308

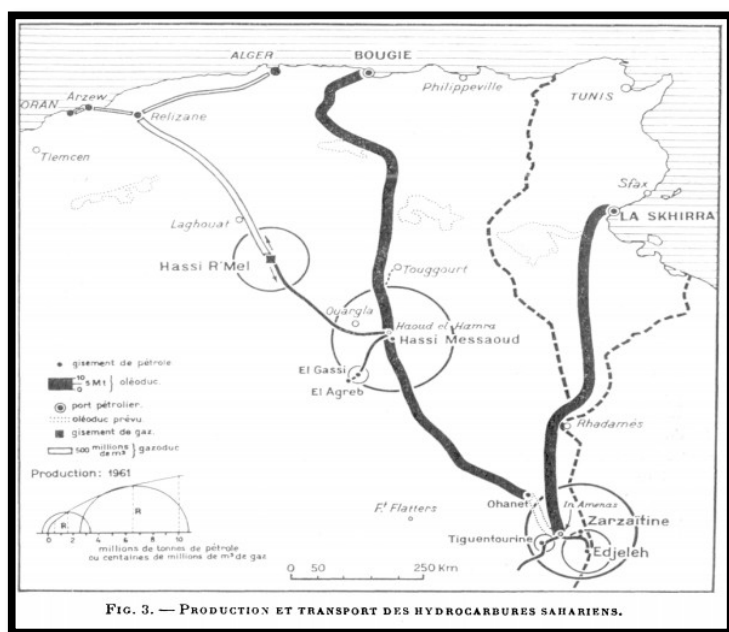
Other discovered natural gas fields that can be located in Figure 12 are the following: La Reculée gas field, in the Polignac Basin, with 150 bcm of probable reserves; Ahnet natural gas field, located in the heart of the Sahara Desert, in the region In Salah; Nezla and Hassi Touareg gas fields, south-east of Hassi Messaoud; El Atchane gas field, south-west of Hassi Messaoud. A Amasralad gas field, near the Libyan border and north of Zarzaitine, where production tests gave flow rates of 100,000 to 200,000 m³ per day and in Hassi Ouan Abeghen gas field, south of

Edjelh, 100,000 m³ per day (Fosset, 1962). In Adaoui, 16 km north-east of Ohanet, was discovered gas rich in petrol components.

In November 1961, Gassi Touil,¹³⁵ a large natural gas field in the Sahara Desert region of Grand Erg Oriental, within the commune of Hassi Messaoud, caught fire while the gas was burning at a rate of 10 to 15 million m³ per day, which confirmed the existence of a deposit of several bcm.

Figure 13 shows the hydrocarbon transportation network inaugurated in April 1961 with a total length of 795 km. It was meant to transport natural gas to Oran and Algiers. Without any compressor station, the maximum possible flow was set at 1.6 bcm, which greatly exceeded the absorption capacity of Algeria's internal market in 1961, estimated at 0.5 bcm (Fosset, 1962). However, it was then estimated by the authorities that exploitation was profitable only with a minimum annual flow of 3 bcm, which implied a rapid industrial development in Algeria and/or the setting up of a massive export infrastructure to Western Europe.

Figure 13. Transportation of hydrocarbon resources in Algeria in 1961



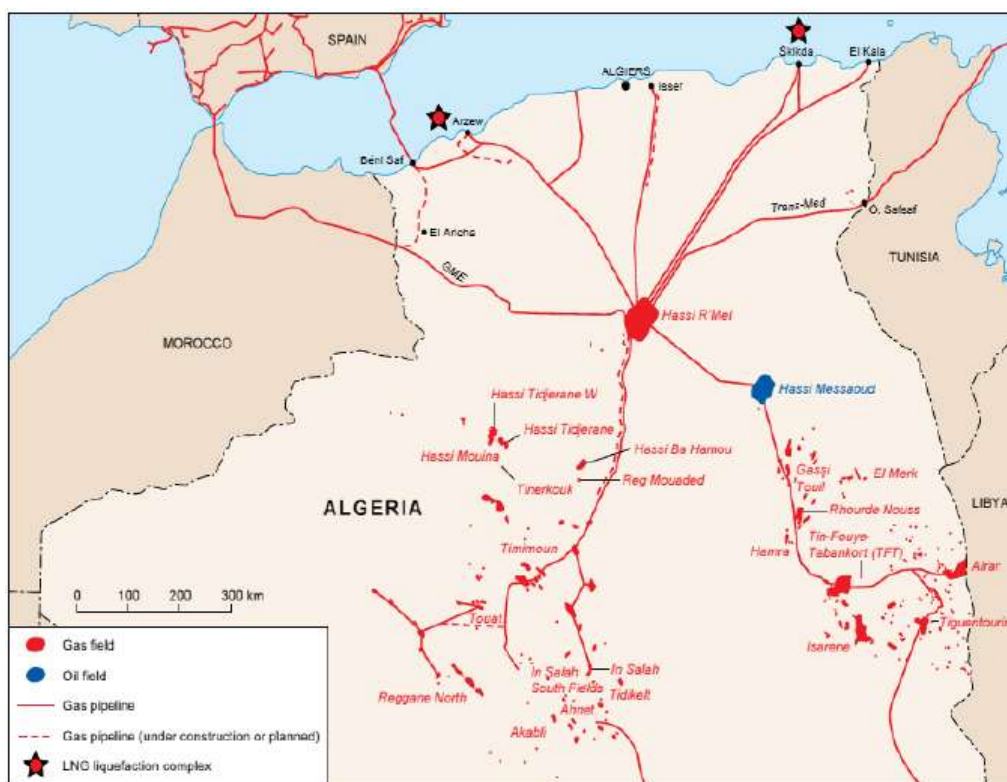
Source: Fosset, R. (1962). Pétrole et gaz naturel au Sahara. In: *Annales de Géographie*, 71 (385): 279-308

¹³⁵ Gassi Touil is the site of a major LNG development project, in which natural gas extracted from this field is piped to a liquefaction plant at Djedid. The project was initially developed by Spanish firms Repsol and Gas Natural (later, Naturgy), but their contract was terminated in 2007 by Sonatrach, which pursued the project on its own.

Figure 14 features equivalent charts to those in in Figures 12 and 13 but for the year 2015, with the red spots indicating natural gas fields and gas transport infrastructure, and the blue spots crude oil fields and oil transport infrastructure. In 2015, Algeria had a pipeline network of more than 18,512 km for the transport of hydrocarbons, both natural gas and crude oil. Algeria also operated multiple dispatching centers to manage its hydrocarbon logistics. The Liquid Hydrocarbons Dispatching Center, situated in Hassi Messaoud (Haoud El Hamra), handled crude oil distribution, while the Gas Dispatching National Center in Hassi R'Mel served as a hub for collecting and directing natural gas through pipelines. This facility supplied gas to domestic customers, including Sonelgaz (the state-owned utility responsible for electricity and natural gas distribution), third-party clients, and Sonatrach's internal operations. It also facilitated exports, delivering gas to liquefaction plants and international markets via cross-border pipelines. In 2015, Sonatrach operated 22 pipeline transportation systems (20 fully operational, one under construction, and one in the launch phase), supported by 82 pumping and compression stations, including 39 designed for crude oil. These pipelines had a combined capacity of 145 million tonnes (Sonatrach 2015).

Regarding export infrastructure, Sonatrach managed several LNG loading berths at the ports of Arzew and Skikda, where its liquefaction facilities were located. Algeria's gas export network in 2015 comprised three major cross-border pipelines: two supplying natural gas to Spain and one to Italy. The largest, the Enrico Mattei pipeline (commonly known as the TransMed pipeline), spanned 1,646.4 km, connecting Algeria to Italy through Tunisia. The Pere Duran Farell pipeline (Maghreb-Europe pipeline) extended 521.4 km through Morocco to Spain. The newest pipeline, Medgaz, stretched 201.2 km across both land and sea, linking Algeria directly to Spain via the Mediterranean Sea.

Figure 14. Production and transportation of hydrocarbon resources in Algeria in 2015



Source: Sonatrach's oil and gas map of Algeria (2015)

After this brief section, in which we have described the basic upstream natural gas infrastructure in Algeria by the end of the period covered by the thesis (2015) in relation to the year independence was declared, we now examine in detail the regional GVC in the Western Mediterranean. But first, we disentangle the structure of the natural gas value chain, the first upstream segment of the Western Mediterranean's GVC.

3.3 Disentangling the concept of the natural gas value chain

Compared to oil, natural gas consumption remains very localised: nearly 75 percent of the natural gas consumed worldwide is consumed in the country where it is produced, in comparison with the more than 60 percent of global oil production that is exported (BP Statistical Review of World Energy, 2015). Nonetheless, the portion of natural gas traded internationally has been increasing every year due to the expansion of LNG, which introduces a lot more of flexibility in

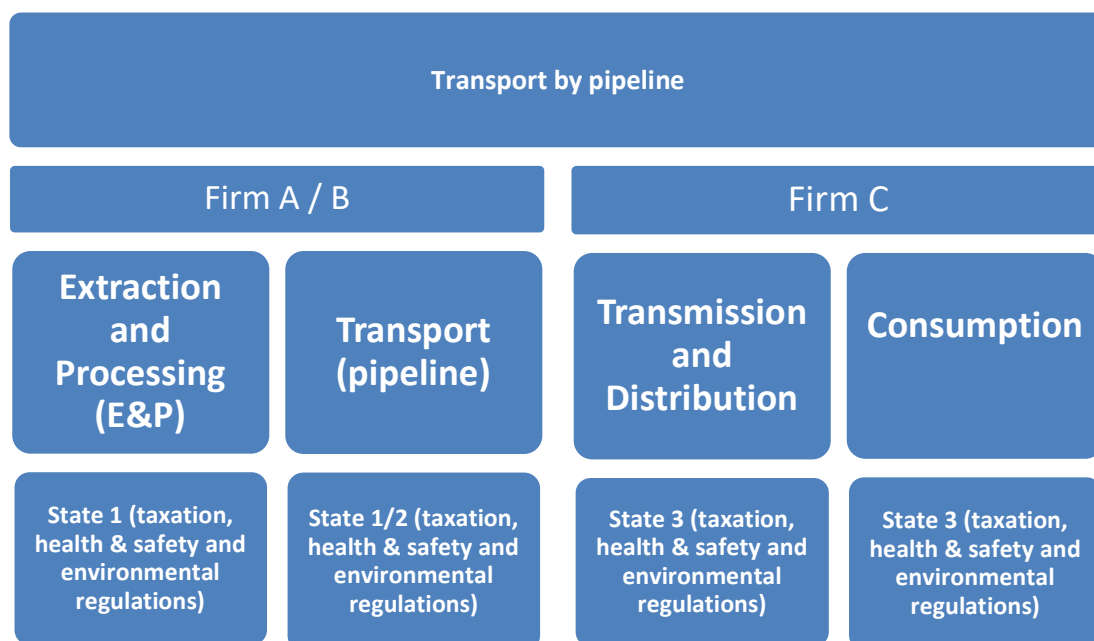
comparison to physical cross-border interconnections such as gas pipelines. In particular, the LNG value chain is a process of capital-intensive material transformation that upgrades the value of gas per unit volume.

In the value chains involving energy products it is possible to distinguish between three productive stages – *upstream*, *midstream* and *downstream* – as part of an overall value creation process. The upstream includes activities of exploitation, development and production of the primary energy source (in the case of natural gas, for example, this would include the search for gas fields, initial explorations, engineering projects, etc., and especially the extraction of natural gas). The midstream refers to all infrastructure related to the transportation and storage of the resource until it reaches the processing facilities, be it via physical interconnections (gas pipelines) or liquefied gas shipped in seagoing vessels. Finally, the downstream covers those activities required to transform the natural gas into the final energy product, as well as the activities linked to its commercialisation.

In particular, in the case of LNG, value chains are structured around the flow of gas from the upstream to the downstream stages, which include material exchanges and transformations associated with extracting, processing, distributing and consuming gas (as with the case in which natural gas is transported through physical interconnections), but also liquefying, shipping and re-gasifying.

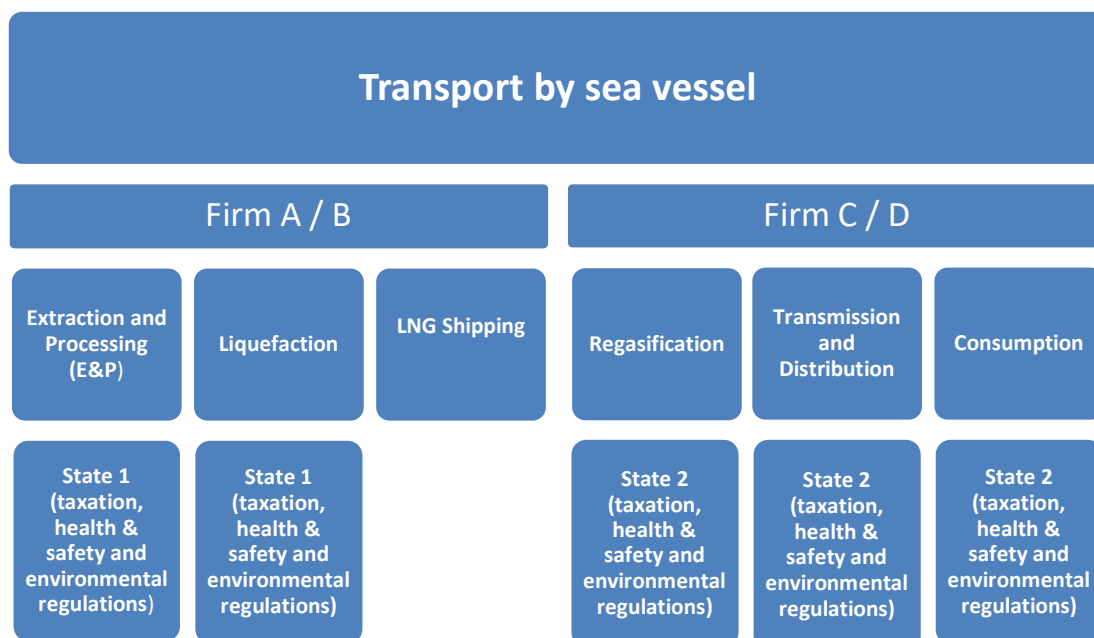
Figures 15 and 16 outline how the value chain is structured around the flow of natural gas from the upstream, midstream and downstream phases as part of an overall value creation process. Specifically, Figure 15 reflects the chain for natural gas transported by pipeline, whereas Figure 16 reflects the chain for LNG production.

Figure 15. Conceptualising the natural gas value chain



Source: Compiled by the author based on *The Petroleum Sector Value Chain* (WB, 2009) and BMI Research (2018)

Figure 16. Conceptualising the LNG value chain



Source: Compiled by the author based on *The Petroleum Sector Value Chain* (WB, 2009) and BMI Research (2018)

The value chains of energy products are becoming increasingly complex and include a greater number of stages (or productive segments), with the companies involved also having different interests. Furthermore, the relationship between the different stakeholders in the value chain of energy products is not symmetrical, and not all stakeholders are able to exert the same influence over the chain as a whole. By using the above proposed frameworks, it is possible to observe how economic activity within the chain is coordinated and to identify which links (upstream, midstream and downstream) and which stakeholders (lead firms) have the greatest capacity to control the chain. A large part of the contribution to a territory's development and of the interrelations between different territories depends on how energy value chains are structured and on the "power" of the stakeholders located in different countries. Hence, the value is not only captured by analogous firms, but also amongst firms and non-firm entities such as state agencies and supranational institution. The understanding of how this rent is captured through the network of agents that takes part in the sector will help determine the roles that each of these agents play in the natural gas value chain, as well as the terms and conditions in which integration occurs.

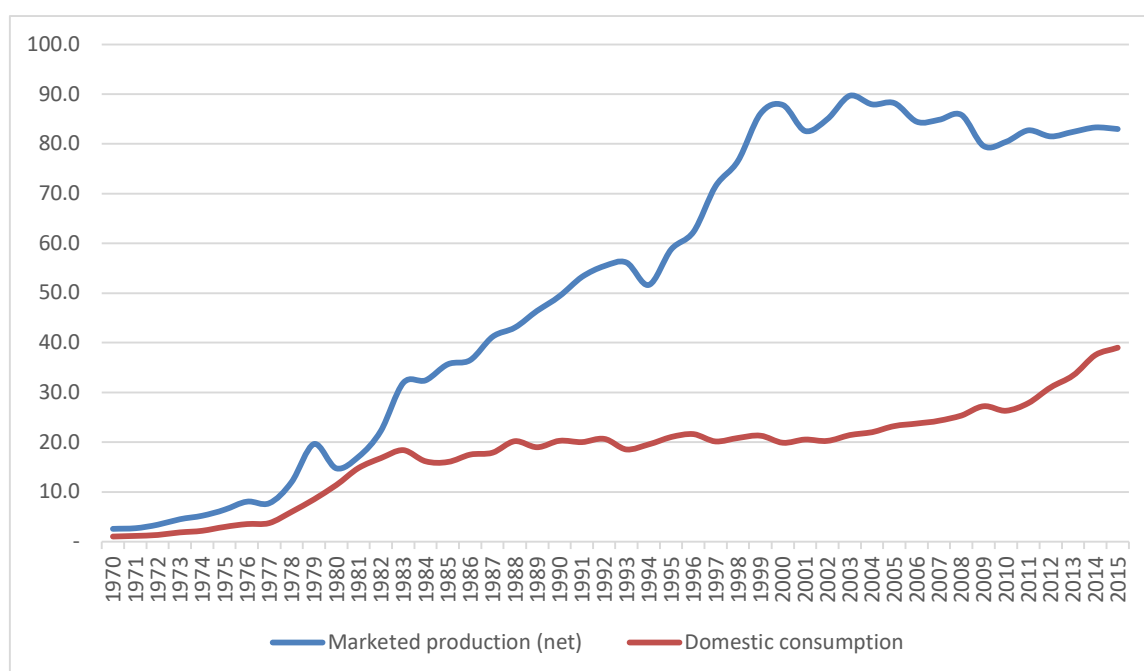
At the end of the present chapter a qualitative exercise is conducted with the aim of determining the relational nature of the different companies involved in the natural gas value chain in the Western Mediterranean and establishing the dynamics of powers that these companies exert within the chain.

At this point, in the coming three sections we delve into each of the segments of the natural gas value chain in the Western Mediterranean, starting with the upstream segment, which mainly looks into the natural gas production in Algeria, focusing on the upstream activity and the development of significant projects when the gas industry matured by the end of the 1980s. Later, we continue with the midstream segment and finally the downstream segment. Finally, we carry out a qualitative exercise to determine the relational dynamics among the various companies involved in the natural gas chain in the Western Mediterranean, and hence obtain some conclusions on the symmetry of power among these agents that take part in the natural gas value chain.

3.4 Natural gas production and the upstream activity

A quick review of Algeria's natural gas marketed production balance over the last four decades shows an uneven production profile, especially during the 1970s and 1980s and from the year 2000 onwards. As clearly shown in Figure 17, 1980 was characterised by a sharp decrease of gas production of one third as a result of sudden changes in the political leadership, which prompted an evaluation of the massive industrialisation programme of the previous administration of Boumédiène and of its hydrocarbon strategy (VALHYD). This included the cancellation of a third LNG plan project and all the supply contracts supporting it, while it happened in the aftermath of the withdrawal by the US from its commitments to additional LNG imports from Algeria (contracts with El Paso company¹³⁶). All of this happened at a moment in which Algeria was still mainly exporting crude oil at the expense of natural gas as a result of the position of the country in OPEC. The reduction in gas production was even higher than the reduction caused by the 1986 oil crisis with a one third drop between 1979 and 1980. The reduction in gas production was even higher than the reduction caused by the 1986 oil crisis with a one third drop between 1979 and 1980.

Figure 17. Natural gas marketed production and domestic consumption in Algeria in bcm (1970-2015)



Source: Compiled by the author based on data retrieved from OPEC Statistical Bulletin and BP Statistical Review

¹³⁶ See Section 3 in Chapter 2.

Figure 17 also reflects a rapid growth during the second half of the 1990s, which resulted from the policy reforms and catch-up measures of the late 1980s and early 1990s, namely the hydrocarbon legislative reforms¹³⁷ of 1986 and 1991, only disrupted by the oil crisis of 1994. Since the mid-2000s, marketed production declined, and has subsequently stagnated, also as a result of the increasing competition posed by LNG from Qatar and Australia, which became the largest LNG exporter worldwide. Interestingly, the early deterioration of natural gas production coincides with the 2005 promulgation of the new hydrocarbons law and its subsequent inauspicious revision in 2006 (Ouki, 2019). Between 2005 and 2013, marketed gas production declined by about 11 percent from 89 bcm to about 80 bcm natural gas production. Particularly since 2010, gas production has been faced with increasing maturity of Algerian fields (Chyong & Slavkova, 2015). In addition, since 2013 it stagnated at 83 bcm, most likely due to the Tiguentourine (In Amenas) gas processing facilities, which were damaged during the 2013 terrorist attack.

The deterioration of Algeria's natural gas production balance was not only driven by declining or stagnating gas production since the mid-2000s, but also by the rapid growth of domestic gas consumption. Indeed, between 2008 and 2015, total gas use by the domestic market increased by 70 percent at an average annual growth rate of over 5 percent. In contrast, since the 1970s the growth of domestic gas consumption was more stable and aligned with the fluctuations of the natural gas marketed production. It is only from 2003 that one can infer an acceleration in the growing path of this pattern in comparison with that of gas production. In addition, this acceleration in the domestic consumption of natural gas in a context of a stagnated and even declining pattern in the gas production has also triggered a reduction of the natural gas exports, as we will outline in the next section.

3.4.1 The super-giant field of Hassi R'Mel

As noted, whereas natural gas production started in 1960 from Hassi R'Mel, the super-giant field discovered by SN Repal and CFP in 1956, such production was very limited, given that the Algerian domestic market was then not significant and the prospects for gas exports relied on meaningful infrastructure that did not exist, such as liquefaction plans and sub-sea pipelines. Moreover, exports to other North African countries were even less envisaged by the Algerian

¹³⁷ For a more in-depth description of the hydrocarbon legislative reforms of 1986, 1991, 2005, 2006 and 2013, see Section 3 in Chapter 2.

authorities because those markets were less prepared to build the necessary infrastructure to import natural gas.

Hence, the first interest in commercialising the gas produced from the Hassi R'Mel field was the extraction of the hydrocarbon liquids contained in the gas.¹³⁸ To this end, during the first years until 1966, the joint venture of SN Repal and CFP exploited the field as a liquid reservoir, thus flaring all surplus natural gas.¹³⁹ However, in 1966 when Sonatrach's mission was expanded and given a role in the production of natural gas, the Algerian government prohibited exploitation of the field as a liquid reservoir. Finally, after the nationalisation of 1971, the investments undertaken by Sonatrach entailed a better cycling process to combine both the production of natural gas and NGLs.¹⁴⁰ The field has been operated by Sonatrach ever since, given that since 1991 the subsequent legislative reforms had only granted rights to foreign companies for non-discovered and non-exploited gas fields.

The early stages of the nascent natural gas industry in Algeria involved solely the field of Hassi R'Mel. Natural gas exports from the field were pumped by pipeline to the Mediterranean terminals of Arzew and Skikda, as there were several pipelines from the field to supply the domestic market. The gas field could produce up to 65 bcm gross per year by 1980.¹⁴¹ As the natural gas extracted from Hassi R'Mel is wet, it contains 200 grammes of condensates and four grammes of LPG per cubic metre. In order to maximise oil recovery, part of the gas produced

¹³⁸ Natural gas can be “dry” or “wet”. Wet gas contains natural gas condensate in a proportion of 220 grams per m³.

¹³⁹ In 1960, the gross production of natural gas was 1 bcm, of which 0.9 bcm was flared and only 0.1 bcm was used, whereas in 1965 the gross production of natural gas increased to 2 bcm, of which 0.2 bcm was flared and 1.7 bcm was used (Petroleum Press Service, 1960-65).

¹⁴⁰ By exploiting the field only as a liquid reservoir, the production was limited to natural gas liquids (NGLs), which are hydrocarbons, in the same family of molecules as natural gas and crude oil, composed exclusively of carbon and hydrogen such as ethane, propane, butane, isobutane, and pentane. Therefore, the remaining part of the extracted resource was flared (combustion).

¹⁴¹ When the hydrocarbon industry was nationalised in 1971, Hassi R'Mel was only producing 4 bcm per year. Its annual capacity was raised to 14 bcm in 1974 to enable it to supply feedstock to the Skikda liquefaction plant for LNG. A second major development programme was completed in October 1980 to supply to the LNG plants in Arzew. Its purpose was also to establish alternate production zones and re-injection zones. The programme required 110 production wells to be drilled (compared to 21 in operation in 1974) and the 52 injection wells. The drilling work was completed by the end of 1979. Two 30 bcm per year compressor stations and most of the processing facilities were completed (Shammas, 1999).

at Hassi R'Mel was reinjected into these structures at high pressure through two 30 bcm per year compressor stations.

In February 1993, Sonatrach hired a Japanese group formed by JGC Corporation and Itochu to revamp the Hassi R'Mel gas processing plants. Worth USD 1.1 billion, this contract addressed renovation in the upstream facilities and provided for the replacement of obsolescent equipment and the streamlining of operating and safety conditions in various units, furnaces and heat exchangers. The contract was financed under a deal signed in 1992 between Sonatrach and a group of Japanese banks led by the state's Export-Import Bank of Japan to expand gas export capacity.

With the turn of the century, Algerian gas output remained heavily dependent on the giant Hassi R'Mel field, which triggered a quick maturing process and a decrease in production over the last years before 2015. Underinvestment in maintaining the field and infrastructure was partly to blame as the Hassi R'Mel field was also severely over-produced in the early 2000s, which caused lasting damage to the reservoir.

3.4.2 The other main gas fields and the upstream activity

In the 1980s, apart from the mega-giant field of Hassi R'Mel, two additional non-associated wet gas fields turned to be commercial and started operating: Alrar gas field,¹⁴² officially inaugurated by President Bendjedid in November 1984 and Rhourde Nouss gas field,¹⁴³ in 1988. The combined productions of these two gas fields and Hassi R'Mel were considered sufficient to supply all the domestic and foreign demand until the end of the 20th century. But with the aim of avoiding an overly-rapid depletion of the Hassi R'Mel gas field, measures in the 1990s were undertaken by Sonatrach to invest in gas fields that had not been developed so that they could be brought into production, namely Sbaa in 1995, Hamra in 1996, and Tin Fouyé Tabenkort in 1998. The second largest gas field located south of Hassi Messaoud, the Rhourde Nouss, consists of five fields: Rhourde Nouss (the first one being discovered in 1980), Rhourde Nouss Sud-Est,

¹⁴² The Alrar gas field is located in the Ouargla Province and is developed by Sonatrach. It produces natural gas and condensates. The total proven reserves of the Alrar gas field are around 130.82 bcm, and initial production was slated to be around 6 bcm per year (Petroleum Economist, 1984).

¹⁴³ The Rhourde Nouss gas field is located in the Ouargla Province and is developed by Sonatrach. It began production in 1980 and produces natural gas and condensates. The total proven reserves of the Rhourde Nouss gas field are around 368.12 bcm, and production is slated to be around 47.85 million m³ per day (Petroleum Economist, 1984).

Rhourde Adra, Rhourde Chouff, and Rhourde Hamra. In this regard, Rhourde Chouff and Rhourde Hamra were developed in the late 1980s and brought into production in 1992.

The three largest natural gas producing fields in Algeria until 2015, Hassi R'Mel, Rhourde Nouss and Alrar, were exclusively operated by Sonatrach. As noted in the previous chapter, it is worth recalling that unlike the post-nationalisation legislation and the hydrocarbons law of 1986, the law of 1991 granted the right for IOCs to participate in discovered or producing fields, in partnership with Sonatrach, and especially the right to share in natural gas discoveries, which facilitated foreign companies operating in the development of new gas fields. Table 4 shows an exhaustive list of 20 major natural gas upstream projects in Algeria from 1991 to 2015. In the table, there are several foreign companies that participate in several upstream projects. However, for the size of the investment and the length of their presence in the country, two companies were dominant: the British BP and the Norwegian Statoil (later, Equinor), both from outside the Western Mediterranean area. Five other foreign companies, from the Western Mediterranean area, have played an increasingly larger role throughout this period: the French Total and Gaz de France (later, Engie), the Spanish Repsol and Gas Natural (later, Naturgy), and the Italian Eni. Other foreign companies with a minor role include the Dutch Royal Shell, the US Anadarko Petroleum, and the Australian BHP.

Table 4. Main natural gas upstream projects in Algeria (1991-2015)

Name	Foreign company	Date of the agreement	Observations
Hamra East	Total	May 1991	Total financed 2/3 of the USD 500 million cost of developing Sonatrach's Hamra gas field in Algeria in return for access to all the condensate and LPG from the field. Sonatrach took all the gas from the field, which lies south-east of the Hassi Messaoud.
In Salah	BP (49 percent), Sonatrach (51 percent)	December 1995	First gas production sharing agreement with a private company. The project, with an estimated cost of USD 2.7 bn, was expected to bring a further 9 bcm on stream by 2004.
Tin Foyé Tabankort	Total (35 percent), Repsol (30 percent), Sonatrach (35 percent)	January 1996	Second gas production sharing agreement with a private company. The project amounted to USD 700 million and came on stream in May 1999 with 20,000 m ³ of wet gas per day.

In Amenas	Amoco	June 1998	A 20-year agreement between Sonatrach and Amoco is signed for the development of four gas fields in the In Amenas region. The project aimed to produce 7 bcm per year from 2002 and Amoco had to invest about USD 900 million.
Ohanet	Australia BHP	July 2000	Acquisition of a 60 percent stake in the Ohanet gas condensate project to produce 665 m ³ of natural gas as from October 2003.
Ahnet	Gaz de France and Petronas of Malaysia	January 2001	Development of seven blocks in the Ahnet region with an estimate amount of gas reserves of 140 bcm.
In Amenas	BP	November 2002	Development of gas at In Amenas in the Illizi basin worth USD 18 million and was expected to come on stream in 2005 and produce 26 million m ³ .
Tiguentourine, Hassi Farida, Ouan Taredert, Hassi Ouan Abecheu	BP (46 percent), Sonatrach (8.1 percent), Statoil (45.9 percent)	June 2003	BP entered into an agreement with the Norwegian Statoil, which bought half of BP's shares in the In Amenas fields. The agreement entailed that the gas produced at In Amenas was marketed by Sonatrach, while BP and Statoil were reimbursed with the condensate and LPG output of the facility. The investment amount of the first phase of development was USD 1.2 billion.
Krechba, Teg, Reg, Garet El Befinat, Gour Mahmoud, In Salah, Hassi Moumene	Statoil (31.85 percent), BP (33.15 percent), Sonatrach (35 percent)	December 2003	Decision made through which the Norwegian Statoil joined the joint venture of In Salah Gas, which had been established in 1995. Production commenced in 2004 from three fields in the north of the area: Krechba, Teguentour and Reg. The Southern Fields projects involved the development of four dry gas fields in 2016: Gour Mahmoud, In Salah, Garet el Befinat and Hassi Moumene. Developing the Southern Fields increased planned production at 9 bcm per year.
El Merk	Anadarko Petroleum (49 percent), Sonatrach (51 percent)	July 2005	A Memorandum of Understanding was signed between Sonatrach and Andarko with a view to establish a joint venture that could develop the gas and oil fields.

Gassi Touil, Hamra, Rhourde Nouss	Repsol Exploration Algeria (48 percent), Gas Natural Exploration (32 percent), Sonatrach (20 percent)	March 2006	Establishment of a joint venture between Sonatrach and Repsol and Gas Natural to develop exploration, production, liquefaction and commercialisation of a hydrocarbon reserves block in the eastern Algerian regions of Gassi Touil, Rhourde Nouss and Hamra, along with the construction and operation of a new liquefaction terminal in Arzew.
Menzel Ledjmet East (MLE), Central Area Field Complex (CAFC)	Eni S.p.A (75 percent), Sonatrach (25 percent)	December 2008	Eni acquired this project of the Canadian company First Calgary Petroleum, which envisaged the development of the gas fields of the blocks of North Berkine. Gas brought on stream in 2013, and a plant located in the field, allows for the treatment of rich gas for the daily production and sale of 9 million m ³ of gas, 15,000 barrels of oil and condensate and 12,000 barrels of LPG.
El Assel	Gazprom (49 percent), Sonatrach (51 percent)	January 2009	Gazprom and Sonatrach signed an agreement for the transfer of rights for hydrocarbon exploration and production in the onshore area El Assel located in the Berkine Basin of Algeria. It turned out to be the first agreement signed by the Russian Gazprom in Algeria. El Assel includes three blocks covering a total of 3,083 km ² .
Ahnet	Partex Oil and Gas Group (2 percent), Total (47 percent), Sonatrach (51 percent)	December 2009	A development plan was to be submitted for approval before mid-2011, with first gas scheduled for 2015. The Ahnet licence contains significant reserves (approximately 500 bcm of natural gas) and production is estimated to be 4 bcm a year.
Touat	Sonatrach (35 percent), Engie (65 percent)	July 2009	Sonatrach and GDF Suez decided to jointly operate the Touat project involving development of 10 fields in the Touat gas area in west-central Algeria in the Timimoun basin. The development started that year with gas production due on stream in 2013 and peaking at 4.5 bcm per year. Sonatrach was in charge of selling the gas produced. The 10 fields are Hassi Ilatou, Hassi Ilatou Cambrien, Hassi Ilaout Nord Est, Gour Nefrat Gedinnen, Gour Nefrat Ordovicien, Bou Hadid, Bou Hadid Ouest, Oued Hamou, Oued Zine, and Sbaa.

Sud-Est (South-East) Illizi Block	Engie (20 percent), Repsol (52.5 percent), Enel (27.5 percent)	January 2010	A contract for exploration and exploitation of the “Sud-Est Illizi” gas field in south-eastern Algeria was signed with ALNAFT and Sonatrach. In 2012, the consortium announced a first significant gas discovery at a depth of 1,073 metres and preliminary testing produced gas flows of 105,000 m ³ per day. A second discovery was announced in 2015 of 175,000 m ³ per day.
Reggane, Azrafil Southeast, Kahlouche, South Kahlouche, Sali, Tiouliline	Repsol (29.25 percent), Edison International (11.25 percent), RWE Dea (19.5 percent), Sonatrach (40 percent)	December 2011	ALNAFT granted final approval for the development plan presented for the important Reggane gas project. This relevant milestone allowed the work to develop the area to commence in 2012, such as the drilling, extension and completion of wells to start extracting gas in 2017.
Tinhert, Hassi Bahamou and Hassi Mouina	Sonatrach (100 percent) for the first two fields; and Statoil (75 percent), Sonatrach (25 percent) for Hassi Mouina	July 2014	The first two fields to be developed by Sonatrach, while the third field jointly with the Norwegian Statoil. For the Tinhert field, it was expected to have an initial output of 14 million m ³ per day, climbing to 24 million m ³ per day in 2017, whereas for the remaining two it was expected to have a capacity of 21 million m ³ per day in 2017.
Timissit Permit Licence	Sonatrach (51 percent), Royal Dutch Shell (19 percent), Statoil (30 percent)	September 2014	A licence to explore the Timissit area in the Illizi-Ghadames Basin is granted by ALNAFT. The award represents an opportunity to test a potentially large shale resource play. The opportunity is aligned with Statoil’s exploration strategy of early access at scale and deepening core positions.
Rhourde Oulad Djemaa, Sif Fatima Nord-Est	BHP Billiton (45 percent), Eni S.p.A (55 percent)	July 2017	Even if the field was operational to mainly produce crude oil since 2003, an agreement was signed to extend the production sharing contract (PSC) for the Rhourde Ouled Djemma (ROD) and satellite fields in blocks 401a/402a for an additional 10 years.

Source: Compiled by the author based on several sources, including Sonatrach. Rapports Annuels (2001-2015); Regional surveys of the world. The Middle East and North Africa (2004); The Report, Algeria (2006-2014); BMI research (2016)

In December 1995, British Petroleum and Sonatrach signed the first gas production sharing contract in Algeria for a 30-year period. The British company committed to invest USD 2.7 billion to develop seven of these fields: Reg. Teguentour, Krechba, Garat El Baninat, Hassi Moumene, In Salah, and Gour Mahmoud, covering a total area of 23,000 km², with the distance between the first and last fields being about 350 km. The In Salah area is located in district III in the Tamanrassett province, in the gas-prone Ahnet Basin, which is the centre of Algeria south-west of Alrar, and has 30 gas fields. The first of these fields was discovered in 1958 by the French CREPS. The gas production sharing contract signed by Sonatrach and BP¹⁴⁴ resulted from five years of tough negotiations and came into force in February 1997.

Prior to that, in 1978, Total Algeria, under a contract awarded by Sonatrach, had launched a major delineation programme of the In Salah region to evaluate its gas reserves, as well as the reserves of structures in the Nezla and Gassi Touil areas to the north-east of In Salah. The work was completed early in 1981, and the proven recoverable reserves of Reg. Teguentor and Krechba alone were estimated at 71.2 bcm.

Similarly, other major IOCs like Shell, Exxon and Enron envisioned similar agreements than the one reached by Sonatrach and BP Amoco for In Salah gas fields but also for other regions that could be explored and eventually exploited. In fact, Shell and Sonatrach had a widespread number of cooperation deals, first signed in 1989, covering upstream oil and gas, LNG and LPG marketing, a plant in Algeria to process gas into motor petrol and other products. Nevertheless, the decline of oil prices in 1998 and 1999, and consequently the fall in the value of natural gas supplied to Europe, caused the latter to reconsider its initial plans to massively invest in the country, and it even triggered major concerns in BP Amoco on the real possibility to invest the funds it had previously committed regarding the In Salah fields.

In June 1998, Sonatrach and Amoco Algeria Petroleum (later being absorbed by BP) signed a 20-year agreement for the development of gas fields in the In Amenas region of south-eastern Algeria not far from the Libyan border. The project was intended to produce 7 bcm per year from 2002 and Amoco had to invest about USD 900 million to develop four fields, in addition to spending USD 435 million on the drilling of 80 wells. The four In Amenas fields had already

¹⁴⁴ At the end of 1998, BP absorbed the US company Amoco and became known as BP Amoco, one of the three biggest IOCs in the world of petroleum. In 2003, the Norwegian Statoil decided to acquire part of BP's participation in the joint venture (see https://ec.europa.eu/competition/mergers/cases/decisions/m3230_en.pdf).

been discovered and Amoco was to receive condensates and LPG for its share, while all the dry gas would go to Sonatrach.

In the following years, the British BP, after having absorbed Amoco Algeria Petroleum, was very successful in extracting natural gas on a very large scale in all its In Amenas and In Salah fields, to the extent that they also decided to expand the exploration activities to the Bourarhet block, adjacent to In Amenas.

In June 2003, BP entered into an agreement with the Norwegian Statoil, which bought half of BP's shares in the In Amenas fields. The agreement meant that the gas produced at In Amenas was marketed by Sonatrach, while BP and Statoil were reimbursed with the condensate and LPG output of the facility. During the first phase of the In Amenas Gas project, a total amount of USD 1.2 billion was invested in the development of the Tiguentourine gas field. In May 2011, a USD 213 million contract was awarded to Japan's JGC Corporation for the development of a compression project at In Amenas, scheduled for completion by 2013. This project involved adding two compression zones to the existing processing plant, constructing a new slug catcher facility, and building a permanent accommodation camp along with utility structures. Soon after the execution of this project, the In Amenas gas facility was attacked by Islamist terrorists in January 2013 and was shut down after the attack and could not return back to normality until the end of 2015.

With the turn of the century, Algeria was poised to increase the number of explorations in the vast Saharan Desert, and between 2000 and 2008, these amounted to 100 new discoveries, half of which involved natural gas. As shown in Table 5, eight discoveries were made in 2005, 17 in 2006, 20 in 2007, 16 in 2008 and eight in 2009. On average, half of those were undertaken by Sonatrach alone and the other half by Sonatrach with foreign partners. It has to be noted though that the numbers per year were modified as a result of six consecutive licensing rounds undertaken by the National Agency for the Valorisation of Hydrocarbon Resources (ALNAFT) that took place during the timespan 2000-05, which caused delays in the start of the exploration activities, and consequently on the date of the discoveries.

Table 5. Number of hydrocarbon discoveries in Algeria (2005-2010)

	Total	Sonatrach	Sonatrach with partners
2005	8	6	2
2006	17	9	8
2007	20	8	12
2008	16	9	7
2009	8	3	5
Total	69	35	34

Source: Compiled by the author based on data retrieved from Sonatrach. Rapports annuels (2006-2010)

In March 2006, the Spanish companies Repsol YPF and Gas Natural signed with Sonatrach the constitution of a joint venture to develop the integrated Gassi Touil gas project in Algeria. Indeed, the Gassi Touil project had been awarded in 2004 by the agency ALNAFT to both Spanish companies who bade in the form of a consortium (Repsol YPF with a share of 60 percent and Gas Natural with 40 percent). The resulting company of the signed joint venture agreement, called *Sociedad de Licuefacción* (SDL), was supposed to construct and operate the natural gas liquefaction terminal that was part of this project, along with the exploration, production, liquefaction and commercialisation of natural gas reserve blocks in the eastern Algerian regions of Gassi Touil, Rhourde Nouss and Hamra. Nevertheless, one and a half years later, Sonatrach terminated the agreement and continued on its own.¹⁴⁵

In spite of this backlash, the Spanish company Repsol recovered very quickly and, at the beginning of 2009, it announced no fewer than four discoveries in the Ahnet basin and in the Reggane basin, in partnership with the Italian Edison International and the German RWE-Dea, and in the Gassi Chergui Ouest perimeter, in partnership with Gas Natural.

The great recession of 2008-2011 hit the developed economies, which, coupled with a stricter regulatory environment in Algeria, lowered the interest from IOCs to bid in the subsequent rounds for natural gas concessions. For instance, in the licensing round in March 2011 only two out of 10 oil and gas blocks were awarded to the Spanish company Cepsa and to Sonatrach. While Algerian officials blamed the international banking uncertainty, which made financing

¹⁴⁵ For further reference, see Escibano (2012).

tighter, foreign companies argued that the 2006 amended hydrocarbon law limited liberalisation in the upstream sector and introduced new extraordinary profit taxes. This situation led to the changes in the hydrocarbon law of 2013 with the aim of encouraging participation from foreign companies. Yet, in December 2011, ALNAFT granted the permissions to initiate the development of the Reggane Nord gas field in the Sahara Desert to a consortium of companies led by the Spanish Repsol.

One of the consequences of the hydrocarbon law of 2013 was a better regulation and a plan of incentives for the exploitation of non-conventional hydrocarbons. As not

ed, much earlier than 2013 Algeria had been signalled as one of the countries in the world with the highest reserves of shale gas (Arab, 2012). A first positive result on the use of hydraulic fracturing in Algeria to obtain shale gas was carried out by the Irish Petroceltic International in Ain Tsila field in south-eastern Algeria in 2011. In September 2014, the interim CEO of Sonatrach, Saïd Sahnoun, proclaimed that the company was aiming to reach shale production of 20 bcm by 2022 and 30 bcm by 2027 (Osmani, 2022: 10). The initial prospective drilling activities concentrated in the Illizi basin in the south-east and in the Ahnet basin in the south-west of Algeria. To this end, several IOCs such as ExxonMobil, Total, Eni and GDF Suez expressed their interest in shale exploration and production in Algeria, prompting the Algerian authorities to facilitate this activity in the hydrocarbon law of 2013.¹⁴⁶

However, despite these efforts to attract investors, only four out of 31 blocks on offer were awarded in an early 2014 bidding round. In this context, it is uncertain whether the Algerian government remained committed to the exploration of unconventional gas, especially after drilling the first exploration wells in the country proved to be contentious, triggering sustained local protests. It could very well be that the government was more interested in conventional low-risk projects and short-term results rather than uncertain, controversial, and long-term shale gas development (Boersma et al., 2015).

¹⁴⁶ Prospective resources are in the Ghadames and Illizi basins in east Algeria, the Timimoun, Ahnet and Mouydir basins in central Algeria, and the Reggane and Tindouf basins in southwest Algeria. However, there has been little movement toward the development of these resources. Indeed, in the 2014 licensing round, the Timissit licence, awarded to Statoil and Shell, was the only shale licence bid for. The exploration programme is relatively unambitious, including just two exploration wells by 2017. Additionally, local protests erupted in January 2015 after Sonatrach spud a shale pilot well in the Ahnet Basin, suggesting that there will be domestic opposition to shale development moving forward.

As noted, as of 2015, Algerian gas output remained heavily dependent on the giant field of Hassi R'Mel, even if it has been maturing and seen production decreasing over the last few years. Other major fields that faced similar decline rates included the Rhourde Nouss, Alrar and Hamra fields. Algeria planned at that time to offset decline from these fields with a number of small and medium-sized project developments. Most central was the south-west gas project, which comprises a number of distinct developments including Reggane North (2.9 bcm), Timinoun (1.6 bcm) Touat (4.5 bcm) and Ahnet (4.0 bcm). It involved the construction of gas gathering facilities, a gas treatment plant and connecting pipeline infrastructure. The In Salah Southern Fields development project, part of the In Salah Gas project, was another driver of medium-term production growth. The project, which included the four dry gas fields of Gour Mahmoud, In Salah, Garet el Befinat, and Hassi Moumene, was expected to produce 9 bcm per year, according to BP.

As of 2015, Sonatrach accounted for nearly 80 percent of oil production and more than 90 percent of natural gas supply. Table 6 shows the main foreign companies that have a role in the upstream activities in Algeria. The involvement of IOCs is therefore quite extensive, although all major projects are still carried out in partnership with Sonatrach using production sharing agreements (PSAs).

Foreign companies that had high stakes in the production of natural gas in 2015 were the Norwegian Statoil, the British BP, the French Total, the Spanish Repsol and the Italian Eni, as shown in Table 6. BP has no significant oil volumes (5,000 barrels per day net in 2015), but is a more meaningful gas player (1.1 bcm in 2015). BP works alongside Statoil, which acquired interests in Algeria in 2003. Repsol's activity in Algeria is focused on three areas: the continued production from an existing asset (Tin Fouyé Tabenkort), the start of a gas production project considered key in the 2012-2016 Strategic Plan (Reggane), and an additional exploration block (SE Illizi). The Spanish company has bought Canadian independent Talisman Energy, which also has a significant presence in Algeria. Through directly-owned interests, French Total received approximately 0.9 bcm of natural gas. Italy's Eni is the country's biggest foreign oil producer, having increased its presence through the acquisition of exploration companies Lasmo and First Calgary, but it did not increase significantly its share in natural gas production until

2022 when it reached an agreement to take over BP's operations in Algeria, including In Amenas and In Salah.¹⁴⁷ Eni could be a potential investor in Algerian unconventional gas.

Table 6. Key upstream players in the Algerian hydrocarbon sector (2015)

Company	Liquid production (000b/d)	Market share (in percentage)	Gas production (bcm)	Domestic market share (in percentage)
Sonatrach	1,510	76.0	56.2	65.0
Anadarko Algeria	52	3.0	N/A	N/A
Eni Algeria Production	74	3.6	0.2	N/A
Total Algeria	25	1.2	0.9	1.0
CEPSA Algeria	40	2.0	N/A	N/A
BHP Billiton	20	1.1	N/A	N/A
Statoil Algeria	N/A	N/A	2.6	3.2
Hess	14	0.7	N/A	N/A
Maersk Oil & Gas	5	1.5	N/A	N/A
BP	5	0.3	1.1	1.3
ConocoPhillips	14	0.7	N/A	N/A
Talisman Algeria	7	0.4	N/A	N/A
Repsol Algeria	5	0.3	0.8	0.1

Source: BMI Research (2016)

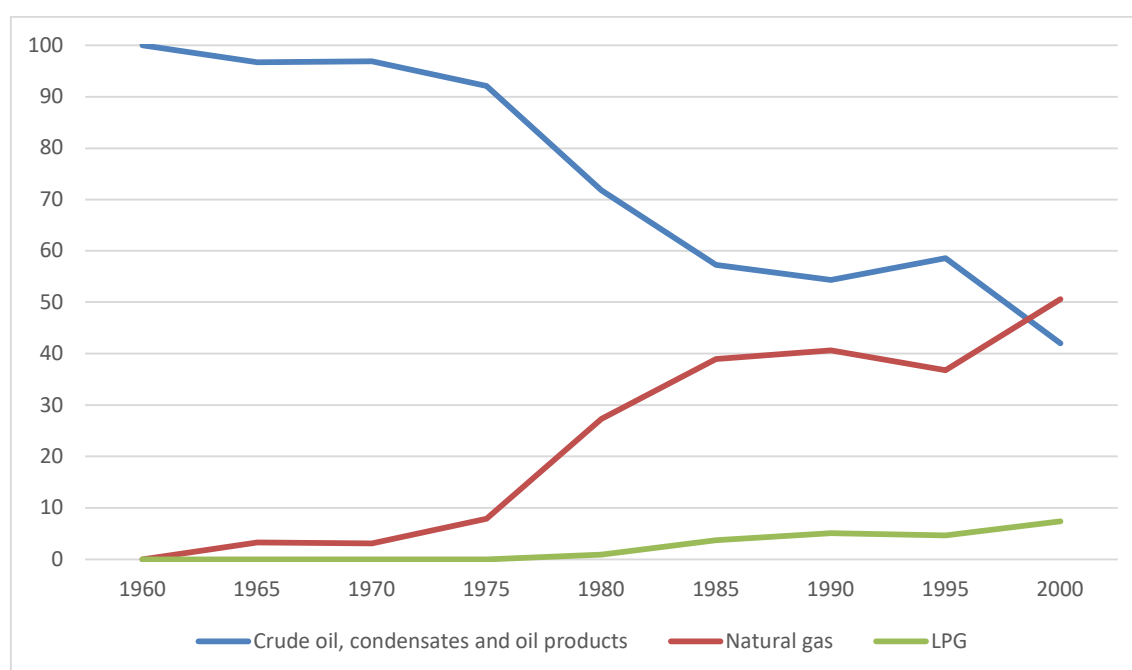
3.5 The midstream segment

The composition of the Algerian hydrocarbon exports has drastically changed since 1962 when Algeria became independent. As mentioned, in the early 1960s when the giant field of Hassi R'Mel became operational, exports were limited to a small amount of condensate, as a result of the exploitation of the wet gas field as a liquid reservoir by the French companies. In 1964, with the coming into operation of the pioneering liquefaction plant of Camel in Arzew, LNG exports started to flow thanks to a first supply contract of 1 bcm per year for a period of 15 years from

¹⁴⁷ See <https://www.eni.com/en-IT/media/press-release/2022/10/berkine-south-start-production-two-gas-fields.html>

British Methane. The LNG was then shipped from Arzew in Algeria to Convey Island in the UK. Whereas the LNG export terminal in Skikda and the Transmed gas pipeline from Algeria to Italy became operational in 1983, product exports increased to the detriment of crude oil. As shown in Figure 18, there are very clear trends on the hydrocarbon exports per product (crude oil and oil products, natural gas and LPG). In 1960, all exported hydrocarbon products were crude oil (2,000 boe per day), while in 2000 natural gas becomes the single most important export item, representing half the export volumes with 61.69 bcm per year.

Figure 18. Trends of Algerian hydrocarbon exports in percentage (1960-2000)



Source: Compiled by the author based on data retrieved from Sonatrach and OPEC annual reports (several years)

Overall, the turnaround came at the end of the 1980s with a historical shift of disproportioned consequences: the fall of the Berlin Wall of November 1989, followed by the dissolution of the USSR in December 1991, paved the way towards the emergence of a new concept of long-term energy security in Western Europe (Aïssaoui, 2001). Indeed, Western Europe was concerned about energy supply for its domestic markets and decided to work towards the establishment of a European internal energy market that would seek the liberalisation of its internal market of natural gas. Consequently, this move quickly raised the attention of the Algerian authorities, which started to focus more and more in the EU as the natural space for Algerian gas exports.

The European Communities (EC, later the EU) enlargement to Spain and Portugal in 1986 and the establishment of the Arab Maghreb Union in 1989 facilitated the necessary impetus to deepen the bilateral EU-Algeria energy dialogue and exploit the emerging European gas markets. Not only by deepening gas trade relations with the new EC members, Spain and Portugal, but also by exploring gas sales to Central and Eastern European countries via Italy. To that end, the EC strongly supported the construction of the Maghreb-Europe Gas Pipeline, along with the expansion of the Transmed gas pipeline as it was keen on diversifying the supply of natural gas to Europe in the framework of a Trans-European Network (TEN) programme.¹⁴⁸ The latter regarded Algeria, Russia, Norway and the UK as the major natural gas suppliers to the EU.

Hence, during the 1980s and 1990s, in spite of the 1986 oil price collapse, Algeria's natural gas exports witnessed a steady increase of more than 200 percent.¹⁴⁹ With the exception of the downward pressures on crude oil prices by the end of 1993 and 1994 that triggered an inflexion of hydrocarbon exports, including those of gas, natural gas exports steeply increased as shown in Figure 19. The evolution has been less stable since 2001 onwards with a new record peak in 2005 in the natural gas exports and a declining pattern since then (see Figure 19), due to declining gas production and growing domestic consumption, which eroded the capacity to sustain, and even increase, Algeria's natural gas exports since 2009 (see Figure 19). In addition, from 2004-05, economies such as Qatar (and later also Australia) and Russia benefitted from supplying LNG and new pipeline routes to European markets, the main source of destination of Algerian natural gas.

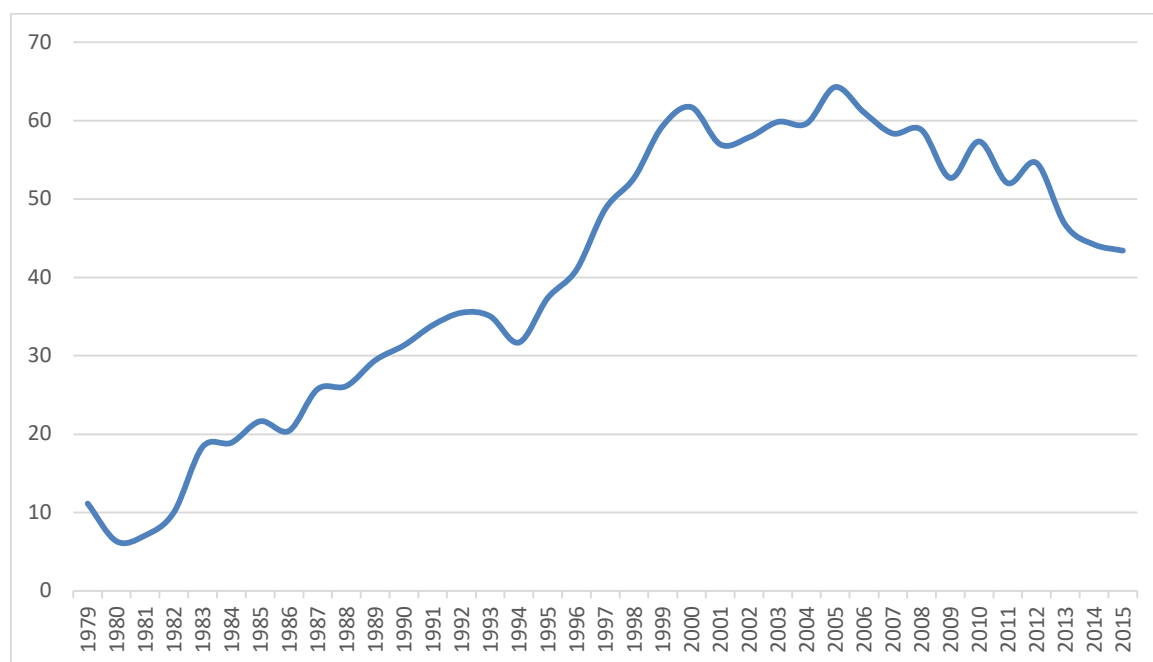
Finally, the sharp decline in gas exports of 2009 and 2011, depicted in Figure 19, was also the result of the severe contractions in natural gas exports to Southern European countries that were hit by the financial crisis of 2008-09 and the debt sovereign crisis of 2010-2012.

¹⁴⁸ The Maastricht Treaty gave the EU the task of establishing and developing trans-European networks (TENs) in the areas of transport, telecommunications and energy in order to help develop the internal market, reinforce economic and social cohesion, link islands, landlocked and peripheral regions with the central regions of the Union, and bring EU territory within closer reach of neighbouring states.

In its 1993 White Paper on Growth, Competitiveness and Employment, the European Commission (EC) emphasised the fundamental importance of the TENs to the internal market, and in particular to job creation, not only through the actual construction of infrastructure, but also thanks to their subsequent role in economic development. Fourteen priority projects (PPs) for transport and 10 PPs for the energy sector were approved by the Corfu and Essen European Councils in 1994.

¹⁴⁹ Algeria exported 20.44 bcm of natural gas in 1986 and it raised to 61.69 bcm in 2000.

Figure 19. Evolution of Algeria's natural gas exports in bcm (1979-2015)



Source: Compiled by the author based on data retrieved from OPEC statistical bulletins and BP Statistical Review (1980-2016)

The midstream segment of the GVC encompasses the movement of natural gas from the gas fields to processing facilities, and from those facilities to the end market. Beyond the existence of supply and demand of natural gas, the midstream segment is key because it enables natural gas exports to be realised, without which a GVC could not be envisaged because gas supply and demand would not meet. In this context, gas exports can happen via pipeline or by vessel (LNG), in which case a process of liquefaction is needed at the country of origin and a process of regasification is needed at the country of destination. We will first examine the evolution of the Algerian LNG industry, and secondly the gas pipelines.

3.5.1 The development of the Liquefied Natural Gas industry

Being an indispensable part of the GVC in the midstream segment, the liquefaction industry is completely dependent on the capacity to export natural gas to regional and foreign markets, especially when physical interconnections (i.e., gas pipelines) do not exist across the boundaries of a natural gas producing country. Specifically, the latter was the case for Algeria until 1983, when the first international gas pipeline became operational connecting Algeria with Italy via Tunisia. As indicated, Algeria inaugurated the first commercial natural gas liquefaction plant

worldwide (GL4Z) in September 1964 to comply with the contract signed with British Methane in 1963 to supply 1 bcm of LNG per year for a duration of 15 years (see Table 8).

Only three years later, in 1967, Sonatrach and ERAP created a joint venture entitled Somalgaz with the aim to build a second LNG plant in Skikda (GL1K), on the east coast of the country, with a total initial capacity of 3.5 bcm per year. It became operational in 1972, the year it was taken over by Sonatrach following the nationalisation wave of 1971. A new liquefaction node was built in 1978 and 1981 on the western coast of the country, close to Arzew, with two plants (GL1Z and GL2Z) that had an initial capacity of 21 bcm per year. Also, that same year, a fifth liquefaction plant (GL2K) was opened in Skikda with an initial capacity of 4.2 bcm per year. The capacity in all these plants was revamped in 1996 (GL2K), in 1998 (GL1Z) and in 1999 (GL1K), totalling a capacity of 29 bcm per year in 2000. In 2010, the old Camel facility (GL4Z) was finally shutdown and, in 2014, a new train¹⁵⁰ was brought online in Arzew to process gas from the Gassi Touil, Hamra and Rhourde Nouss gas fields. The other LNG terminals are supplied by natural gas from the Hassi R'Mel dispatching node. Thus, in 2015 the total production capacity of LNG in Algeria was 44 bcm per year (see Table 7).

In Table 7 one can also look at the diversity of the LNG buyers. Most private companies purchase LNG to distribute it in their home countries. This depends on the capacity for these countries to regasify LNG using regasification terminals. Table 7 reflects almost the same companies purchasing gas from different LNG terminals in Algeria, which often respond to long-term contracts that are summarised in Table 8 between Algeria's Sonatrach and the private companies acquiring LNG. The same contract with one company grants the private company the right to acquire a fixed annual volume of LNG, which can be dispatched from different LNG terminals in Algeria, depending on the geographical origin of the natural gas to be exported. The origin of most LNG buyers is the Western Mediterranean area (France, Italy and Spain), as well as other Mediterranean countries (Greece and Turkey). In this vein, the main LNG buyer is GDF Suez, which responds to the fact that it is the only Western Mediterranean private company that serves in a territory that is not directly connected with Algeria via cross-border gas pipeline, and thus imports all Algerian gas via LNG. In Table 8 we will also see that

¹⁵⁰ An LNG train is a LNG plant's liquefaction and purification facility. Each LNG plant consists of one or more trains to convert natural gas into LNG.

it is the private company that accounts for more LNG long-term contracts with Sonatrach along the period examined (1963-2015).

Table 7. LNG Terminals in Algeria (2015)

Location	Code	Start-up date	Nominal capacity (in bcm/year) ¹⁵¹	Owner and operator	LNG buyers
Arzew-Bethioua	GL1Z	1978	10.9	Sonatrach	GDF Suez (FR), Botas (TK), Eni (IT), Iberdrola (ES), Depa (GR), Cepsa Gas (ES), Statoil (NO), Endesa (ES)
Arzew-Bethioua	GL2Z	1981	11.3	Sonatrach	GDF Suez (FR), Botas (TK), Eni (IT), Iberdrola (ES), Depa (GR), Cepsa Gas (ES), Statoil (NO), Endesa (ES)
Arzew-Bethioua	GL3Z	2014	6.5	Sonatrach	GDF Suez (FR), Botas (TK), Eni (IT), Iberdrola (ES), Depa (GR), Cepsa Gas (ES), Statoil (NO), Endesa (ES)
Skikda	GL1K	1972	4.4	Sonatrach	GDF Suez (FR), Botas (TK), Eni (IT), Iberdrola (ES), Depa (GR), Cepsa Gas (ES), Statoil (NO), Endesa (ES)
	GL2K	1981			

Source: Compiled by the author based on data retrieved from BMI Research (2016) and Sonatrach annual report (several years)

During the 1980s, as a result of the policy revisions of 1979 and 1980 prompted by the administration of President Bendjedid, LNG terminals did not run at full capacity. The high costs of operations involved and also the large investments required to keep the facilities running discouraged the full use of the terminals (Djaroud, 1991). However, in 1989 in the context of a new strategy to double gas exports by the end of the 1990s as a consequence of the burgeoning markets of Spain and Italy, the existing LNG facilities were revamped. This process, which

¹⁵¹ LNG is typically measured in volumetric units like million tonnes per year (mtpa). It is sometimes measured in the amount of gas that it will provide when converted back to a gaseous form. In this case, common units are bcm. For this exercise, we have converted mtpa to bcm/year using the conversion rate of 1 million tonnes per year (mtpa) (LNG) = 1.379 bcm/year (gas).

required a substantial amount of capital, was undertaken by Sonatrach alone, which ruled out any type of foreign equity participation in the LNG industry.

By the end of the 1990s, Sonatrach succeeded in doubling its exports of natural gas. The company managed to secure a number of contracts to mainly supply Europe with LNG. Table 8 shows a comprehensive list of all LNG long-term contracts since the first one in 1963 with British Methane until the last ones signed with Gaz de France, which extend their period of validity beyond 2015.

Table 8 also shows an evolution amongst clients' countries of origin. Whereas in the 1960s and 1970s we clearly coped with a diverse range of nationalities, including UK, US and Belgium, contracts signed from 1990 onwards are almost exclusive to European IOCs, mainly from Western Mediterranean countries – France, Spain and Italy –, as well as Turkey. The latter will help understand an increasing dependence of Algeria on these Western Mediterranean countries, which will be further illustrated in this chapter. In particular, exports to France (contracted by GDF) are remarkably high due to the absence of physical interconnections, as is the case with Italy and Spain. Not only the number of contracts but also the volumes of LNG contracted indicate that the absolute priority (or possibilities) to supply LNG has been given to the Western Mediterranean countries mentioned above. In this context, Sonatrach has favoured long-term, oil-linked contracts and has offered little flexibility in relaxing destination restrictions (BMI, 2016), but a global trend has accelerated towards a higher level of gas hub indexation in pricing formulas, increasing contract flexibility and a growing market share for spot and short-term transactions. This also explains why Table 8 shows shorter long-term contracts from the 1990s onwards.

Table 8. Sonatrach's portfolio of LNG long-term contracts (1963-2015)

Contract's date of signature	Client	Country	Yearly volume (in bcm)	First delivery	End of deliveries	Contract duration	Total volume (in bcm)
1963	British Methane	UK	1	1964	1978	15	15
1965	GDF	France	2	1972	2013	42	84
1969	El Paso I	USA	1	1972	1996	25	25
1971	GDF	France	3.5	1973	1993	21	74
1975	Distrigaz	Belgium	4.5	1982	2006	25	113
1975	Enagas	Spain	4.5	1979	1999	20	90
1976	GDF	France	5.2	1982	1993	12	62
1976	Distrigas	USA	1.3	1978	1991	14	18
1976	Distrigas	USA	1.22	1978	2006	29	35
1976	Duke Energy	USA	1	1982	1989	8	8
1987	Distrigas	USA	0.75	1987	2003	17	13
1987	Duke Energy	USA	1	1989	2009	21	21
1987	Panhandle	USA	0.81	1989	2005	17	14
1988	Depa	Greece	0.7	2000	2020	21	15
1989	Distrigas	USA	1.3	1991	2013	23	30
1991	GDF	France	0.5	1993	2002	10	5
1991	GDF	France	3.5	1993	2013	21	74
1991	GDF	France	5.2	1993	2002	10	52
1991	GDF	France	1.1	1992	2002	11	12
1992	Botas	Turkey	4.14	1994	2013	20	83
1994	Snam	Italy	1.8	1996	2016	21	38
1997	Enel	Italy	1.55	1999	2022	24	37

1997	Eni	Italy	1.8	1997	2015	19	34
2000	GDF	France	0.5	2002	2013	12	6
2000	GDF	France	5.2	2002	2013	12	62
2000	GDF	France	1.1	2002	2013	12	13
2000	Cepsa	Spain	1.06	2002	2022	21	22
2000	Endesa	Spain	1.04	2002	2017	16	17
2001	Statoil	USA	1.04	2003	2009	7	7
2002	Iberdrola	Spain	1	2004	2018	15	15
2002	Distrigas	USA	0.75	2003	2008	6	5
2007	GDF	France	0.5	2013	2019	7	4
2007	GDF	France	1.43	2013	2019	7	10
2007	GDF	France	5.2	2013	2019	7	36
2007	GDF	France	1.1	2013	2019	7	8

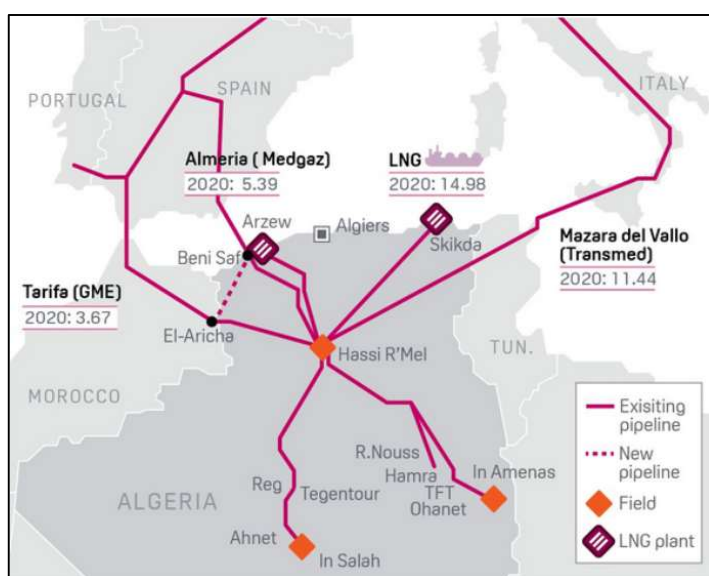
Source: Compiled by the author based on several sources: Aïssaoui (1999, 2001); Ballesterro (2017); Datamonitor (2009); Regional surveys of the world. The Middle East and North Africa (2004); The Report, Algeria (2006-2014); Platts Market Data. International Gas Report (2000); Cedigaz News Report; GIIGNL (2008, 2009, 2010; 2012); Sonatrach. Rapport Annuel (2001-2015)

3.5.2 The development of the Trans-Mediterranean Gas Pipelines

The second sector of the midstream segment of the GVC is the development of physical interconnections that enables natural gas to be exported from one country to another without liquefaction, and therefore in its gaseous form. Historically, the complexity of natural gas processing and transportation (onshore pipelines) has limited long-distance trade flows and diversity of trade flows (BP Statistical Review of World Energy, 2015). Expensive and unique gas transportation projects require substantial investment, and thus, long-term contracting (World Bank, 2011), leading to mono- or oligopolistic markets and significant variations of gas prices across global markets.

As explained, in Algeria up to 2015, three cross-border gas pipelines have been built and are still operational:¹⁵² (1) the Trans-Mediterranean Gas Pipeline, linking Algeria and Italy via Tunisia; (2) the Maghreb-Europe Gas Pipeline,¹⁵³ linking Algeria and the Iberian Peninsula (Spain and Portugal) via Morocco; (3) the Medgaz Gas Pipeline, linking Algeria and Spain directly. As shown in Figure 20, all three trans-Mediterranean pipelines originate in Hassi R'Mel as the Gas Dispatching National Centre. This is a hub where gas gathering and dispatching occurs through gas pipelines to local customers (Sonelgaz, third-party clients and Sonatrach plants' own final use) and international customers (delivery to liquefaction plants and Trans-Mediterranean Gas Pipelines). All other gas fields dispatch natural gas to Hassi R'Mel and from there natural gas continues to international destinations. Moreover, Figure 20 summarises the technical features of each regional gas pipeline as of 2015, given that some of their technical features have evolved over time.

Figure 20. Algeria's regional cross-border gas pipelines (2015)



¹⁵² In October 2021, beyond the time limit covered by the present research, the Maghreb-Europe Gas Pipeline ceased to operate after Algeria unilaterally decided to close it. In 2022, Spain re-opened it to supply gas to Morocco. For further reference, see <https://www.cidob.org/publicaciones/escalating-rivalry-between-algeria-and-morocco-closes-maghreb-europe-pipeline>

¹⁵³ In 2000, Algerian President Bouteflika renamed the two existing Mediterranean regional gas pipelines – the Trans-Mediterranean and the Maghreb-Europe – as the Enrico Mattei gas pipeline and the Pere Duran Farell gas pipeline in honour of the late chairmen of ENI, Enrico Mattei, and of Gas Natural, Pedro Duran Farell.

Source: S&P Global Commodity Insights. Platts Market Data

Name of the pipeline	Trans-Mediterranean	Maghreb-Europe	Medgaz
Owners and managers	Algerian section: owned and controlled by Sonatrach; Tunisian section: owned by Sotugat and controlled by Sergaz; sub-sea segment (Strait of Sicily): Trans-Mediterranean Pipeline Company (TMPC), a joint venture of Eni and Sonatrach (at 50 percent each); Italian section: Snam Rete Gas	Algerian section: owned and controlled by Sonatrach; the Moroccan section, including the section that runs under Moroccan territorial waters in the Strait of Gibraltar: owned by the Moroccan state and operated by Europe Maghreb Pipeline Limited (77.2 percent Gas Natural; 22.8 percent Galp Energia). Metragaz (76.68 percent Gas Natural; 22.64 percent Galp Energia; 0.68 percent ONHYM) operates on its behalf; the Spanish section: owned and operated by Enagas (with a participation of 33 percent of Galp Energia); the Portuguese section: owned and operated by REN Gasoductos	Algerian section: owned and controlled by Sonatrach; the sub-sea section: managed by Medgaz (43 percent Sonatrach; 42 percent Cepsa; 15 percent Gas Natural)
Investment	USD 6.25 billion (Algerian section USD 2 billion; Tunisian section USD 0.95 billion; sub-sea section USD 1.5 billion; Italian section USD 1.8 billion)	USD 1.9 billion (Algerian section USD 456 million; Moroccan and sub-sea sections USD 1.05 billion; Portuguese interconnection USD 400 million)	EUR 900 million (Algerian section EUR 270 million; sub-sea section EUR 630 million)
Capacity (in bcm per year)	38	11	8
Length (in km)	2,475	1,620	757
Date of completion	June 1983	November 1996 (sub-sea pipeline); December 1996 (Spanish segment); February 1997 (Portuguese segment)	March 2011
Route	Algeria to Italy via Tunisia	Algeria to Spain and Portugal via Morocco	Algeria to Spain directly

Source: Compiled by the author based on several sources, mainly corporate information of Transmed S.p.A., Europe Maghreb Pipeline Limited and Medgaz S.A.

We will now assess the historical context that triggered the planning and development of the aforementioned infrastructures.

Trans-Mediterranean Gas Pipeline

In the early 1970s, Italian publicly-owned company Eni¹⁵⁴ secured gas imports from the USSR and the Netherlands, while it strengthened the existing good relations with the Algerian company Sonatrach with the aim of securing supply contracts that could diversify its rapidly growing gas imports. In this regard, the first oil shock of 1973 provided to Eni grounds to reassert the implementation of a strategic policy based on natural gas as an alternative source to meet Italian energy needs. However, technical difficulties associated with the building of a pipeline that was supposed to cross the Mediterranean Sea would only delay the project. In fact, proposals to import natural gas from Algeria date back to the 1960s, only envisioned using LNG technologies. As the costs of such technology were already high, Eni was encouraged to explore the feasibility of a pipeline that would link Italy with North Africa.

A first feasibility study was terminated in 1969 and further research was required to develop the necessary technology to bring such an ambitious project into reality, given that in the early 1970s the existing knowledge was limited to technology able to be deployed in waters with depths of less than 150 metres. Hence, new technologies were needed to be developed for remote controlled seabed preparation equipment and pipelaying procedures adapted to the much-increased depths and pressures (Caroni, 1992). All research and development were tasked within the Eni group to subsidiaries of the group, which could come up with technical solutions and carry out the technical tests to install pipes in the Mediterranean Sea between 1974 and 1975. Negotiations on the concrete terms of the agreement began in 1977 between Eni, Sonatrach and the Tunisian authorities, but soon disagreements arose due to the amount requested by the latter to pay for transit rights. Finally, the Tunisian government accepted a payment of 5.62 percent of transported gas volumes, in cash or in gas, to allow the transit of natural gas across its territory (Hayes, 2004).

¹⁵⁴ Ente Nazionale Idrocarburi (Eni) is the main Italian energy company established in 1953. Considered as one of the "Seven Sisters" of the oil sector, Eni was a publicly-owned company until 1995, when it went through a progressive partial process of privatisation. The first CEO of the company (1953-1962), Enrico Mattei, cultivated personal relations with the Algerian FLN before independence, which paved the way for the development of strong links between Eni and Sonatrach during the 1970s and 1980s.

Between July and October 1977, two separate agreements were signed between Eni and the Tunisian government, on the one hand, and between Eni and Sonatrach, on the other. As for the first contract, it is worth noting that it was due to the leadership of Tunisian President Habib Bourguiba, who managed to keep Algeria outside the negotiations (Hayes, 2004: 14). The agreement envisaged that a Tunisian company fully owned by Eni would carry out the construction activities, and later on, once the pipeline became operational, the property rights would be transferred to the Tunisian state-owned company *Société du Gazoduc Transtunisien* (Sotugat). A third company (Trans-Tunisian Pipeline Company) would be in charge of transporting the gas from the Algerian-Tunisian border to the first European destination in Sicily.

In spite of Algeria being excluded from the Tunisian section of the pipeline, the Algerians managed to acquire a stake in the section crossing the Strait of Sicily. Indeed, Sonatrach established with Eni a joint venture entitled Trans-Mediterranean Pipeline Company with a participation of 50 percent, which became responsible for the financing, construction and operation of this section of the pipeline. A subsidiary group of Eni, Snam, and Sonatrach covered 100 percent of the necessary investments. The construction of the under-sea pipeline (line 1) began in 1978 and was commissioned in June 1983, right before the operations of the whole pipeline began.

A second line was built parallel to the first line to import an additional 7 bcm per year of gas, whose construction commenced in 1991 and was completed in 1997, while a third line spanning 550 km was built in March 2010 to carry natural gas from the Hassi R'Mel gas field to the Tunisian border, where it was coursed into the Trans-Mediterranean pipeline. Finally, a 35 km-long extension line was also constructed from the Italian mainland to Slovenia.

Maghreb-Europe Gas Pipeline

The first oil shock crisis of 1973 also had severe effects on the Spanish economy as it spurred a balance of payment crisis, increased interest rates and inflation, and ultimately hindered economic growth in line with other oil dependent economies in Western Europe. It is worth emphasising that during the 1960s and 1970s the natural gas market was almost non-existent in Spain, even though the Spanish state gas transport company, Enagas, already had plans to increase gas imports. Indeed, the macroeconomic costs entailed by oil price volatility were one

of the main reasons to start considering the import of natural gas as a complementary energy source. Other push factors were underpinned by Spain's geostrategic position in securing the supply of Algerian gas to Western Europe in the context of an enduring conflict between the US and the Soviet Union (Hayes, 2004).

However, initial plans to connect Algeria with Western Europe to secure a constant flow of natural gas are older. As noted, as early as 1963 a group of French companies, with the endorsement of the French government, had envisaged the physical connection between Algeria and Spain to transport natural gas further into France (Pawera, 1964). The first plan from the 1960s aimed at connecting the Hassi R'Mel giant field with Morocco, and later across the Strait of Gibraltar to Spain, and finally to Strasbourg (in France) with a total route of some 3,200 km (Pawera, 1964), whereas the second plan aimed at connecting Hassi R'Mel, following an existing pipeline route towards the Camel LNG facility in Arzew, and later head to Almería in Spain for nearly 200 km at depths of up to 2,500 metres below sea level.

Both options faced major technical constraints when they were conceived in the 1960s and 1970s, considering that the industry's experience with sub-sea pipelines was very limited. As explained, the Trans-Mediterranean pipeline required a massive investment in technology innovation and research to enable the construction of a pipeline to be developed across waters of a similar depth to those of the Strait of Gibraltar. However, the direct link between Arzew and Almería was much more technically complex. Despite the technological hurdles and in the context of the first oil crisis in November 1973, a first consortium called *Sociedad de Estudios para el Gasoducto del Mediterráneo Occidental* (Segamo)¹⁵⁵ was established by Sonatrach (50 percent), Enagas (25 percent) and GDF (25 percent) in order to launch the feasibility studies¹⁵⁶ for the direct route (Arzew to Almería), which could shorten by 500 km the distance from Algeria to France across Spain, and which was thought to be less costly than the route across the Strait of

¹⁵⁵ The consortium was formed by Sonatrach (50 percent), Enagas (25 percent) and Gaz de France (25 percent).

¹⁵⁶ A first study had been previously commissioned to the US engineering firm William Brothers, which came up with a first assessment in 1975 that favoured the pipeline across Morocco over the direct pipeline. The feasibility studies commissioned by Segamo were a continuation of the ones prepared by William Brothers.

Gibraltar¹⁵⁷ (Balletero, 2017). In addition, as the political relations between Morocco and Algeria had worsened, the option of advancing the route across Morocco seemed to be less realistic.

Overall, political relations between Algeria and Morocco had deteriorated since Algeria became independent in 1962 due to a dispute over the border between the two countries, which even fuelled a war¹⁵⁸ in 1963. One of the conflicts over this dispute that aggravated the situation took place in the mid-1970s as a result of the process of decolonisation of Western Sahara,¹⁵⁹ which had been partly colonised by Spain until 1975.

Although the Trans-Mediterranean pipeline had shown that Eni could establish separate agreements with Algeria and Tunisia, which were in conflict at that time, the state of relations between the Spanish company Enagas, Morocco and Algeria was not analogous. In fact, the separate negotiations led by Eni could be conducted thanks to the major role that the Italian government and banks were able to play, whereas Spain and Morocco were not on the best possible terms during the 1970s, especially after the conflict in Western Sahara arose in the mid-1970s. A proxy war between Morocco and Algeria followed during the 1980s until a UN brokered ceasefire between Morocco and the self-recognised Saharan Arab Democratic Republic was negotiated in 1991.

The stalling political relations between Spain and Morocco, coupled with the technical difficulties of the Algerian-Spain direct gas pipeline, meant that neither of the two pipeline projects could be fully feasible before the second half of the 1990s, and therefore during the 1980s Segamo's studies were abandoned (Balletero, 2017). Furthermore, any pipeline route to Spain would have needed to deliver at least 10 bcm of natural gas per year to be economically viable, whereas total gas consumption in 1973 was less than 2 bcm per year (Balletero, 2017). Enagas was not positioned to mobilise further capital in order to expand the natural gas grid across the Spanish domestic market. As a matter of fact, Enagas signed an LNG contract with Sonatrach in 1975

¹⁵⁷ The reality is that a similar project (Medgaz) was finally implemented 30 years later, connecting Béni-Saaf in Algeria with Almería, but it never managed to be completed up to France, as we will explain in the next section.

¹⁵⁸ The Sands War was a border conflict between Algeria and Morocco in October 1963, which came as a result of the Moroccan government's claim to portions of Algeria's Tindouf and Béchar provinces. The Sands War led to high tensions between the two countries for several decades, while it also triggered the first multinational peacekeeping mission carried out by the Organization of African Unity.

¹⁵⁹ On the use of the term "Western Sahara", see UNGA resolution 3292 of 1975: <https://digitallibrary.un.org/record/190206>, as well as UNSC resolutions 377, 379 and 380 of 1975.

to acquire 4.5 bcm per year for a period of 20 years (see Table 8), but could never market more than 1.5 bcm per year of what had been agreed, nor could pay for the full amount of what had been committed due to the size of the Spanish gas market during the 1980s (Hayes, 2004).¹⁶⁰

At the political level, the first public reference to the Maghreb-Europe pipeline was made explicit in May 1983 during the speech by¹⁶¹ then Spanish Minister of Industry and Energy, Carlos Solchaga, at the annual forum of the International Energy Agency (IEA) in Paris, even if the French government was very reluctant based on the ongoing tense relations between Morocco and Algeria during the 1980s. However, Spain's entry into the EC in 1986 improved relations between Spain and Morocco, on the one hand, while the establishment of the Arab Maghreb Union in 1989 improved the cooperation between Morocco and Algeria, on the other. Consequently, on 30 April 1991 two important agreements were concluded in Madrid.

The first agreement between the Spanish and the Moroccan governments established that Enagas would be responsible to finance and execute the construction activities of the pipeline in its Moroccan section. Enagas would retain the ownership of the facilities until the beginning of operations of the pipeline, which would then be wholly transferred to the Moroccan state. Enagas would then keep the exclusive rights to transport gas. In addition, Morocco would receive a transit fee of 7.15 to 8.15 percent of the value of the gas that entered its territory in the Algerian-Moroccan border. The second agreement added the Algerian government to the Moroccan and Spanish parties, and it convened full support from the Algerian side to the initiative and the possibility for other European companies to join the project in the future.

One year later, in June 1992, Sonatrach and Enagas signed the agreement through which the former would supply the latter with an amount of 6 bcm of natural gas per year in the Algerian-Moroccan border as from 1995. From there, the acquired natural gas would be transported to Spain along the pipeline. The pay-or-take contract would have a duration of 25 years and it contained a flexibility clause to adjust the supplied amounts to the demand from Enagas as to avoid the previous conflicts taking place in the 1980s. Additionally, the Europe Maghreb Pipeline

¹⁶⁰ The Sonatrach and Enagas contract was take-or-pay, establishing a rigid long-term supply flow of natural gas. The head of Sonatrach, Ait Laoussine, was probably hesitant to exert pressure on Enagas contractual violations after having considered the fragile state of the gas sector in Spain. Under the leadership of President Boumédiène, the strategy was to secure a foothold in European markets (Hayes, 2004).

¹⁶¹ In his speech he did not refer to Algeria solely as the origin of European imports of natural gas but also Nigeria, the second largest African gas producer.

Limited (EMPL) company was established in July 1992 to promote, finance and operate the Maghreb-Europe Gas Pipeline through Morocco under exclusive use rights, including the section that runs under Moroccan territorial waters in the Strait of Gibraltar. EMPL was therefore responsible for commercial gas transportation through the Moroccan section and it was fully owned at the time by Enagas. Furthermore, a second company, Metragaz, was also created in July 1992 with the initial purpose to build the gas pipeline and, once in service, to operate and maintain the gas pipeline installations on behalf of EMPL. This second company was owned back then by Enagas and the Moroccan publicly-owned *Société Nationale des Produits Pétroliers* (Snpp) had a small share.

Nonetheless, in 1993 Enagas, which had been a publicly-owned company, was partly privatised by the Spanish government. The Spanish private company Gas Natural SDG acquired 91 percent of Enagas, and therefore a new instrumental and temporary society, Sagane, was created immediately after in order to preserve the public nature of the Maghreb-Europe project. Indeed, Sagane, of which the Spanish state was the main shareholder (in a proportion of 91 percent), kept control of all the assets and obligations of the 1991 and 1992 agreements that involved Enagas with regards to the development of the Maghreb-Europe Gas Pipeline, including the investment obligations and the purchasing contracts of natural gas with Sonatrach. In February 1996, once the pipeline was already built, Enagas, which still belonged to Gas Natural SDG, acquired the public participation of 91 percent of Sagane.

In 1994, Transgas,¹⁶² the Portuguese public transport natural gas company, was incorporated into the project, which allowed Portugal to be supplied by Algerian natural gas¹⁶³ from 1997 onwards, but also entailed the interconnection of the natural gas grids between Portugal and Spain, and thus the emergence of a truly integrated Iberian natural gas market. The signing of the agreement took place at the bilateral summit of Spain and Portugal in November 1994, at which it was agreed that Transgas would join the EMPL. A few months earlier, Transgas had

¹⁶² In 1998, the Portuguese government decided to restructure the oil and gas sector by establishing a new company called Galp Energia, which took over Transgas and all its foreign participations. Later on, in September 2006 the Portuguese government decided to concentrate all natural gas transportation and electricity transmission infrastructure in one regulated business. Accordingly, the concession for gas transmission within the Portuguese territory was transferred from Transgas to REN Gasoductos, leaving the participations in pipelines in the Maghreb-Europe, te Extremadura and Al-Andalus gas pipelines within Galp Energia.

¹⁶³ At that time, Portugal was only supplied by LNG from Nigeria.

signed a contract with Sonatrach to acquire nearly 2.5 bcm of natural gas per year through the Maghreb-Europe Gas Pipeline for the next 25 years, whereas Sonatrach would join Trngas with a participation of 5 percent.

In October 1996, the Maghreb-Europe Gas Pipeline was inaugurated and became operational with a total capacity of 8.5 bcm per year, which was expanded in 2002 to 11 bcm per year after Sonatrach and Gas Natural signed a new long-term contract to supply Algerian natural gas through the pipeline. With the passing of time, the Maghreb-Europe Gas Pipeline has represented around one third of all natural gas imports into Spain.

Medgaz Gas Pipeline

Only four years afterwards, in 2000, the Spanish company Cepsa signed an agreement with Sonatrach to promote the feasibility studies to connect Algeria with Spain through a direct pipeline and a new company (Medgaz)¹⁶⁴ was established, following the initial plans that had been worked out during the 1960s and the 1970s. At that moment, technology had not sufficiently advanced to overcome the geological obstacles in record-breaking water depths exceeding 2,100 metres, but with the turn of the century the situation had changed. The project also aimed to respond to the favourable prospects of rising demand for natural gas in Europe and particularly in Spain. The increase in demand was primarily stemming from the development of the electric power generation sector, prompted by the latest technological advances (Hayes, 2004). To this end, a number of European companies such as BP, Gaz de France, Endesa, Eni and TotalFinaElf were invited to join the project and form a consortium.

In 2002, the first feasibility study¹⁶⁵ was published, which envisaged a suitable pipeline corridor crossing the Alboran Sea area in the Western Mediterranean. This pipeline, which stretched from Beni Saf in Algeria to the coast of Almería, in Spain, was able to transport natural gas at the rates of 8 to 16 bcm per year. In 2003, the Italian major Eni decided to withdraw from the consortium of companies, and it was replaced by the Spanish company Iberdrola. The new configuration of

¹⁶⁴ A company was created for the study and promotion of the Algerian-European Gas Pipeline via Spain called Medgaz S.A..

¹⁶⁵ See <https://www.medgaz.com/en/medgaz-completes-marine-survey-for-the-pipeline-linking-algeria-and-europe-via-spain/>

the consortium was composed by Cepsa and Sonatrach, both having a 20 percent stake, and BP, Total, Endesa, Gaz de France and Iberdrola, with 12 percent each.

Following the finalisation of all the feasibility studies and the obtention of the permits, physical works began in the end of 2006, after Sonatrach signed natural gas supply agreements between each partner in the project. Consequently, a new shareholding configuration of Medgaz was determined on the basis of the amounts of natural gas that each partner had agreed with Sonatrach: Sonatrach 36 percent, Cepsa and Iberdrola 20 percent each, and Endesa and Gaz de France 12 percent each. The necessary investment for the total project amounted to roughly EUR 900 million, a figure that included past costs of the project, the construction and start-up of an initial gas pipeline with a capacity of 8 bcm per year, and 210 km under deep sea waters. In the Algerian section, the pipeline included the Hassi R'Mel-Beni Saf gas pipeline operated by Sonatrach, while in Spain, it linked up with the Almería-Albacete gas pipeline belonging to Enagas, which aimed at facilitating its connection to the Spanish and European natural gas grid.

After nearly five years of public works, the new Medgaz pipeline began commercial operations on 1 April 2011, providing 25 percent of all imported natural gas in Spain. At the end of December 2012, the Spanish Iberdrola and Endesa decided to sell their participations in the project to the Belgian gas infrastructure group Fluxys, and only a couple of weeks later, in January 2013, the Spanish Gas Natural Fenosa – the main Spanish shareholder of the Maghreb-Europe Gas Pipeline – reached an agreement with Sonatrach to acquire 10 percent of its participation in the project. However, Sonatrach and Cepsa prevented the Belgian group Fluxys from acquiring Iberdrola's and Endesa's shares by acquiring them themselves. Hence, as of February 2013, the configuration of the shareholders of Medgaz was as follows: Sonatrach with 43 percent, Cepsa with 35 percent, GDF Suez with 12 percent, and Gas Natural Fenosa with 10 percent. Only a few months later, in July 2013, the French group GDF Suez decided to sell its participation in Medgaz, and thus Cepsa acquired 7 percent of GDF Suez's participation and Gas Natural Fenosa acquired the remaining 5 percent.

Throughout its recent history, Algeria has envisaged the construction of two additional transcontinental natural gas export pipelines: Galsi and the Trans-Saharan Gas Pipeline. The Galsi gas pipeline aims at connecting Algeria with Italy directly through the island of Sardinia and then through the island of Corsica with a possible mainland connection to the French

market. The Trans-Saharan Gas Pipeline aims at connecting Algeria with Nigeria, the second largest African gas producer, via Niger.

Table 9 provides a comprehensive list of all long-term contracts signed by Sonatrach and European companies to export natural gas through the three cross-border Mediterranean natural gas pipelines in the period 1977-2015. As the dates of completion, and thus operation, of the three pipelines are 1983 – Transmed –, 1996 (for the Spanish segment) and 1997 (for the Portuguese segment) – GME –, and 2011 – Medgaz –, the delivery of the first contract begins in 1983 for Italian and Slovenian companies, and in 1996 and 1997 for Spanish and Portuguese companies.

Table 9. Sonatrach's portfolio of long-term contracts to export pipeline gas (1977-2015)

Date contract	Client	Country	Yearly volume	First delivery	End of deliveries	Contract duration	Total volume
1977	Snam	Italy	10.30	1983	1992	10	103
1985	Petrol	Slovenia	0.60	1992	2007	16	10
1989	Etap	Tunisia	0.40	1990	1999	10	4
1990	Snam	Italy	10.30	1992	2019	28	288
1992	Enel	Italy	4.00	1994	2014	21	84
1992	Enagas	Spain	6.00	1996	2015	20	120
1994	Transgas	Portugal	2.50	1997	2020	24	60
1997	Etap	Tunisia	0.40	1999	2020	22	9
1999	Edison	Italy	4.00	2004	2018	15	60
2002	Gas Natural	Spain	9.00	2005	2019	20	180
2002	Cepsa	Spain	1.00	2011	2021	10	10
2003	Mogest	Italy	0.50	2005	2019	15	8
2006	Cepsa	Spain	1.60	2007	2027	20	32
2006	Iberdrola	Spain	1.60	2009	2028	20	32
2006	GdF	France	0.96	2009	2028	20	19
2006	Endesa	Spain	0.96	2009	2028	20	19
2007	EDP	Portugal	1.60	2008	2018	10	16
2013	Gas Natural Fenosa	Spain	0.80	2014	2031	18	14.4

Source: Compiled by the author based on several sources: Aïssaoui (1999, 2001); Ballesterio (2017); Regional surveys of the world. The Middle East and North Africa (2004); The Report, Algeria (2006-2014); Cedigaz News Report; Gas Matters Today (2003); Sonatrach. Rapport Annuel (2001-2015)

Unlike the LNG long-term contracts that have seen their duration reduced over time due to the changes favouring the spot market over the “take-or-pay” contracts, in the case of the pipeline gas, the contract duration continues to be rather stable along the timeline, depending on the capacities to import pipeline gas. In contrast, the total volumes contracted have been lowered over time, which is the result of further diversification in the sources of origin of natural gas imports, particularly for Italy, but also Spain. As we will review in the next section, Italy has considerably increased imports of pipeline gas from Russia, whereas Spain has increased LNG imports from different sources (Qatar, US, Nigeria...), in many cases at the expense of the pipeline gas to be imported from Algeria. In the case of Portugal, LNG imports have mainly come from African and Asian destinations, leaving little margin for pipeline gas imported from Algeria. On the other hand, and as noted, the absence of physical interconnections from Algeria to France (directly or via Spain) has triggered French imports of Algerian gas being transported by LNG. The sole interconnection between the Spanish and French gas systems, the so-called VIP Pyrenees, is situated on the western flank of the Pyrenees, far away from the entry points of Algerian gas in the Iberian Peninsula.

The specific patterns of trade flows of natural gas between Algeria and the specific north Western Mediterranean countries will be assessed in detail at the next section when examining the downstream segment of the GVC.

3.6 The downstream segment

The unfolding of the GVC in the Western Mediterranean, in which its downstream segment mainly materialises in consuming countries like Italy, Spain and France, cannot be disentangled from the very fact that these three consuming countries in this geo-energy space are part of a supranational institution that has also framed their energy policy. Hence, we cannot assess the evolution of the GVC without properly assessing how the set of relations between the EU and Algeria has progressed since the latter became independent, and soon afterwards, nationalised the hydrocarbon resources of the country.

Under the French colonial regime, Algeria’s territory was divided into three departments of France. As such, in 1957, despite being in the midst of a war for independence from France, Algeria automatically became part of the EC when France signed the Treaties of Rome. By way of analogy, on achieving independence in 1962, Algeria exited the EC and distanced itself from

Europe by aligning itself with the Non-Aligned Movement, seeking to break out of an economic order dominated by rich industrialised countries, including those of the EC.

In this context, the first years after Algeria's independence, relations with Europe progressed very modestly. The bilateral cooperation with the EC dates back to 1976 when a first Cooperation Agreement to facilitate tariff-free entry for selected goods to the EC was signed. This agreement was the outcome of a long process whose origin emanates from the Treaties of Rome.¹⁶⁶ These cooperation agreements of first generation between the European Economic Community (EEC) and three Maghreb countries – Algeria, as well as Morocco and Tunisia – were limited to trade facilitation of certain type of goods by providing free access or reducing import quotas to the EEC market, along with a package of financial assistance targeting economic development.

A second attempt to enhance this bilateral cooperation came between 1985 and 1992 when a direct dialogue on energy issues between the EC and Algeria was established. However, neither attempt reflected well the increasing importance of Algeria as a possible natural gas supplier to Europe, able to increase its energy security by diversifying the various possible sources. After the fall of the Berlin Wall, and the subsequent transition that many Central and Eastern European countries initiated, the EEC engaged in their transition to democracy and market economy. Precisely due to concerns about long-term energy security for Western Europe and the economic situation in Eastern Europe, the EU promoted a Treaty on the European Energy Charter¹⁶⁷ that was signed in December 1994.

In response to this initiative, France proposed an analogous policy targeting the Southern Mediterranean countries like Algeria through a Renovated Global Mediterranean Policy. However, it was not until 1995, when the Barcelona Conference marked the start of the so-called Barcelona Process and the establishment of the Euro-Mediterranean Partnership (EMP), which

¹⁶⁶ The signatories to the EEC Treaty had sketched out the principle of cooperation in 1957 in a declaration of intent, which stated that the Community was ready to conclude conventions for economic association with the independent countries of the French franc area in so far as they were “anxious to maintain and intensify the traditional trade flows between the Member States of the European Economic Community and these independent countries and to contribute to the economic and social development of the latter.” As Algeria was not independent yet, this declaration referred only to Morocco and Tunisia.

¹⁶⁷ The Treaty on the European Energy Charter stemmed from the European Energy Charter, which was a political declaration that aimed at promoting mutually co-dependent beneficial cooperation on the energy sector, given Europe's growing energy demand and vast resource availability in post-Soviet nations.

entailed the first over-arching EU regional cooperation policy with the Southern Mediterranean countries. A few years later, in 2004, the EU launched a second major policy instrument of cooperation named European Neighbourhood Policy (ENP).

The first of these policy instruments, the EMP, was a broad initiative covering items from democracy to trade with the purpose of establishing an economic and financial partnership that could foster political stability and security in the region. Likewise, the centrality of energy issues was acknowledged, among others, in the only EC Communication entirely dedicated to energy cooperation in the so-called “Euro-Mediterranean region” (European Commission, 1996). The EMP energy vector was characterised by a twofold regional approach: political dialogue between energy ministers from both shores in the framework of Euro-Mediterranean Ministerial Conferences and expert dialogue between representatives of the partner countries and the EC in the Euro-Mediterranean Energy Forum. Ultimately, the objective consisted of associating the Southern Mediterranean countries with the aforementioned Treaty on the European Energy Charter. In this context, the position of Algeria as the largest Mediterranean producer of natural gas became extremely important (Aïssaoui, 2001).

In 2008, the EMP-Barcelona Process evolved into the Union for the Mediterranean (UfM) at the Paris Summit of Heads of State and Government at which an intergovernmental organisation¹⁶⁸ was established with 43 member states and the EU was given a prominent role. One of the six priority areas in which the UfM works is energy, and in 2015 the UfM energy platforms were launched in order to foster dialogue between regulators, private sector representatives and academia. One of these UfM energy platforms is dedicated to natural gas.¹⁶⁹

The second of these policy instruments, the ENP, was a policy dedicated to cooperation between the EU and its southern and eastern neighbourhood countries over a number of areas. The ENP novelty was that it combined regional aspects with an increasingly strong bilateral dimension: the EC proposes bilateral action plans¹⁷⁰ to each of its neighbour countries, framing cooperation around a series of issues, among which is energy. The plans encourage convergence toward the

¹⁶⁸ The UfM was established in 2008 as a multilateral partnership. It only acquired the status of intergovernmental organisation in 2015. In addition, the EU adopted a prominent role only in 2012 when the High Representative / Vice-President of the EC was designated as co-president of the organisation.

¹⁶⁹ See <https://www.ufmgasplatform.org/about/>

¹⁷⁰ After the review of the ENP in November 2015 they are called “Partnership priorities”.

EU legal and regulatory framework insofar as each concerned country is available to commit itself (Escribano, 2010). It has been argued that the bilateral dimension of the ENP was meant to bypass the political obstacles hampering regional cooperation among the Southern Mediterranean countries (Tholens, 2014).

The ENP did not only represent a reframing of the Euro-Mediterranean energy cooperation (Vantaggiato, 2013), but of the whole of the EU external dimension. Three main events occurred in or around the year 2004: first, the Second Energy Package entered into force framing the EU internal energy policy in much more ambitious terms than ever; second, the eastward enlargement of the EU took place; and lastly the Energy Community Treaty (ECT), extending the energy acquis to countries in Southeastern Europe, holding a membership perspective, was signed in 2005 and entered into force in 2006. The same could not be expected at that precise moment for the Southern Mediterranean countries, even if all these changes forced Algeria to adapt its hydrocarbon policy considering that the North African country was already exporting most of its natural gas to the EU, as we have examined at length in Chapters 2 and 3.

Political divisions impeded regional cooperation among Southern Mediterranean countries. In the absence of a membership perspective, the EC had no coercive strength (Vantaggiato, 2016). The presence, among the latter, of net exporting countries like Algeria and net importing countries like Morocco or Tunisia that also represented important transit countries unveiled steep asymmetries of interests and bargaining power (Padgett, 2011) both between themselves and with the EU. Hence, the ENP came to perform a key policy function: it marked the boundaries of the EU, separating members (and potential members such as the ECT signatories) from countries without a membership perspective (Cardwell, 2011). It also juxtaposed bilateral relations over an initiative initially premised on a regional approach. Importantly, with the launch of the ENP, the EC removed Mediterranean regional energy initiatives from the EU Energy Policy and inserted them into the scope of EU External Relations.

The EU first talked about a Mediterranean Energy Community in the aftermath of the Arab Spring (European Commission, 2011).¹⁷¹ The idea was to advance Euro-Mediterranean energy

¹⁷¹ See the Joint Communication “A partnership for democracy and shared prosperity” (March 2011), specifically the following reference (p. 10): “It is desirable to open a credible perspective for the integration of the Southern Mediterranean in the EU internal energy market based on a differentiated and gradual approach. In the mid to long term, this would mean establishing a form of ‘EU-Southern Mediterranean Energy Community’ starting with the Maghreb countries and possibly expanding progressively to the Mashreq. Extending the Energy Community Treaty

integration as a driver of Mediterranean southern partners' development, with the final goal to contribute to shared prosperity. In its original formulation it was presented as another example of outward Europeanisation in the field of energy, with Southern Mediterranean countries having to almost passively adopt the energy related *acquis communautaire*. Energy convergence was simply understood as downloading EU energy software (norms) without fully considering the divergence in energy preferences among and between EU member states and Mediterranean Partner Countries (MPCs) (Escribano, 2016). Recent EU documents point to either an extension of the Energy Community Treaty toward those few Southern Mediterranean countries ready to adopt a significant part of the EU *acquis*, or to the creation of an EU-North Africa Energy Community, based on a differentiated and gradual approach (Glachant & Ahner, 2013).

During its Presidency of the European Council, the Italian Government hosted in November 2014 a high-level Conference on Energy, whose main outcome was the establishment of three platforms for Euro-Mediterranean energy cooperation: gas, electricity, and renewable energies.

In February 2015, the EC issued a further communication, launching the European Energy Union. It strongly advocated the completion of the internal market and for enhanced interconnection among member states. The discourse framing these topics was based on geopolitical worries and energy security. The Mediterranean entered the picture of the Energy Union due to gas supplies present in the region. Steering committee meetings for the gas platform began in March 2015. In May 2015, the new EU Commissioner for Energy undertook an energy diplomacy trip to Algeria and then to Morocco to deepen energy ties. In Morocco, the three platforms were relaunched. The platforms are inscribed into the framework of the UfM. However, the *Observatoire Méditerranéen de l'Energie* (OME) industrial association was named as the secretariat for the gas platform. The UfM secretariat, instead, coordinates the work of the electricity platform together with Mediterranean Energy Regulators (MEDREGs) and Med-TSO associations.

This relation of strong interdependence in the energy sector between Algeria and the EU led to the establishment of an EU-Algeria strategic partnership on energy in May 2015. It covers cooperation on natural gas, renewable energy, energy efficiency and energy market integration.

with the Union's Eastern and South-Eastern neighbours, or building on its experience, this community should cover relevant parts of the EU's energy legislation with a view to promoting a real and reliable convergence of South Mediterranean partners' energy policies with EU policy."

It consists of an annual meeting of the EU Commissioner for Energy and Climate Change and the Algerian Minister for Energy, two working groups on gas and renewable energy and energy efficiency, and a business forum. The strategic partnership on energy is a permanent and structural component of Euro-Algerian relations. The EU Commissioner and the Algerian Minister for Energy, as well as the working groups, have been meeting since 2015.

From an energy cooperation standpoint, as well as others, there is little doubt that the 1971 nationalisation process of the gas and oil industries in the country has more implications than the 1962 independence process in defining the type of relations that Algerian NOC would be forging with its Western Mediterranean counterpart IOCs in the pathway toward energy cooperation. We cannot speak of a geo-energy space by then, but we can date to 1971 a starting point from which different agents – public and private – from different countries in the Western Mediterranean are in operation to progressively build up an architecture of institutions and processes – formal and informal, public and private –, which might contribute to the formation of a new geo-energy space (Mañé-Estrada, 2006).

We will now look into how this relationship was built from a historical perspective taking into consideration certain aspects in the development of the downstream sector of the GVC in the Western Mediterranean in Italy, Spain and France.

3.6.1 The surge of gas trade between Italy and Algeria

Following the Second World War, Europe experienced a shift from a coal-based to an oil-based energy paradigm, which responded to geopolitical reasons. Indeed, a new international energy framework facilitated the access to cheap crude oil from the Middle Eastern region. In this context, Italy followed a pattern like the rest of Western European nations toward an energy-intensive development, grounded by the increase in crude oil consumption, especially after the 1950s. Nevertheless, in parallel, Italy was a pioneer in the use of natural gas (methane) for industrial heating purposes, which became a very timely source in this approach, and also as a means to reduce the consumption of coal, without necessarily increase the import of oil. The

growth of methane industry was the result of a strategy undertaken by Agip.¹⁷² Later, other Western European economies followed the same path.

In fact, from 1935 onwards very small companies began the exploitation of small spots of natural gas mixed with saltwater in the delta of the Po River, in an area administratively shared by the regions of Veneto and Emilia Romagna. This very small-scale industry was integrated as part of the government's policy for national fuels, even if natural gas producers dismissed the possibility of conducting more serious explorations to locate large reservoirs of natural gas that could be developed and marketed. However, a few years later, at the end of the Second World War in 1943, when Agip had also acquired new technology, it discovered the Caviaga reservoir, a relatively large field near Lodi in the region of Lombardy.

With the end of the Second World War, Enrico Mattei¹⁷³ was appointed commissioner of the partisan forces at Agip and under his leadership he built the hegemony of Agip, and later Eni, over the hydrocarbon national industry (Pozzi, 2003). Hence, the underlying strategy focused on leveraging natural gas to foster the growth of national industries in northern Italy, thereby fuelling the post-war economic boom known as the "Italian economic miracle".¹⁷⁴ Rather than simply replacing imported oil, natural gas served as a more affordable and efficient alternative to imported coal, which was essential for expanding industrial activities. The substantial profits generated from natural gas sales were reinvested in exploration, production, pipeline expansion, and attracting new customers (Pozzi, 2003).

¹⁷² *Azienda Generale Italiana Petroli* (Agip) was established in 1926 as an Italian joint stock company, whose purpose was to conduct all activities related to the oil industry, producing petrol, diesel, LPG, lubricants, fuel oil, and bitumen. In 1953, it became part of Eni.

¹⁷³ A very charismatic figure in the Italian political and economic landscape, Mattei was the son of a policeman who managed to set up his own chemical plant in Milan in spite of his humble origins. During the Second World War, he became a member of the Christian Democratic partisans and fought against the Nazi occupation. In 1945, he became President of Agip, and later on of Eni when the former integrated the latter. He passed away suddenly in a plane crash in 1962. For further information on the relevance of the figure of Mattei and his visionary role as chairman of Eni, please see Dechert (1963), Frankel (1966) and Colitti (1979).

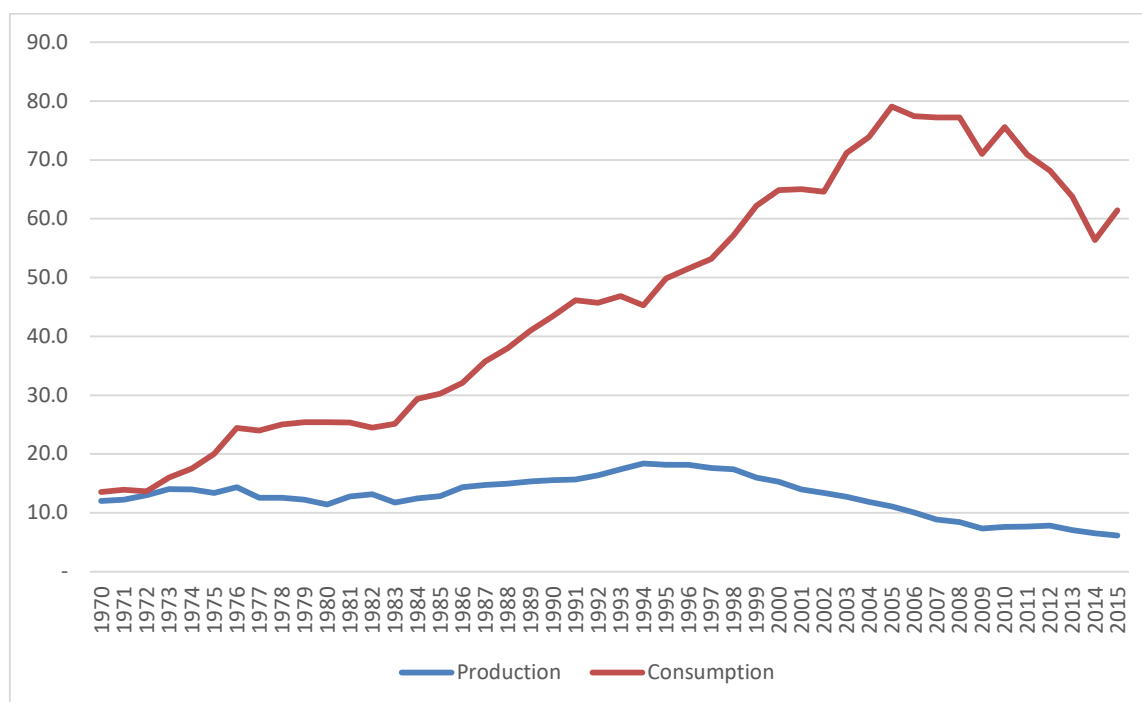
¹⁷⁴ In November 1949, Mattei publicly stated that the Po Valley's subsoil was rich in oil and methane, and Italy would solve all its energy needs using its own resources. Through the Italian press, he then promoted the idea that Italy, while still suffering the consequences of the Second World War, would soon become rich. Agip's financial value immediately grew in the stock exchange markets, and the company (owned by the state, but operating as a private company) became at once solid and important. The reality was a little different: in the Po Valley, a certain amount of methane had been found together with a small quantity of oil.

A new law was passed by the Italian Parliament in 1952 to set up *Ente Nazionale Idrocarburi*, (Eni) which absorbed Agip, as well as all the other state-owned entities that operated in the hydrocarbon business (i.e., Snam and Anic). Thus, the exclusive rights to explore, produce and transport natural gas within the Po Valley area were given to Eni, and later it would also gain a monopoly over gas imports, transport and marketing. By 1965, Italy was the largest producer and consumer of natural gas in Western Europe (Darmstadter & Teitelbaum, 1971), as other countries such as the UK did not yet produce natural gas,¹⁷⁵ and others like Spain or Germany were either not yet producing or consuming natural gas. Thanks to a strong strategic vision on the expansion of the Italian natural gas sector, Mattei not only promoted the construction of a national gas grid to enhance the consumption of natural gas across the country, but it also forged strong alliances with big companies abroad.

In this context, Mattei soon realised that the future domestic demand of gas consumption would not be supplied by domestic production. Figure 21 illustrates the evolution of natural gas production and consumption in Italy from 1970 onwards, and one can easily notice that these two indicators follow divergent trends since 1972, as the consumption needs exceed by far the production capacity of the country. The time in which trends diverge coincides with the signing by Eni of the first contracts to import natural gas from the Soviet Union and the Netherlands, and the first shipments of Libyan natural gas to a new LNG regasification facility located near Genoa. In this vein, the trend in gas consumption is upwards with normal volatility connected to the economic cycle until 2008, when this trend experiences an important turnaround as a result of the great recession, and subsequent sovereign debt crisis in the Eurozone that hit the Italian economy until 2014 and triggered an oversupply crisis that affected the European market of natural gas.

¹⁷⁵ UK gas development began during the second half of the 1960s, following the successful development of the oil reserves in the North Sea. UK fields were developed (until the late 1990s) purely for the domestic market and it began exporting to the European continent in 1989.

Figure 21. Natural gas production and consumption in Italy in bcm (1970-2015)



Source: Compiled by the author based on data retrieved from BP Statistical Review (several years)

For many years, Mattei had managed to build strong relationships with producing countries based on pure pragmatism. This was the case when he was courting the Algerian insurgent National Liberation Front (FLN) before independence, which would facilitate important agreements of Eni with Sonatrach after the nationalisation of Algerian hydrocarbons in 1971 (Musso, 2017). To this end, despite the sudden loss of Mattei in 1962, Eni's strategy of internationalisation that he devised would continue over time.

During the 1970s, as a result of the existing plans to start importing natural gas from Algeria, a very vivid debate was held within the Eni group to devise whether natural gas should be imported using ship-based LNG technologies or a direct pipeline link. LNG costs were very high, which resulted in the commissioning of the first feasibility studies in 1970 to build a sub-sea pipeline that could connect Algeria with Italy, as explained in detail. Likewise, with the inauguration of the first regasification facility in Panigaglia (near Genoa), the subsidiary of Eni, Snam, started delivering LNG from Libya on its own tankers to Italy (Colitti, 2003). However, this first supply contract resulted in various problems related to the quality assurance of the product, which would have required additional refining investments either at the Libyan

liquefaction or at the Italian regasification plants (Dispenza, 2003). Against this backdrop, Snam management finally considered the pipeline option as the most effective to bring natural gas from Algeria. In this context, Sonatrach also concurred with this idea, taking into consideration the cost experience with LNG exports. Finally, as Eni would be mainly involved in the financing of the costs of the pipeline and the distance of a pipeline from the Hassi R'Mel mega-giant field to the Tunisian border was shorter than to the Algerian liquefaction plants on the Mediterranean coast, Sonatrach strongly endorsed the pipeline option.

The strategic decision to import Algerian natural gas via pipeline and not via LNG was not insignificant and drastically shaped the future evolution of the Italian natural gas market. First and foremost because Italy, which as of 2015 was the second largest European consumer of natural gas in between Germany and the UK, has based the expansion of the natural gas sector on imports reaching Italy via a transnational pipeline network, which then redistributes domestically through another network owned and operated by Snam Rete Gas. Indeed, in 2001, 90 percent of Italian imports of natural gas reached Italy via transnational gas pipelines,¹⁷⁶ contrary to the remaining 10 percent that reached Italy via LNG. Similarly, in 2015, 90 percent of imported natural gas was reaching Italy via pipeline too. The only significant difference with regards to the situation in 2001 is that pipeline gas was overwhelmingly supplied by Russian companies and no longer by Algeria.¹⁷⁷

Hence, one of the main consequences is that Italy, despite being one of the main natural gas consumers in Europe, is less equipped with LNG facilities than other European countries with similar natural gas consumption patterns like Spain, as we will examine in the next sub-section. Due to the fact that Italy has opted for pipeline gas instead of LNG when importing since the beginning of the development of natural gas markets, the number of LNG infrastructures has remained low. Table 10 summarises the list of operational LNG terminals, both onshore (1) and offshore (2), which are located on the north-western coast (2) and east-western coast (1) of the country. From Table 10, below, it can also be inferred that the percentage of total capacity worldwide is considerably low due to the fact that Italy has prioritised pipeline infrastructure

¹⁷⁶ Out of this 90 percent of gas imports, almost 90 percent of this natural gas came from Algeria and Russia alike (BP, 2002).

¹⁷⁷ In 2015, more than 50 percent of pipeline gas was supplied by Russian companies compared with 13 percent supplied by Algerian Sonatrach, which differs from the 45 percent of 2001.

over LNG infrastructure. In this respect, in 2015 Italy accounted for 5.4 percent of total natural gas imports worldwide, but only for 1.61 percent of total worldwide capacity to import natural gas via LNG (BP Statistical Review of World Energy, 2016). These two percentages prove that Italy, despite being one of the largest natural gas consumers worldwide, has been mostly obtaining this gas from an extensive transnational pipeline connection and not from LNG.

Table 10. List of LNG import terminals in Italy (2015)

Name of the LNG terminal	Panigaglia. La Spezia	Adriatic LNG. Rovigo (offshore)	Livorno OLT Cross Gas (offshore)
Shareholders	Snam (100 percent)	ExxonMobile (70.7 percent); Qatar Terminal (22 percent); Snam (7.3 percent)	E.On Group (46.79 percent); Iren Group (46.79 percent); OLT Energy Toscana (3.73 percent); Golar LNG (2.69 percent)
Year of operation	1971	2008	2013
Capacity (bcm/year)	3.50	8.00	3.75
Percentage of capacity worldwide	0.45	0.77	0.39

Source: Compiled by the author based on data obtained in Snam, ExxonMobile and E.On Group

After 2015, the Italian Government already authorised the construction of other three LNG terminals: an LNG terminal in Falconara Marittima, owned by Api Nòva Energia, with a capacity of 4 bcm per year; an LNG terminal in Gioia Tauro, owned by MedGas LNG Terminal, with a capacity of 12 bcm per year; and an LNG terminal in Porto Empedocle, owned by Nuove Energie, with a capacity of 8 bcm per year (Snam, 2020).

The absence of higher volume capacity to import LNG has been offset by an extensive network of transnational pipeline connections that have made the Italian gas market as one of the most dynamic and better interconnected in Europe. In addition to the Trans-Mediterranean Gas (Transmed) pipeline (see Figure 20) with a total capacity of 38 bcm per year and operational since 1983, there are the following transboundary gas pipeline connections as of 2015:

- The Trans-Austria Gas (TAG) pipeline is the largest supplier of natural gas in Italy. With a total capacity of 40 bcm per year, the pipeline mainly transports Russian natural gas from the Slovakian-Austrian border to the Austrian-Italian border. It is owned by the Italian company Snam (84.47 percent) and the Austrian company Gas Connect Austria

(15.53 percent). It has been operational since 1974 but its capacity was expanded in the 1980s and 1990s.

- The Transgas pipeline is the third largest supplier of natural gas in Italy. With a total capacity of 22 bcm per year, it is the Swiss section of the high-pressure natural gas pipeline that connects the Northern European gas fields with Italy across Switzerland. It is owned by the public company Swissgas (51 percent), the Belgian company Fluxys (46 percent) and the German company Uniper Global Commodities (3 percent). The Italian interconnection became operational in 2003.
- The Greenstream Gas pipeline is the fourth largest supplier of natural gas in Italy. With a total capacity of 11 bcm per year, this pipeline connects Libya with Sicily through a sub-sea pipeline following the example of the Transmed Gas Pipeline. It is owned by Eni (50 percent) and the Libyan National Oil Company (50 percent) and became operational in 2004.

Other pipeline projects were commissioned, the main one of which was the Trans-Adriatic Gas pipeline as part of the EU Southern Gas corridor, which aims to market natural gas from the Caspian Sea region to EU countries like Greece and Italy.

Table 11 shows the volumes of natural gas imported to Italy by entry point during the timespan 2002-2015. As explained, there are five entry points by transnational gas pipelines and three entry points by LNG terminals. The table confirms that Italy has been importing pipeline gas to a much larger extent than LNG, as noted. However, the most striking feature is the decrease in volumes by the Transmed entry point in Sicily and the increase in volumes by the TAG entry point in Tarvisio, which can be explained by the drastic fall of gas imports from Algeria since 2012-2013, which were replaced by imports of Russian gas, making Italy the most dependent EU country on Russian gas from 2015 onwards.

Table 11. Volumes of imported natural gas by Italian entry point in bcm (2002-2015)

	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015
Tarvisio (TAG)	21.0	22.3	24.3	23.7	22.9	24.1	24.6	22.9	22.5	26.5	23.9	30.3	26.2	30.2
Gorizia (Slovenian)	0.1	0.2	0.3	0.3	0.2	0.2	0.1	0.0	0.1	0.2	0.2	0.0	0.0	0.0
Passo Gries (Transitgas)	13.8	14.6	16.5	16.2	17.7	15.1	15.7	12.0	7.8	10.9	9.0	7.5	11.4	10.5
Mazara del Vallo (Transmed)	20.6	21.1	23.3	25.2	24.5	22.2	24.4	21.4	25.9	21.3	20.6	12.5	6.8	7.3
Panigaglia (LNG terminal)	3.5	3.5	2.1	2.5	3.2	2.4	1.6	1.3	2.0	1.9	1.1	0.0	0.1	0.0
Gela (Greenstram)	0.0	0.0	0.5	4.5	7.7	9.2	9.9	9.2	9.4	2.3	6.5	5.7	6.5	7.1
Cavarzere (LNG terminal)								1.5	7.1	7.0	6.2	5.4	4.4	5.7
Livorno (LNG terminal)												0.3	0.1	0.1
Others	0.2	1.1	0.9	1.1	1.2	0.7	0.6	0.8	0.4	0.3	0.2	0.4	0.3	0.4
Total (in bcm)	59.3	62.8	67.9	73.5	77.4	74.0	76.9	69.3	75.3	70.4	67.7	62.0	55.8	61.3

Source: Compiled by the author based on data retrieved from *Autorità di Regolazione per Energia Reti e Ambiente* (ARERA)

Table 12 describes the trade flow of natural gas between Algeria and Italy in the timespan 1983-2015, from the year in which the Transmed Gas pipeline became operational, and therefore trade flows intensified. The first two columns detail the amount of natural gas imports from Algeria to Italy via pipeline and via LNG. The third column illustrates the ratio of Italian imports of Algerian natural gas to the total Algerian exports of natural gas, while the last column reflects the ratio of Italian imports of Algerian natural gas to the overall Italian imports of natural gas. Hence, the third column measures the weight of Italian imports of Algerian natural gas in relation with the total Algerian exports of natural gas, whereas the last column measures the weight of Algerian exports to Italy in relation with total Italian imports of natural gas.

As previously mentioned, data shows that Italy has been mainly importing Algerian natural gas via pipeline and not via LNG (90 percent versus 10 percent on average), and while the absolute

volumes of imported natural gas have been increasing and maintained with fluctuations until 2011, they have started to severely decrease since then. This is not only the result of lower levels of natural gas consumption in Italy earmarked as from 2009 (see Figure 21) and the higher consumption of natural gas in Algeria, as well as the oversupply crisis that hit the European market of natural gas in 2009 and 2010, but also the fact that Russian companies have become the largest suppliers of natural gas in Italy. The latter is the result of an agreement in 2013 between Eni and Sonatrach¹⁷⁸ to reduce certain quantities of the contractual gas volumes delivered into Italy with the aim to seek more competitive prices for natural gas other than those imposed by oil-indexed long-term contracts, which are the main typology used in Sonatrach's agreements.

Table 12. Trade flow of natural gas between Algeria and Italy (1983-2015)

	Total natural gas imports (in bcm)		Ratio of Italian imports to Algerian exports (in percent)	Ratio of Italian imports from Algeria to total Italian imports (in percent)
	Pipeline	LNG		
1983	2.13	0	12	
1984	6.28	0	32	
1985	8.22	0	37	
1986	8.12	0	41	
1987	10.84	0	43	
1988	10.53	0	41	
1989	11.19	0	38	39
1990	11.08	0.03	35	36
1991	14.1	0.14	42	42
1992	14.75	0.59	44	44
1993	13.65	0.29	39	42
1994	11.53	0.21	37	40
1995	17.44	0.05	47	50
1996	19.08	0	47	51

¹⁷⁸ See <https://www.eni.com/en-IT/media/press-release/2013/05/eni-and-sonatrach-reached-an-agreement-on-their-gas-contract.html>

1997	18.8	1.9	42	53
1998	20.81	1.99	43	53
1999	24.64	2.06	44	54
2000	25.6	2.6	46	49
2001	21.85	2.25	42	44
2002	20.56	2.2	39	39
2003	21.45	2.02	39	38
2004	23.6	2.1	42	38
2005	25.23	2.5	42	38
2006	24.46	3	45	36
2007	22.1	2.43	42	33
2008	24.44	1.56	44	34
2009	21.37	1.27	43	33
2010	27.56	0.72	51	38
2011	21.3	1.6	45	33
2012	20.6	1	43	32
2013	11.4	0.05	27	20
2014	6.2	0.1	15	12
2015	6.6	0.05	16	12

Source: Compiled by the author based on data retrieved from Cedigaz, and BP Statistical Review

The result of this process can be perceived in both the share of Italian imports to Algerian exports and the share of Italian imports of Algerian gas to the total of Italian imports of gas, which have been considerably reduced overtime from record figures at the end of the 1990s. There are two additional factors that can explain the dynamics therein: firstly, further development of natural gas in the 1990s related to the phasing out of fuel oil in the power sector that contributed to the expansion of gas-fired power plants after Italy gave up nuclear power; secondly, the liberalisation process of the Italian gas market at the end of the 1990s and beginning of the 2000s, which followed the approval of several EU directives to this end.

Figure 21 shows the sharp increase of natural gas consumption in Italy during the timespan 1994-2005. In fact, by 2005 natural gas accounted for 35.8 percent of total Italian energy consumption – the second most important after oil –, with 24 percent of total gas sales

dedicated to industrial consumption, 35 percent to residential consumption and 38 percent to power generation (*Autorità per l'Energia Elettrica e il Gas*, 2006). This reflects the importance that power generation was playing in the consumption of natural gas in Italy.¹⁷⁹ Indeed, demand of natural gas for the purpose of generating power more than doubled between 1990 and 2000, even if this increase in gas demand was also transposed to the other sectors (commercial and industrial consumption) to a lower extent: 32.5 percent increase for residential and commercial use, and 29 percent increase for industrial use.

The liberalisation of the gas market was also a decisive factor in boosting natural gas consumption. Before liberalisation, the Italian gas industry was vertically integrated, and thus Eni was involved in the natural gas value chain from production to distribution, either as a monopolist or as the dominant player together with Eni subsidiaries (i.e., Snam and Agip, among others).

European liberalisation¹⁸⁰ aimed at breaking vertical integration in the gas industry and introducing competition by dissociating potentially competitive activities of the gas industry (i.e., production, trade, distribution...) from those segments of the GVC characterised by a natural monopoly (i.e., transmission and storage), and also by granting third-party access to essential facilities (i.e., distribution networks, LNG terminals, storage facilities...). Eventually, the reforms were aimed at liberalising the demand side of the market so that customers could pick which company was supposed to provide natural gas.

Even before the transposition of EU directives, other national laws had introduced some profound changes to the Italian gas industry. In this vein, Eni's exclusive rights to gas exploration and production were abolished in the 1990s, and Eni was progressively privatised, with state ownership reduced to 30 percent. Similarly, an independent regulatory commission for electricity and gas was created called *Autorità per l'Energia Elettrica e il Gas* with the aim of achieving efficiency goals by shifting from direct control of public utilities and cost-plus practices to price cap methods (Cavaliere, 2007). Concerning the transmission network, Italy opted for

¹⁷⁹ Data shows that Italy steadily increased the use of natural gas for power generation from 1994 to 2008 when it reached its highest peak of 56.41 percent in the electricity mix, while it slowly decreased thereafter (Ember, 2021). The year 2000 is the first one in which natural gas surpasses oil as the main source of electricity production (Ember, 2021).

¹⁸⁰ As a result of the transposition of the first EU Gas Directive (98/30/EC), the second EU Gas Directive (2003/55/EC), and the Third Energy Package approved in 2009, effective March 2011.

dissociating the national transmission system from the gas imports and supply. On the one hand, Snam Rete Gas assumed the operation of the national transmission network, whereas gas imports and supply in the sale market were assumed by a subsidiary of the former integrated utility, Eni Gas & Power. Snam, initially controlled by Eni, was partially privatised in 2001 by floating 40 percent of its shares, and it was mainly held as of 2015 by CDP Reti (29 percent).

3.6.2 The surge of gas trade between Spain and Algeria

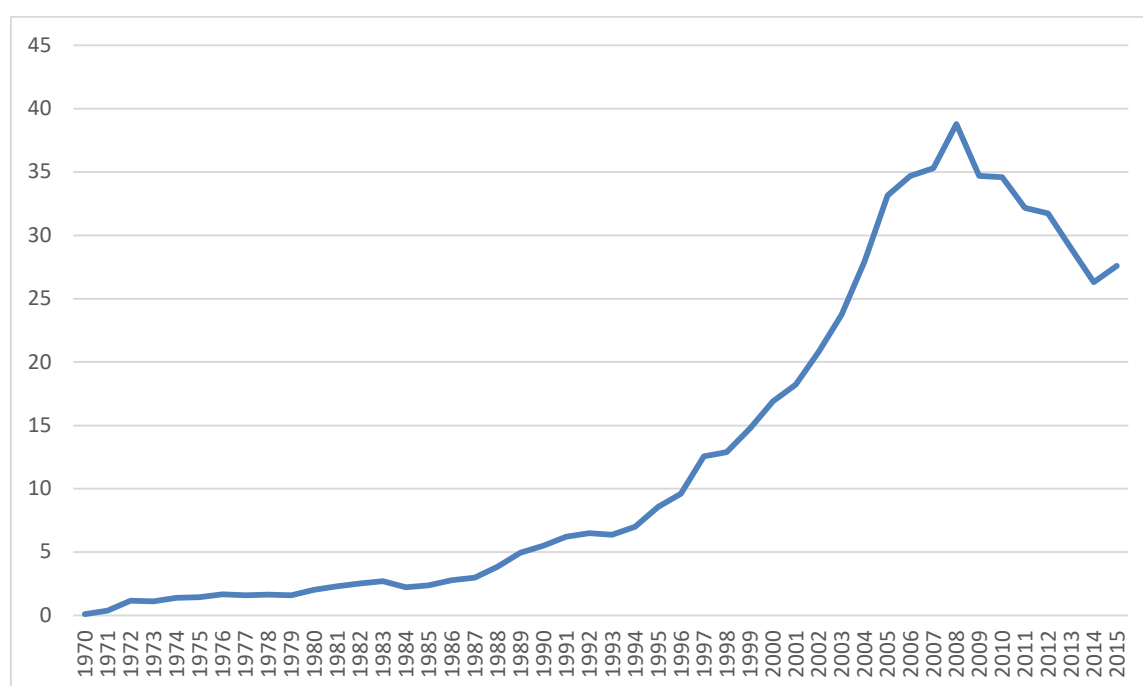
Unlike the Italian case, Spain developed its natural gas sector at a much later stage because it was not endowed with domestic hydrocarbon resources. In this regard, when Italy was already developing natural gas in the Po Valley, Spanish gas production was non-existent and the consumption was very marginal, even if between 1960 and 1973, Spain's total primary energy demand multiplied by three at an annual growth rate of 8.5 percent (IEA, 1978). The manner in which Spain managed to compensate such energy demand increase was through heavily increasing oil imports. Hence, Spain was severely exposed to crude oil price fluctuations during the 1973-74 oil shock, which triggered economic growth stagnation as a result of a balance of payment crisis, very high inflation rates and mounting interest rates.

As previously noted, the preliminary engineering reports prepared by French companies to build sub-sea pipelines between Algeria and Spain date back to 1963 (Pawera, 1964) and the feasibility studies undertaken by Segamo date back to 1973, but the cross-border gas trade projects did not materialise until the second half of the 1990s. This responds to both Spanish endogenous and exogenous factors. Among the endogenous factors, probably the main reason to explain such late development is related to the weakness of the public national gas company Enagas, which as compared to other national enterprises such as Eni, did not have the capacity to mobilise the resources required to create a successful natural gas import project in the 1970s and 1980s. Expanding gas infrastructure required major public support in the form of both regulation and financing, which did not arrive until the gas market was liberalised during the 1990s. Whereas crude oil prices declined after 1982, Spain found no major impediment to easily continue its dependence on imported oil, and thus no market incentives were generated to partly shift its primary energy mix to natural gas.

This situation did not change significantly until the mid-1990s, when the Spanish government was able to stimulate a burgeoning gas market by opening the Spanish gas and electric power markets to new investments, particularly in gas-fired power generation (Hayes, 2006; Mañé-

Estrada, 2009). Figure 22 shows the intensification of the pace of natural gas consumption in Spain from the mid-1990s, which reflects the change of model of primary energy consumption in Spain, and triggered the rapid development of a domestic gas market. Obviously, before these events Enagas had attempted to import Algerian natural gas via LNG (see Table 8) but these imports had not stimulated the domestic demand enough. The pattern in gas consumption follows a similar trend to the Italian, with less volatility: an upward trend until 2008 and then a fall until 2014, which can be explained in the same way.

Figure 22. Natural gas consumption in Spain in bcm (1970-2015)



Source: Compiled by the author based on data retrieved from Cedigaz and BP Statistical Review

Among the exogenous reasons, at least two can be identified. First and foremost, the geopolitical conflict between Algeria and Morocco, coupled with the strained Hispano-Moroccan relations, as explained in detail. The second exogenous factor that discouraged further imports of natural gas at an earlier stage during the 1980s was a consequence of the “gas price battle” that happened between Sonatrach and Eni during the construction of the Transmed gas pipeline,¹⁸¹ and which

¹⁸¹ After the 1979 second oil shock, prices soared, and Sonatrach notified Italy that it would demand two dollars more per MBtu for gas delivered to the Tunisian border in comparison with the price determined by the formula in the 1977 Eni-Sonatrach agreement that was fixing the price of the gas flowing from Algeria to Italy, across Tunisia, once the Transmed gas pipeline began operations in 1983. After the intervention of the French government

eventually impacted the agreement to import LNG that Enagas had signed with Sonatrach in 1975 (see Table 8). Indeed, Enagas was not willing to accept a rise in the selling price for the Algerian gas after French, Belgian and Italian companies accepted. Sonatrach pursued arbitration and obtained a compensation of USD 200 million in damages for breach of the original LNG contract with Enagas (Hayes, 2006).

Despite all these dissuasive factors that hampered the stimulation of a burgeoning natural gas market, the province of Barcelona had made substantial progress in the expansion of natural gas thanks to the efforts undertaken by the company *Catalana de Gas y Electricidad*,¹⁸² which decided in 1965 under the leadership of Pere Duran Farell, President of *Catalana de Gas*, to start importing natural gas to Spain. To this end, a new company called *Gas Natural SA* was established by *Catalana de Gas* and Exxon Corporation to import LNG from Libya. The first LNG import terminal was open in 1969 in Spain (see Table 13), in the surroundings of Barcelona. Duran Farell was a pioneer in the introduction of natural gas in Spain. As a businessman, he exerted pressure over the central government authorities to let them understand about the need to introduce natural gas in the Spanish primary energy mix, and thus the role that this process entailed for the public sector. Subsequently, in 1972 Enagas was established as a public subsidiary of the state-owned financing and industrial holding company, *Instituto Nacional de Industria* (INI). As the development of a truly national domestic market for natural gas in Spain was very slow, *Gas Natural SA* decided in 1975 to sell to the recently established Enagas the regasification plant in Barcelona, and to transfer the contracts to import Libyan and Algerian LNG into Spain. Similarly, the gas distribution segment of *Gas Natural SA* was transferred to *Catalana de Gas*, which became an integrated utility of natural gas distribution to households, and industrial and commercial units.

Due to the aforementioned factors, the development of a natural gas market in Spain during the second half of the 1970s and 1980s was very slow, but in the 1990s new opportunities emerged

in 1982, using a price formula imposed on a new Gaz de France contract with Sonatrach to import LNG, the Italians sought the acceptance of a new subsidised price for the imported gas flowing along the Transmed pipeline (Buxton, 1982).

¹⁸² The origins of this company date back to 1843 when *Societat Catalana per a l'Enllumenat per Gas* was founded. In 1912, the company was renamed *Catalana de Gas i Electricitat* with the main purpose of supplying town-gas in Barcelona and its surroundings. In 1987, the company was again renamed *Catalan de Gas* after selling its hydropower plants, and thus concentrating solely on the natural gas business. In 1992 after absorbing *Gas Madrid*, the company was renamed as *Gas Natural SDG*, which in 2009 would become *Gas Natural Fenosa*.

with the development of gas-fired power generation and the market liberalisation process. In the meantime, Enagas had further expanded the domestic pipeline network to many other regions in Spain and had constructed two additional LNG import terminals, Huelva (1988) in southern Spain and Cartagena in eastern Spain (1989), in order to increase the amount of imported LNG and better distribute it across the country (see Table 13). Likewise, in 1991 *Catalana de Gas* decided to absorb the company operating in the central regions of Spain, *Gas de Madrid*, and thus a new company was created, entitled *Gas Natural SDG*. Only three years later, the central government decided to partly privatise Enagas (91 percent) and sell it to *Gas Natural SDG* but in 1998 the state would sell the remaining participation (9 percent) to *Gas Natural SDG*. In 1996, the Maghreb-Europe Gas Pipeline became operational, as it has been explained at length, prompting a sharp increase of natural gas imports from Algeria, as reflected in Figure 22.

Table 13 summarises a comprehensive list of all LNG import facilities operational in Spain as of 2015. Unlike Italy, throughout this period Spain has balanced its gas imports via pipeline and via LNG. Therefore, the latter has required the construction of six LNG import terminals with a total capacity of 5.6 percent of the LNG capacity worldwide, much higher than the 1.61 percent of Italy, even though Italy's consumption of natural gas was more than the double Spain's in 2015.

Table 13. List of LNG import terminals in Spain (2015)

Name of the LNG facility	Barcelona	Bilbao	Cartagena	Huelva	Sagunto	Mugardos
Shareholders	Enagas (100 percent)	Enagas (50 percent); Ente Vasco de Energía (50 percent)	Enagas (100 percent)	Enagas (100 percent)	Enagas (72.5 percent); Osaka Gas UK (20 percent); Oman Oil (7.5 percent)	Reganosa (85 percent); Sojitz Corp. (15 percent)
Year of operation	1969	2003	1989	1985	2006	2007
Capacity (bcm /year)	17.38	6.90	12.00	11.00	8.83	3.59
Percentage of capacity worldwide	1.63	0.64	1.12	1.03	0.83	0.34

Source: Compiled by the author based on data retrieved from Enagas and Renagosa

Furthermore, Table 14 shows the volumes of imported natural gas by LNG terminal in the timespan 2005-2010, whereas volumes of exported natural gas by LNG terminal are not significant. Table 14 reflects a steady increase of the overall imported natural gas via LNG until 2008, and a decrease since then, which is paired with the decrease in the absolute volumes of natural gas consumed in Spain (see Figure 22). In addition, a decrease of import volumes can be observed for the LNG terminals with the largest import capacity, namely Barcelona, Cartagena and Huelva. The last LNG terminals to be opened – Sagunto and Mugar dos – have partly absorbed the volumes of the LNG terminals with the largest regasification capacity. In the timespan 2000-2015, most of this LNG has been purchased by the Gulf countries (Qatar), Nigeria and Trinidad and Tobago (Sedigas, 2015).

Table 14. Volumes of imported LNG by terminal in Spain in bcm (2005-2010)

	Barcelona	Bilbao	Cartagena	Huelva	Mugar dos	Sagunto	Total (in bcm)
2005	7.79	3.89	8.20	6.31	-	-	26.20
2006	7.09	5.22	5.75	6.47	-	4.43	28.96
2007	6.38	4.59	4.68	6.01	0.99	6.05	28.69
2008	7.55	5.82	4.89	6.47	2.21	7.01	33.95
2009	7.41	5.14	4.42	5.99	1.63	6.71	31.30
2010	8.17	5.00	4.23	7.15	1.89	5.61	32.04
2011	6.20	3.89	3.92	6.45	2.20	4.50	27.17
2012	6.22	4.11	3.86	4.94	2.10	3.12	24.34
2013	3.83	3.10	2.11	3.83	1.88	3.05	17.81
2014	3.82	1.89	2.93	3.90	2.16	3.74	18.44
2015	3.88	2.35	1.44	3.39	1.69	2.80	15.56

Source: Compiled by the author based on data retrieved from Cores

Due to the lack of available pipeline infrastructure, for many years import volumes to Spain of natural gas were made possible through LNG import terminals. It was not until 1997 that natural gas started flowing through the recently inaugurated Maghreb-Europe Gas Pipeline, even if volumes were still very limited in comparison with what Spain was importing via LNG. This was in complete contrast to the situation in Italy, which since 1974 had been importing large volumes of natural gas through the Trans-Austria Gas (TAG) pipeline, and later from 1983 through the Transmed Gas Pipeline. As reflected in Table 15, which indicates the volumes of imported natural gas by entry point (excluding LNG import terminals), the reality only changed in 2013,

when for the first time the total volume of imported gas via pipeline was clearly higher than that imported via LNG. In any case, data illustrated in both Tables 14 and 15 confirms a very different configuration in Spain as compared to Italy regarding the natural gas import sector: imports in Spain have been dominated by LNG, and since the end of the 1990s, with new pipeline infrastructure in place, import via pipeline has become more relevant especially since the entry into functioning of the second pipeline connection between Algeria and Spain. In this vein, 2013 marks a turning point, with more weight given to imports via pipeline, but still in a balanced manner. Consequently, the stock of infrastructure that Spain had to plan to sustain this import model has been significant, not only in terms of cross-border gas pipelines, but also in terms of regasification and storage plants.

From 2015, there have been six cross-border entry points for natural gas in Spain, as enumerated in Table 15: the two main connections in terms of import volumes were the Maghreb-Europe Gas Pipeline, from Algeria to Spain (in Zahara de los Atunes) via Morocco, and the Medgaz pipeline, from Algeria to Spain (in Almería) directly. These two entry points support more than 75 percent of the imported natural gas via pipeline, and they have already been analysed in detail. Natural gas flow along these two routes was unidirectional and allowed Algerian gas to be imported into Spain, but Spanish gas could not be re-exported.¹⁸³ In addition, there were two other main cross-border routes: the first one in volume connecting Spain and France (VIP Pyrenees) through Irún and Larrau, and the second connecting Spain and Portugal (VIP Iberian) through Badajoz and Tuy.

The first international cross-border connection started operating in 1993, the Larrau to Calahorra gas pipeline, which was the first connection in Spain to the European gas pipeline network. An important part of this pipeline runs along the Navarre Pyrenees range, which is over 2,000 metres above sea level. The second cross-national connection started operating when the terminal receiving gas transported by the Maghreb-Europe Gas Pipeline became operational in October 1996, and it is located in Zahara de los Atunes (Cádiz). In this location the two underwater sections that cross the Strait of Gibraltar end, and the Al Andalus pipeline, which transports a significant part of Spain's and Portugal's natural gas supplies, begins. The third cross-border connection became operational in 1996 between the Spanish and Portuguese

¹⁸³ In October 2021, beyond the period covered by the present research, the Maghreb-Europe Gas Pipeline ceased to operate after Algeria unilaterally decided to close it. In 2022, Spain re-opened it to supply gas to Morocco.

natural gas transmission network in Badajoz. The other connection point with Portugal is in Tuy (Pontevedra) and became operative in 1998. In 2009, the Medgaz terminal in Almería put into operation. Finally, in 2013, after the indirect acquisition of Naturgas Energía Transporte by Enagas, the international connection of Irún connecting the Basque Country with France joined the infrastructures operated by Enagas

Although both the VIP Pyrenees and the VIP Iberian do not only have the capacity to import natural gas into Spain but also to export it to France and Portugal, the amounts of re-exported natural gas from Spain to Portugal and France has been limited, especially for the inter-connection with France, as can be seen in Table 15.

Table 15. Volumes of imported and exported natural gas by Spanish entry point in bcm (2010-2015)

		Badajoz	GME	Irún	Larrau	Medgaz	Tuy	Total (in bcm)
2010	Import	0.19	8.13	-	1.93	-	-	10.24
	Export	0.51	-	0.06	0.67	-	0.07	1.32
2011	Import	0.46	8.20	0.03	2.58	1.53	-	12.80
	Export	0.78	-	0.06	0.22	-	0.07	1.13
2012	Import	0.00	8.22	0.10	3.50	3.97	0.32	16.11
	Export	0.46	-	0.01	0.01	-	0.37	0.85
2013	Import	0.07	8.56	0.03	4.30	7.10	-	20.06
	Export	0.01	-	-	0.48	-	0.33	0.82
2014	Import	0.02	8.38	-	5.03	7.46	-	20.90
	Export	0.65	-	-	0.04	-	-	0.69
2015	Import	0.00	10.17	-	3.78	7.79	-	21.74
	Export	3.61	-	-	0.57	-	-	4.18

Source: Compiled by the author based on data retrieved from Cores

An alternative gas pipeline, the South Transit East Pyrenees (STEP), aimed at connecting the Spanish and French natural gas systems through the regions of Catalonia and Occitanie, started its construction works on the Spanish side by the end of 2010, but in 2012 the project was then set in stand-by due to a lack of interest from the French government. Later on, in March 2015, the Spanish and French governments alongside the European Investment Bank (EIB) signed

the Declaration of Madrid,¹⁸⁴ which aimed at revamping the project and seeking the endorsement of the EU institutions to partly cover the project's estimated cost of EUR 3 billion. The project had strong support from the EC, which considered that by connecting the Spanish gas system with the French one, Algerian natural gas could reach France – and the European transmission system – by pipeline, and thus reduce Europe's reliance on imported Russian gas. Hence, the project aimed at enhancing the security of supply of natural gas in the EU by increasing the pipeline gas imports from Algeria. However, in 2019 the project was finally rejected by the French energy regulator *Commission de régulation de l'énergie* (CRE) and its Spanish counterpart *Comisión Nacional de Mercado y la Competencia* (CNMC),¹⁸⁵ by arguing that “the market had showed no commercial interest for new capacity in the Franco-Spanish interconnection,” that the “gas interconnection capacity between France and Spain was not congested,” and that the cost of the project was “too high” (CNMC, 2019).

In spite of this backlash, which clearly limits the opportunities that the Iberian Peninsula as a natural gas region has to be better linked to the rest of the European market, Spain has considerably intensified its imports of Algerian gas in the timespan 1983-2015. As shown in Table 16, Algeria has always been the main supplier of natural gas to Spain, with ratios that exceeded the 50 percent of all Spanish imports of natural gas, with the sole exception in the period 2005-2013, in which Spain increased its LNG imports from Qatar, Nigeria and Trinidad and Tobago, but it did not decrease the imported volumes from Algeria. That was the consequence of a quick increase of natural gas demand in the Spanish market and an appetite to moderate the dependence on the Algerian imports. In any case, the trade flows have been very intense throughout this period, even when the Spanish gas market started to develop in the 1990s. In its turn, Algeria's dependence on the gas exports to Spain has also been rising, particularly since the exports to Italy started to decline in 2013, reaching a top record in 2014 of 39 percent of all Algerian natural gas exports going to Spain. It is worth mentioning that the dependence on Algerian gas for the Italian market is higher than that for the Spanish market. This can be explained by the import needs of both Italy and Spain, the volume and contracted

¹⁸⁴ See

<https://www.lamoncloa.gob.es/presidente/actividades/Documents/2015/DECLARACT%C3%93N%20DE%20MADRID%20esp%20FINAL.pdf>

¹⁸⁵ See

https://www.cnmc.es/sites/default/files/editor_contenidos/Notas%20de%20prensa/2019/20190122_STEP_E NG.pdf

capacity of the Transmed pipeline in comparison with that of the combined Maghreb-Europe and Medgaz pipelines, and the fact that Spain has supplied these additional needs of imported gas by diversifying its LNG imports.

Table 16. Trade flow of natural gas between Algeria and Spain (1983-2015)

	Total natural gas imports		Ratio of Spanish imports to Algerian exports (in percent)	Ratio of Spanish imports from Algeria to total Spanish imports (in percent)
	Pipeline	LNG		
1983	0	1.65	9	
1984	0	1.32	7	
1985	0	1.67	8	
1986	0	1.62	8	
1987	0	1.69	7	
1988	0	2.38	9	
1989	0	2.71	9	70
1990	0	3.2	10	72
1991	0	3.88	11	71
1992	0	3.94	11	68
1993	0	4.34	12	71
1994	0	4.13	13	56
1995	0	4.9	13	58
1996	0.6	4.8	13	60
1997	4.23	3.87	17	65
1998	5	3.91	17	67
1999	6.04	4.17	17	66
2000	6.16	4.05	17	61
2001	6.54	5.2	20	62
2002	6.25	5.95	21	58
2003	6.4	7.48	23	58
2004	7.53	6.58	23	52
2005	9.49	5.19	22	44

2006	8.62	2.8	19	32
2007	8.8	4.32	22	37
2008	8.97	4.9	24	36
2009	6.94	5.19	23	34
2010	12.05	2.62	26	40
2011	9.4	4	27	39
2012	10.2	3.6	27	40
2013	11.4	3.2	34	48
2014	11.1	4.9	39	52
2015	12	3.7	38	55

Source: Compiled by the author based on data retrieved from Cedigaz and BP Statistical Review

As noted, reforms in the Spanish energy sector began during the second half of the 1990s prompted by the steady growth in energy demand that was driven by the construction of new gas-fired power plants and the expansion of the grid of natural gas. In reality, all those structural changes anticipated the process of European liberalisation¹⁸⁶ that aimed at breaking vertical integration in the gas industry and introducing competition. By dissociating potentially competitive activities of the gas industry (i.e., production, trade, distribution...) from those segments of the GVC characterised by a natural monopoly (i.e., transmission and storage), and also by granting third-party access to essential facilities (i.e., distribution networks, LNG terminals, storage facilities...), liberalisation became a reality after 2003.

Eventually, the reforms were aimed at liberalising the demand side of the market so that customers could pick which company was supposed to provide natural gas. To this end, both the centre-left and the centre-right governments of Prime Ministers Felipe González and José María Aznar undertook this structural set of reforms: as explained, the privatisation of Enagas was initiated in 1994 and completed in 1998; the privatisation of Repsol, the largest Spanish IOC, was effective in 1997; while the electricity company Endesa was also privatised in 1998. Furthermore, a number of legislative changes¹⁸⁷ allowed the Spanish gas market to be opened to competition, and thus the LNG importing terminals were also subject to the access of new

¹⁸⁶ As a result of the transposition of the first EU Gas Directive (98/30/EC), the second EU Gas Directive (2003/55/EC), and the Third Energy Package approved in 2009, effective March 2011.

¹⁸⁷ Royal Decrees 1377/1996 and 2033/1996.

players. The latter explains why the first three LNG import terminals built in Spain (Barcelona, Huelva and Cartagena) are fully owned by Enagas, while the second set of new LNG import terminals (Bilbao, Sagunto and Mugardos), built as from 2003, incorporated third-party shareholders (see Table 13).

In 1989, the Spanish Parliament passed a new hydrocarbons law¹⁸⁸ that further liberalised the gas sector and also set a limit of 60 percent on natural gas imports from the same foreign country, a measure targeting Algeria in a context of strong dependence of Spanish gas imports. As a result of these changes, the Spanish gas market was fully liberalised in 2003, being one of the first EU gas markets to complete this process.

3.6.3 The surge of gas trade between France and Algeria

The development of the French natural gas market during the last thirty years of the 20th century was characterised by the slowdown in the rise of natural gas consumption due to the priority given to the use of nuclear power in the generation of electricity (Chevalier, 1993). While the respective natural gas sectors in the other three major Western European economies – Germany, United Kingdom and Italy – were developing at full speed (1970-1990), in France the priority was given to nuclear power development, which triggered a lower proportion of gas in primary energy supply as compared with other major European economies, where natural gas plays a critical role in electricity production, resulting in higher dependence on gas demand than in France, given the significant volumes of gas that are needed to produce electricity in gas-fired power plants.

A second major feature of paramount importance in the French energy policy, which has shaped the French natural gas market, is the pursuit of energy independence to the largest possible extent (Finon, 2001). As France is not well-endowed with fossil fuels, and imports have become a necessity over time, especially since France lost its colonies, the country has demonstrated its ability to diversify imports and manage dependency risk (Finon, 2001).

These two characteristics are essential to understand the scope of the French natural gas sector. Notwithstanding the relative importance of natural gas, the legal regime that paved the way to

¹⁸⁸ Law 34/1998.

the expansion of the natural gas industry in France was adopted in 1946 with a law¹⁸⁹ that nationalised gas and electricity industries. The latter prompted the establishment of two very large public energy companies: *Gaz de France* (GDF) and *Électricité de France* (EDF), while it also granted a monopoly to GDF in the activities of purchase, transportation and distribution of natural gas. This monopoly on imports and local distribution started to change in 2000, when part of the market was opened to competition. Later, in 2006, the two historic suppliers (GDF and EDF) changed status from public enterprises to separate public corporations; each of which was then split up into three subsidiary divisions: one for marketing and two others for distribution grids (ENI, 2017). It was the result of the transposition of the first EU Gas Directive (98/30/EC) and the second EU Gas Directive (03/55/EC)¹⁹⁰ that pursued the liberalisation of European gas markets.

The creation of GDF in 1946 allowed the fragmented system based on town-gas networks to be transformed in only 15 years into an interconnected system based on natural gas (Finon, 2001) thanks to the transfer of all assets from most of the existing private companies in the activity of town-gas into the newly established public company.

Furthermore, in 1951, the Lacq deposit¹⁹¹ of natural gas was discovered in south-west France, in the region of Aquitaine. Before such a discovery, the production and consumption of natural gas in France had been limited to the small quantities produced by the Saint-Marcet field and consumed exclusively in the south-west. The exploitation of this deposit began in 1956, two years after the Algerian independence war had begun, a war that cast doubt on the future availability of the fields discovered in the Saharan provinces of Algeria.¹⁹² In addition, the recent Suez Canal crisis, also in 1956, had also brought up this idea that international oil supply could be easily interrupted, thus prompting the search for alternative energy sources in the French

¹⁸⁹ Law no. 46-628 of 8 April 1946 of nationalisation of electricity and gas.

¹⁹⁰ These two directives were transposed into French laws by two Acts, Law no. 2003-8 (3 January 2003) and Law no. 2004-803 (9 August 2004). These laws were subsequently amended by Law no. 2006-1537 (7 December 2006) in what was considered as a very lengthy, gradual and controlled liberalisation (Eni, 2017).

¹⁹¹ The discovery of the Lacq deposit of natural gas caused somehow a disappointment amidst the authorities, which were hoping to obtain oil instead of natural gas, much appreciated at that time.

¹⁹² The super-giant field of Hassi R'Mel had been discovered by *Compagnie française des pétroles* (CPF) in 1956.

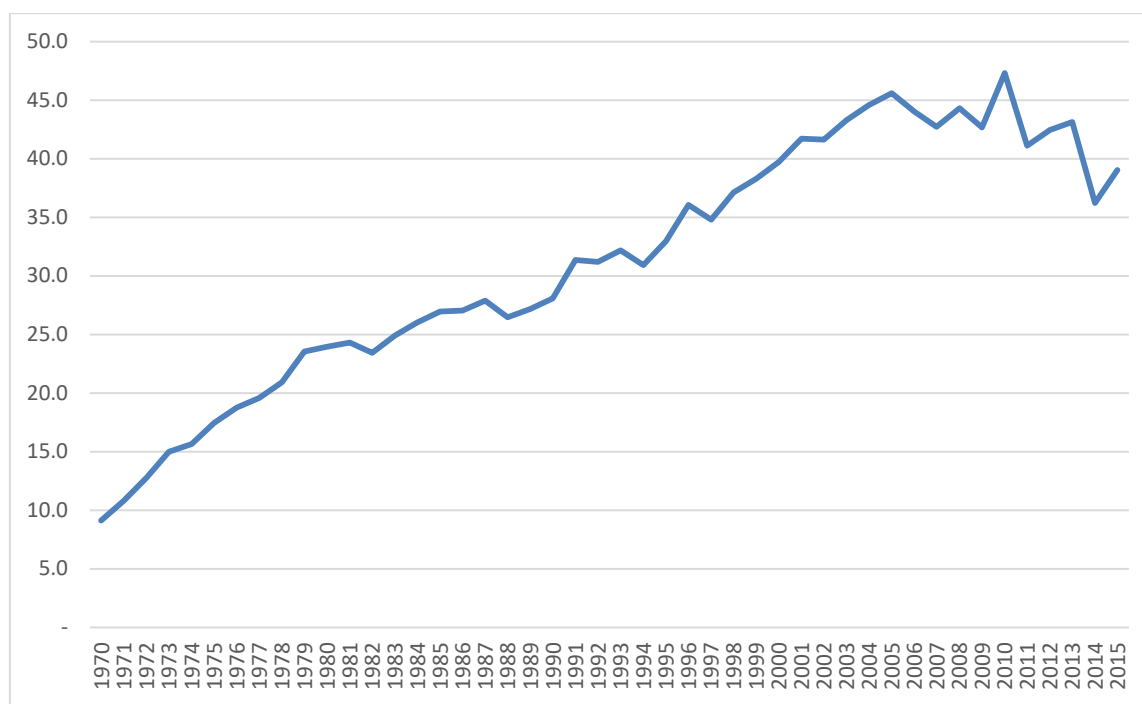
territory. *Société Nationale des Pétroles d'Aquitaine* (SNPA)¹⁹³ was entrusted, first with the exploration, and later with the exploitation of the gas field.

France has traditionally had very little domestic natural gas production, but the exploitation of the Lacq gas field helped develop a high-pressure transport network that interconnected the regional networks with storage units and supplies of gas of different qualities and origins (Beltran & Williot, 1992). In this vein, for many decades most French production of natural gas came from Lacq. Indeed, the peak in terms of production in Lacq was reached in 1982 with 12 bcm per year (Finon, 2001), and then a long decline began until the end of 2013, when the deposit was exhausted.

Figure 23 shows the evolution of the consumption of natural gas in France (1971-2015), reflecting a relatively less steady increase than in the case of Spain, which during the 1990s underwent a very quick development. As previously noted, between 1993 and 1990 restrictions were imposed on increases in sales due to the priority that was given to the development of nuclear power (Chevalier, 1993). Whereas consumption only increased by 13 bcm in France (1973-1990), in Italy, Germany and the UK it increased by more than 30 bcm (BP Statistical Review of World Energy, 2016). For instance, in 1997 consumption of natural gas totalled 35 bcm in France, but 54 bcm in Italy and 85 bcm in Germany and the United Kingdom, which entailed a share in the electricity production of only 14 percent in France against 28 percent in Italy, 21 percent in Germany, and 35 percent in the United Kingdom (IEA, Natural Gas Information, 1997).

¹⁹³ Created in 1941, in 1966 SNPA became ERAP by absorbing the General Union of Petroleum and the General Union of Distribution. The group was renamed *Société Nationale Elf Aquitaine* in 1976. In 1994 the group was privatised and simply became Elf Aquitaine. In 2000, the group was taken over by the French multinational Total, which became TotalFinaElf from 2000 to 2003, when it was renamed Total.

Figure 23. Natural gas consumption in France in bcm (1970-2015)



Source: Compiled by the author based on data retrieved from BP Statistical Review (several years)

In addition, the evolution of natural gas consumption in France follows a similar pattern from the great recession onwards, as shown in the cases of Italy and Spain, with a declining trend in overall consumption (see Figure 23).

Not only has overall consumption of natural gas in France been lower than in the other Western European economies, but also the proportion of gas in primary energy supplies has also been lower. Until 1992, France was promoting electrical heating in domestic consumption above natural gas heating, and, as mentioned, outlets for gas in electricity production have been greatly restricted due to the existence of nuclear power stations.

Despite lower levels of domestic consumption of natural gas as compared with countries like Italy, France also faced an increase of demand until 2010 with some fluctuations. In this vein, the lack of domestic production of natural gas was quickly compensated by steady increases of imports of LNG from Algeria (from 1965 onwards), and pipeline gas from the Netherlands

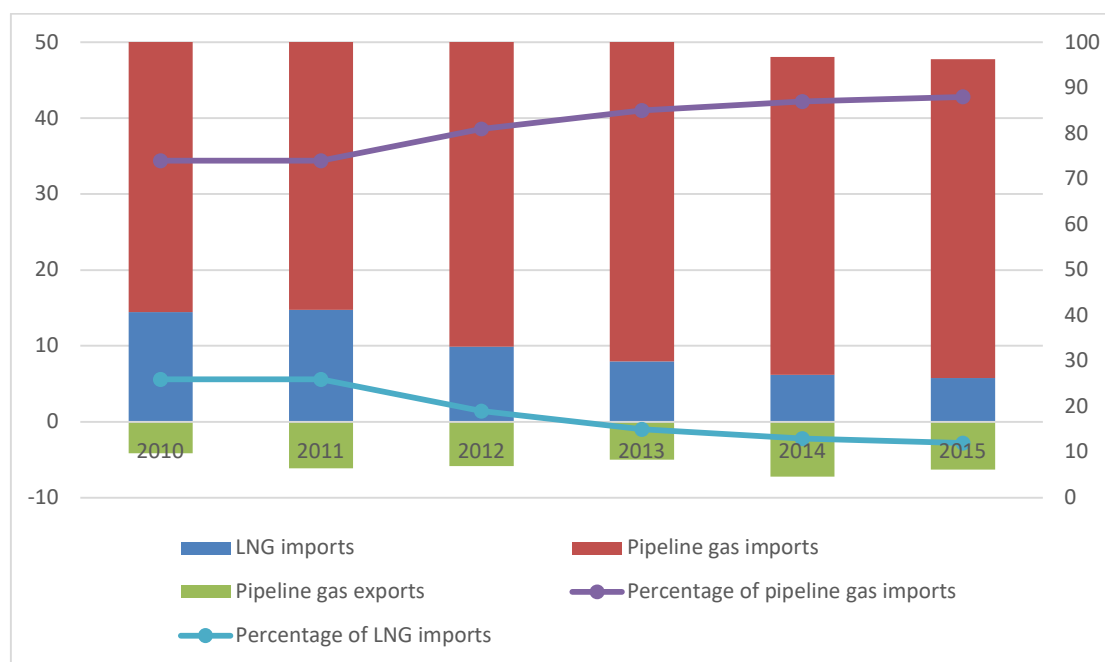
(1967), Norway (1971) and the Soviet Union (1972). The increased need for gas imports led to a diversification in supply sources and entry points, as we will review in this sub-section.

In effect, France started to import all its natural gas in the 1970s from the Netherlands and Algeria, but soon afterwards, from other countries like Norway and Russia. In spite of the Netherlands playing a central role before the 1990s in supplying natural gas to France, alongside other central European countries, and in prompting the emergence of an international network of transmission through pipelines, other countries like Norway and Russia have taken over the role as main suppliers.¹⁹⁴ Whereas Algerian gas has not been supplied to France via pipeline in contrast to Italy and Spain, its position has evolved over time. Before 2000, Algeria was one of the largest suppliers to France of LNG but at the turn of the century its role diminished, although as of 2015 Algeria, with a smaller market share, was still the largest single LNG supplier to France. In point of fact, with the extension of the LNG system worldwide, France has increased its imports from other countries such as Nigeria, Egypt and Trinidad and Tobago. This diversity has allowed the country to be relatively protected against the risk of supplier default (*Commission de Régulation de l'Énergie*, 2016).

Additionally, France has become one of the largest Western European economies, which prioritises the imports by gas pipeline over LNG, as reflected in Figure 24. Contrary to the case of Spain, the vast majority of gas is imported by pipeline. For instance, it represented 88 percent of total gas imports from France in 2015. In this context, France mainly relies on long-term contracts, which represent around 80 percent of its supplies (*Commission de Régulation de l'Énergie*, 2016). Although France, alongside the majority of industrialised economies, has followed an upward trend from the 1970s onwards in terms of LNG imports, since 2010, the share of LNG in French gas supply has more than halved, at 12 percent in 2015, against 26 percent in 2010 and 2011. In spite of a global trend favourable to LNG, this relative drop of LNG imports in France, and more widely in Europe, can be explained by the diversion of LNG volumes to Asian markets, which have become more profitable following the Fukushima accident (*Commission de Régulation de l'Énergie*, 2016).

¹⁹⁴ The Groningen gas field is gradually entering the last period of its operation (reserves amounted to around 680 bcm at the start of 2015). Export contracts terminate between 2021 and 2030 and will not be renewed (2029 in the case of France).

Figure 24. Natural gas imports and exports in France in bcm (2010-2015)



Source: Compiled by the author based on data obtained from GRTgaz and TIGF. Left axis is expressed in bcm for volumes of LNG and pipeline gas, while right axis in percentage.

In order to secure both the supply of pipeline gas and LNG, throughout this period of time (1970-2015) France has been equipped with an extensive network of transnational pipeline connections that have made the French gas market a very dynamic and interconnected European market. Table 17 reports the volumes of imported and exported natural gas in the French territory. In this regard, there are the following transboundary gas pipeline interconnections as of 2015:

- The entry point from which France imports Norwegian natural gas is located in Dunkirk, in the north-eastern region of Hauts-de-France. Natural gas produced offshore in the North Sea is transported through the Franpipe gas pipeline (840 km long). This is one of the main points of gas entry into the French network, and from there, part of it is re-exported to Spain and Italy.
- France has two interconnection points with Belgium in Taisnières, also in the north-eastern region of Hauts-de-France, one dedicated to H gas (high calorific value) and the other one to L gas (low calorific value). A third interconnector point, commissioned in

2015, was created in Alveringem in order to export gas outside France. Taisnières H gas has become the second entry point into France since 2014. Most of the gas imported through this point comes from the mega-giant Groningen deposit in the Netherlands.

- France also has a very important interconnection point with Germany in Obergailbach, in the eastern region of Grand Est. This interconnection is the entry point for gas imports from Russia passing through Germany.
- As explained, France has two physical interconnection points with Spain in Larrau and Biriattou in the south-western region of Aquitaine. Since October 2014, they have been grouped together in a single commercial point named “VIP Pyrenees”.
- France exports natural gas to Italy via Switzerland at the Oltingue interconnection, in the eastern region of Grand Est. It connects the northern zone of the GRTgaz¹⁹⁵ network to the Swiss network operated by FluxSwiss, itself linked to the Italian network of Snam Rete Gas by the interconnection of Passo Gries. Historically, this interconnection was created to supply Italy with gas from Norway, which was why it could only work in this direction.

Table 17 shows four entry points and three exit points in 2015. Data reflects a robust capacity of France to import Norwegian, Dutch and Russian pipeline gas, as well as to export natural gas to Italy and Belgium. In contrast, the capacity to import and export natural gas through the “VIP Pyrenees” is very limited, while the authorities have reasserted their opposition to enhance this capacity, constraining the options of increasing the imports of Algerian gas.

In 2015, additionally, there were two projects to increase the French import capacity. The first one consisted of creating a new interconnection point in the eastern Pyrenees to increase the volumes of Algerian gas transiting across Spain, but it was dismissed in 2019, as explained. The second project was envisaged to revert the flow at the Oltingue interconnection, to open up

¹⁹⁵ Once natural gas enters the French territory, there are two natural gas transmission system operators (TSOs) that transport the gas to end consumers (households, industries...): GRTgaz, a subsidiary of Engie (75 percent) and *Société d'Infrastructures Gazières* (25 percent) that operates the low-calorific value (L) gas network in the north of the country, and the majority of the high-calorific value (H) gas network; as well as TIGF, an old subsidiary of Total and currently a consortium that includes the Italian Snam, GIC, EDF and CAA, and operates the H gas network in the south-west.

access to new sources of gas from Italy, for example from Azerbaijan, via the Trans Anatolian Pipeline¹⁹⁶ (TAP).

Table 17. Volumes of imported and exported natural gas by French entry point in bcm (2005 and 2015)

		Dunkirk	Taisnières (H+L)	Obergailbach	Oltingue	Alveringem	Pyrenees (Larrau+Bariatou)	Total (in bcm)
2005	Import	17.62	26.03	13.65	-	-	-	57.3
	Export	-	-	-	7.08	-	2.57	9.65
2015	Import	18.09	27.61	19.68	-	-	7.14	72.52
	Export	-	-	-	7.08	8.57	5.24	20.89

Source: Compiled by the author based on data retrieved from GRTgaz and TIGF

Along with the infrastructures meant to import and export natural gas via pipelines, France has also been equipped until 2015 with three onshore LNG facilities. Due to the fact that, since the beginning of the development of its natural gas market, it has opted for pipeline gas instead of LNG when importing, the number of LNG infrastructures has remained low, unlike in Spain, as examined in the previous sub-section. Table 18 summarises the list of operational LNG terminals, which are located on the south-eastern coast (2), in the Région Sud, and on the western coast (1), in the western region of Pays de la Loire.

A first LNG terminal was commissioned in Le Havre between 1965 and 1989, which was operated by GDF at the entrance of the main port.¹⁹⁷ It was used for imports of Algerian LNG when no other terminal existed. Later, Fos-Tonkin was built in 1972 and Montoir-de-Bretagne in 1980, both of which have been used to deliver Algerian LNG (Engie, 2015). The total capacity of LNG import terminals has remained relatively low compared with that of Spain, but still higher than the effective capacity of a larger natural gas demanding country like Italy.

¹⁹⁶ The Trans-Anatolian Natural Gas Pipeline is a natural gas pipeline in Turkey. It is the central part of the Southern Gas Corridor, which connects the giant Shah Deniz gas field in Azerbaijan to Europe through the South Caucasus Pipeline and the Trans Adriatic Pipeline. It was commissioned in 2018.

¹⁹⁷ The first delivery took place on 28 March 1965, when the Jules Verne LNG carrier made an arrival at the terminal of Le Havre. Several trips from Arzew to Le Havre were carried out by this LNG carrier until the end of its activity in December 1988 (Engie, 2015).

Table 18. List of LNG import terminals in France (2015)¹⁹⁸

Name of the LNG facility	Fos-Tonkin, Fos-sur-Mer	Montoir-de-Bretagne	Fos-Cavaou, Fos sur Mer
Shareholders	Elengy (100 percent), subsidiary of Engie	Elengy (100 percent), subsidiary of Engie	Fosmax LNG (100 percent), which was owned by Elengy (72.5 percent) and by Total Gaz Electricité Holding France (27.5 percent)
Year of operation	1972	1980	2010
Capacity (bcm/year)	5.50	10.00	8.25

Source: Compiled by the author based on data retrieved from *Commission de régulation de l'énergie*

More specifically, a look at absolute and relative data on French imports of Algerian gas between 1983 and 2015 (see Table 19) confirms the total absence of imported volumes of pipeline gas and the use of LNG as the only means for France to import Algerian natural gas. Moreover, the role that Algerian gas has played in overall French imports of natural gas was substantial at first but has dropped over time very linearly. In 1989, one third of all French imports of natural gas came from Algeria, but in 2015 it was reduced to a mere 10 percent. Such a process by which Algerian gas has lost nearly two thirds of its relative importance to the French imports of natural gas can be explained by at least two factors: the first one relates to the French energy policy, which has pursued diversification as a means of managing dependency risk, and thus mitigating it. However, this policy has given uneven results because, although Algerian imports have clearly dropped in relative terms from the end of the 1980s (before then, the share of Algerian imports increased), it has not occurred with other export countries like Norway, for which French imports in relative terms have increased since 1971. Hence, France is less dependent on Algerian gas but more dependent on Norwegian gas, which suggests that risk management has been conducted on the basis of political risk assessment, Norway being a much more political stable partner than Algeria.

¹⁹⁸ In January 2017, a fourth LNG terminal was commissioned in Loon Plage (Dunkirk). It has an overall capacity of 13 bcm per year, and thus has become the LNG terminal with the largest capacity in France. It is owned by EDF (65 percent), the Belgian Fluxys (25 percent) and Total (10 percent).

A second factor can be explained by the unwillingness to connect Algeria and France via gas pipeline through Spain. As noted, one of the flagship projects of the EC until it was abandoned in 2019 by the strong opposition of both the French and the Spanish energy regulators (CRE & CNMC, 2019) consisted of finalising the interconnection of the French and Spanish gas transmission systems in the eastern Pyrenees to increase the volumes of natural gas being re-exported from Spain to France. Considering that France has progressively relied more on pipeline gas than LNG, the options left for Algerian gas are smaller, especially when industrialised nations have tended to diversify the sources of LNG, as has been the case for France.

Regarding the role that French imports of natural gas have played in the overall Algerian exports of natural gas, the decline that Table 19 reports is of a similar nature. In 1983, French imports accounted for nearly half of all Algerian exports of natural gas, whereas in 2015 this percentage had been reduced to one fifth. In conclusion, the trade relations of natural gas between Algeria and France clearly show that the dynamics of dependence between the two countries have fallen significantly over time.

Table 19. Trade flow of natural gas between Algeria and France (1983-2015)

	Total natural gas imports (in bcm)		Ratio of French imports to Algerian exports (in percent)	Ratio of Algerian exports to French imports (in percent)
	Pipeline	LNG		
1983	0	8.76	49	
1984	0	8.14	42	
1985	0	7.86	36	
1986	0	7.67	38	
1987	0	9.36	37	
1988	0	8.95	35	
1989	0	9.04	31	33
1990	0	9.31	30	32
1991	0	9.16	27	29
1992	0	9.21	26	28
1993	0	9	25	30

1994	0	8.04	25	25
1995	0	7.58	20	23
1996	0	7.3	18	21
1997	0	9.25	19	26
1998	0	9.78	18	27
1999	0	9.8	16	24
2000	0	9.6	16	23
2001	0	9.8	17	24
2002	0	10.2	18	24
2003	0	9.2	15	22
2004	0	6.72	11	15
2005	0	7.5	11	15
2006	0	7.35	12	15
2007	0	7.85	13	17
2008	0	7.6	13	15
2009	0	7.69	15	16
2010	0	6.27	11	13
2011	0	5.7	11	12
2012	0	4.8	9	11
2013	0	5.3	12	14
2014	0	4.4	11	13
2015	0	4.3	10	10

Source: Compiled by the author based on data retrieved from Cedigaz, and BP Statistical Review

The reform of the natural gas sector that France undertook in the 2000s was a direct consequence of the reform package for liberalisation steered up by the EU. The French public authorities and economic agents were satisfied with the organisation of the gas industry before the liberalisation, with its opportunity to control choices of imports (Finon, 2001). Before its partial privatisation, GDF was considered an efficient public company with moderate prices and no deficit (Finon, 2001). Hence, the process of reform in the French gas industry developed very differently from other big Western European countries like Germany, Spain and Italy, in which new legislation at the national level was adopted in 1998 and 1999, following the enactment of

the EU Gas Directive (98/30/EC), not to mention the successive reforms in this sector undertaken in the UK since 1986. The reform process began in August 2000 with 20 percent of the market opened to competition, while it advanced significantly in July 2007 with the total liberalisation of the gas market when over 11 million domestic customers were set to choose their supplier of natural gas (Engie, 2017).

After comprehensively reviewing the development of the natural gas value chain in the Western Mediterranean, we propose the use of a qualitative methodology that allows us to infer the power dynamics within the energy chain by studying the relational nature of the different agents embedded in the energy chain.

3.7 Relational nature of agents integrated in the natural gas value chain in the Western Mediterranean. Qualitative exercise

As a final step to the in-depth analysis of the natural gas value chain in the Western Mediterranean, we conduct a qualitative exercise to assess the relational nature of the power exerted by the various agents taking part in the natural gas value chain, which allows us to make some preliminary conclusions on how these agents integrate the value chain.

The starting point for this qualitative methodology is that, in the context of international energy chains, companies may be of two types: private (IOCs) or national (NOCs). As the motivation of these two types of companies will not be the same, there is a significant difference with respect to non-energy value chains, whereby companies seek to achieve governance of the chain with a single objective: attaining as much as possible of the economic surplus generated by the chain. In the energy context, however, while the main objective of IOCs is to obtain the maximum possible profit (as much surplus as possible) from the value chain, the priority objective of NOCs will be defined in terms of the country's "general interests".

There is also the case that we define as hybrid (see Table 20), which is usually a private company that the government uses as if it were an NOC. Additionally, in the case of natural gas, we add a new typology of company that are regional companies, which we will call ROCs, in line with the "usual" nomenclature, but which are normally companies focused on gas activity – although in some cases not exclusively – and whose main activity is regional, even if they could be active elsewhere in the world.

More specifically, we believe that the potential motivations of companies involved in energy value chains are to attain as much as possible of the surplus, which may be turned into national income or profit; to ensure a safe and constant supply of energy for “their” economy; and to achieve greater influence as a stakeholder on the international stage.

Methodologically, the analysis of these two questions, i.e., that there are two types of stakeholders and that these may have up to three objectives, ranging from the micro level (more profit for the company to the global level, being an important or hegemonic regional or global stakeholder) is favoured within the GCC/GVC/GPN approaches, since the latter integrate both micro/meso and macroeconomic aspects.

As a result of the particular characteristics described above, it is necessary to redefine the *producer-driven* and *buyer-driven* categories of the energy GCC, although the need for such a redefinition in no way invalidates the use of the rest of the conceptual framework implicit within these categories. In particular, the concept of *lead firm* will be highly useful for our analysis of regional power. Indeed, in the case that concerns us here, we consider that the type of governance that prevails in the chain (i.e., producer- or buyer-driven) depends, principally, on the type of company that establishes itself as the lead firm. For energy products, the lead firm determines not only “what” is produced and “how”, but also “for whom” and “for where” the end product is destined. These considerations are reflected in the classification of companies shown in Table 20. The categorisation is based on the case of hydrocarbons (oil and gas).

Table 20. Categorisation of energy companies (oil and gas)

NOCs	State-owned national oil or gas companies
<u>“Old” NOCs</u> If the lead firm is an “old” NOC, the value chain is usually characterised by producer-driven behaviour.	These are upstream companies, some of which will also engage in midstream activity, that serve as an instrument of national, public intervention, their main objective being to generate as much <u>national income</u> as possible for the <i>producing country</i>. Secondary objectives include helping to ensure a stable supply of energy and being a relevant stakeholder on the international stage.
<u>“New” NOCs</u> If the lead firm is a “new” NOC, the value chain may be characterised by producer-driven or buyer-driven behaviour.	These are integrated companies with a broad scope (they act upstream, midstream and downstream) and are commonly found in what are known as <i>emerging economies</i>. They serve as an instrument of national, public intervention. The objective of “new” NOCs is not always the same and, depending on the nature of national requirements, it is not always clear which is the primary objective. In general, some of these companies will have an objective similar to that of “old” NOCs (<u>national income</u>), while the objective of others will be to ensure the <u>final supply</u> of energy to the country. In both these cases, what “new” NOCs have in common is that they are used as instruments to gain <u>power on the regional or international stage</u>, influence market dynamics, attract foreign investment, and drive industrialization within their economies.
IOCs	Integrated, private and transnational energy companies
<u>“Western” IOCs</u> If the lead firm is a “Western” IOC, the value chain is generally characterised by buyer-driven behaviour, although, depending on the company’s profit maximising strategies, it may be producer driven.	These are the large, integrated, private and transnational energy companies that have been established in the Western countries of the OECD and which are clustered around the IEA. The majority of the most important ones are direct descendants of the “Seven Sisters”. These companies are associated with what are known as <i>consumer countries</i>, although their objective is that of private firms, i.e., to maximise profits in the value chain as a whole. Depending on the circumstances, they may act more as extractors/producers or as demand/consumer companies. In both cases their objective is to obtain <u>as much profit</u> as possible.
<u>“Hybrid” IOCs</u> With the exception of Russian companies, if the lead firm is a “hybrid” IOC, the value chain is generally characterised by buyer-driven behaviour.	These are integrated energy companies, generally in the East or in emerging economies, that are privately owned but which directly serve the interests of the government of their respective country. In this regard, and <u>as in the case</u> of “new” NOCs, their objectives will depend on national priorities. However, <u>unlike</u> the “new” NOCs, hybrid companies are not usually strong enough to become significant <u>regional or international stakeholders</u>.
ROCs	Non-integrated, regional energy companies
<u>“Transit ROCs”</u> There is no case in which a transit company is a “lead firm”, but they have great influence because they control the transit of oil or gas.	Depending on the cases, the objective may be purely fiscal, but in others they could serve to achieve an oil or gas supply on favourable terms. Both cases respond to national rather than private interests.
<u>“Western or hybrid ROCs”</u> If the lead firm is a “Western” ROC, the value chain usually is characterised by buyer-driven behaviour.	These are public or private companies, whose regional activity is fundamentally focused on one or two phases of the chain (upstream, midstream and downstream). Although they may have investments elsewhere in the world, the bulk of their activity is carried out at regional level. In general, the business goal of these companies, such as those of the “Western IOC”, with whom they often have alliances, is linked with that of <i>consumer countries</i>.

Source: Compiled by the author based on Mañé-Estrada et al., 2012

We start by assuming that the degree of power a company has in the context of international energy relations does not depend on whether it is an NOC, ROC or IOC, but rather on how integrated it is (the more stages it is involved in the more influence it will have), on the number of territories in which it is present and on the amount of product (primary, secondary or final energy) it controls.

Thus, it is assumed that when a company forms part of a value chain it is more likely to become the lead firm if: a) it is an integrated company (i.e., it acts upstream, midstream and downstream); b) it operates in different countries (i.e., it is transnational, and therefore its raw material sites and/or markets are located in different places around the world); and c) it is among the world's top-ranked companies in one or more of the three stages. Conversely, a company is unlikely to be the lead firm in the energy chain if: a) it is only present in one of the three stages; b) its sphere of activity is national; and c) it is not among the top-ranked companies for any of the three stages.

Thus, in general terms, the six kinds of stakeholders defined above can be classified, as shown in Table 21, according to the amount of power they would have within regional or global energy chains.

Table 21: Possibility of being the lead firm among energy companies, according to category

	Integrated	Transnational	Top-ranked	Power in regional/global chain	Possibility of being the lead firm
“Old” NOCs	No	No	Yes (upstream)	Medium to low	Weak
“New” NOCs	Yes	Yes	Yes (up-, mid- or downstream)	High	Strong
“Western” IOCs	Yes	Yes	Yes (mid- or downstream)	High	Strong
“Hybrid” IOCs	Yes	No	No	Low to medium	Very weak
“Transit” ROCs	No	No	No	Medium to low	None
“Western” ROCs	No	Yes	Yes (up-mid or downstream)	Medium	Strong

Source: Compiled by the author based on Mañé-Estrada et al., 2012

Results and discussion of the qualitative exercise of the Gas Value Chain in the Western Mediterranean

The starting point is already shown in Tables 20 and 21, whereby, in general terms, the six kinds of defined stakeholders can be classified “Old” NOCs, “New” NOCs, “Western” IOCs,

“Hybrid” IOCs, “Transit ROCs” and “Western ROCs”, in accordance with the amount of power they would have within regional or global energy chains.

Given that our case study is limited to the Western Mediterranean area, the only possible scenarios are those set out in Table 22. For the analysis of the energy chain in natural gas, the scenario involves a “new” NOC¹⁹⁹ becoming integrated in chains formed by other types of company, even if Sonatrach’s function within the country is still that of an “old NOC”. However, at the regional level, different types of companies are involved in the Western Mediterranean GVC, as can be deduced from Figures 15 and 16 and reflected in the following Table.

Table 22: Who can be the lead firm in a value chain?

If a “new” NOC becomes integrated in a chain with:	“Old” NOC	“New” NOC	“Western” IOC	“Hybrid” IOC	“Transit” ROC	“Western” ROC
Firms in the Western Mediterranean Gas Value Chain		Sonatrach	Eni, Total, Repsol, Cepsa, Galp, Engie	None	Onhym, Sotugat	Gas Natural, Enagas, Snam Rete Gas
“New” NOC	I1: Lead firm is the “new” NOC	I2: Outcome unclear. Different objectives?	I3: Outcome unclear. Different objectives?	I4: Lead firm is the “new” NOC	I5: Lead firm is the “new” NOC	I6: Outcome unclear. Different objectives?

Source: Compiled by the author based on the methodology established by Mañé-Estrada, A. et al. (2012)

Having established this kind of power relation among companies operating in the energy value chain, the incorporation of the geographical component into the analysis means that the following hypotheses can be proposed:

a) In scenarios I2, I3 and I6, relationships within the governance structure are more symmetrical. The conditions under which the stakeholders become integrated within the energy value chain are more equitable and, therefore, their capacity to influence the institutional structure of the

¹⁹⁹ The case refers to the integration of Algerian company Sonatrach with several other (private but also publicly-owned) companies from Italy, Spain, France, Portugal, Morocco and Tunisia. State-owned Sonatrach is the largest oil and gas company in Algeria and Africa. The company operates in exploration, production, pipeline transportation and marketing of hydrocarbons and by-products. As part of a diversification strategy, Sonatrach stepped up investments in power generation, new and renewable energies, water desalination, and mining exploration and exploitation. The international strategy of the company includes operations in several parts of the world, namely: in Africa (Mali, Niger, Libya, Egypt), in Europe (Spain, Italy, Portugal, UK), in Latin America (Peru) and in the US. As well as being the world's eleventh-biggest oil producer, Sonatrach is also the fourth-biggest global LNG exporter, the third-largest LPG exporter, and the sixth biggest gas exporter. For all the above reasons, in this research we consider Sonatrach as a “new” NOC, rather than an “old” NOC, very much aware of the fact that in precise terms the company would stand somewhat in between what an “old” NOC and a “new” NOC are.

geo-energy space will be more similar. Thus, one can expect relations to be more cooperative, or extremely conflictive. In this case, the centre of the geo-energy space will be more diffuse and widely spread. With the passing of time, this apparent symmetry in power relations might become more asymmetrical, depending on the degree of interdependence, the contracting terms among the various agents, the price evolutions, relation between demand and supply, the energy governance, and so on. This is the power relation that one can expect between companies like the Algerian Sonatrach with others that take part in the value chain, such as the Italian Eni and Enel, the Spanish Gas Natural and Cepsa, the French Engie, and the Portuguese Galp.

b) In the event of scenarios I1 and I5, the governance structure and relations are asymmetrical. The natural resources or stakeholders from the territory of the “old” NOC or “transit” become integrated in a “position of inferiority” and, therefore, have limited decision-making capacity within the institutional structure that develops in their geo-energy space. This is the power relation that one can expect between companies like Algerian Sonatrach with others that take part in the value chain, such as the Moroccan ONHYM or the Tunisian ETAP.

The results of the exercise are not entirely conclusive. Whereas for the Algerian NOC Sonatrach and the Western IOCs and ROCs participating in the energy chain the conditions under which they become integrated into the energy value chain seem more equitable and symmetrical, with the passing of time this apparent symmetry in power relations might become more asymmetrical. As for the transit ROCs from Tunisia and Morocco, the result seems to be clearer to the extent that their integration is highly subordinated to the interests of Sonatrach.

3.8 Conclusions

This chapter reviewed the historical development of the natural gas value chain in the Western Mediterranean as a continuation of Chapter 2, in which we described and analysed the origins and historic evolution of the Algerian natural gas industry, without which a natural gas value chain at the regional scale would not have existed as natural gas would have to be fully imported from outside the region. Similarly, the regional GVC would not have arisen without a shift in the energy consumption pattern of Northern Mediterranean countries that sought to increase imports from a reliable gas supplier like Algeria. In this vein, the understanding of the historical configuration of the value chain in the Western Mediterranean is key to examining the nature of the integration of each country into the GVC that is object of in-depth analysis in Chapter 4.

The chapter began by way of introduction with a shallow comparative look at the state of the Algerian natural gas industry in 2015 in relation with the 1960s, when the country achieved statehood. In 2015, Algeria was the world's ninth largest natural gas producer and the largest by far in the African continent (EIA, 2015), with a marketed production of natural gas of 83.04 bcm (OPEC, 2016) and proven gas reserves of 4,502.38 bcm (Oil & Gas Journal, 2015). In terms of transport infrastructure, the country accounted for 18,512 km of hydrocarbon pipelines and three cross-border gas pipelines able to export natural gas to all neighbouring countries (Morocco, Spain, Tunisia and Italy), as well as two LNG terminals in Arzew and Skikda. The situation in 1962 and 1971 was starkly different.

The following sections in the chapter each corresponded to the segments of the natural gas value chain, which were firstly introduced. The evolution of the upstream segment goes in parallel with the trend of the natural gas marketed production, underscoring a low activity pattern during the 1960s and 1970s, while production took off in the mid-1980s, when natural gas was fully considered by the authorities, as noted in the previous chapter. Since the mid-2000s, marketed production declined, and has subsequently stagnated, also as a result of the increasing competition posed by LNG from Qatar and Australia, which became the largest LNG exporter worldwide. It is worth mentioning that Algeria's natural gas production balance has also been impacted by the rapid growth of domestic gas consumption. Indeed, between 2008 and 2015, total gas use by the domestic market increased by 70 percent at an average annual growth rate of over 5 percent, which has had an effect on the export capacity of the country.

In this regard, the upstream activity was greatly dominated by the exploitation of the super-giant field of Hassi R'Mel, as well as the Alrar and Rhourde Nouss gas fields, the combined productions of which were considered sufficient to supply all the domestic and foreign demand until the end of the 20th century. However, to avoid an overly-rapid depletion of the Hassi R'Mel field, measures in the 1990s were undertaken by Sonatrach to invest in gas fields that had not been developed, as well as a result of the adoption of the 1991 hydrocarbon law to attract foreign investment in the upstream activity. Consequently, the chapter includes a list of 20 upstream projects that were jointly developed by Sonatrach and foreign companies in the form of production sharing contracts from 1991 to 2015. Foreign companies with interests in the upstream segment included the British BP and Norwegian Statoil (later, Equinor), and five other companies from within the Western Mediterranean, namely the French Total and GDF (later,

Engie), the Spanish Repsol and Gas Natural (later, Naturgy) and the Italian Eni. It has to be remembered though that, throughout this period, Algerian gas output remained heavily dependent on the giant field of Hassi R'Mel and that Sonatrach accounted in 2015 for 90 percent of the gas production in Algeria.

The next section analysed the midstream segment of the natural gas value chain that encompasses both gas pipelines and LNG. In this segment, and since the 1960s, there were projects to physically interconnect Algeria with France, Spain and Italy. But the low demand of natural gas in countries like France and Spain, as well as the lack of proper technology, delayed the first physical cross-border interconnection to transport pipeline gas until 1983, when the Trans-Mediterranean gas pipeline connecting Algeria with Italy became operational. However, the turnaround that would certainly increase demand of Algerian natural gas came at the end of the 1980s with a historical shift of disproportioned consequences: the fall of the Berlin Wall in November 1989, followed by the dissolution of the USSR in December 1991, which paved the way towards the emergence of a new concept of long-term energy security in Western Europe (Aïssaoui, 2001). The EC (later EU) enlargement to Spain and Portugal in 1986 and the establishment of the Arab Maghreb Union in 1989 did facilitate the necessary impetus to deepen the bilateral EU-Algeria energy dialogue and exploit the emerging European gas markets.

As a result of the natural gas pipelines that were built in order to connect Algeria with Italy via Tunisia (Trans-Mediterranean gas pipeline, 1983), with Spain via Morocco (Maghreb-Europe gas pipeline, 1996) and directly with Spain (Medgaz pipeline, 2011), and all the new long-term “take-or-pay” contracts for pipeline gas and LNG that Sonatrach signed with a number of IOCs, in the timespan 1983-2005 we witness the sharpest increase in the exports of Algerian natural gas. The construction of gas pipelines, coupled with the expansion of new LNG terminals in both Arzew and Skikda, provided Algeria with a considerable infrastructure to export gas to mainly European markets. This section also includes two very exhaustive lists of long-term contracts encompassing all those signed from 1963 to 2015 for LNG and from 1977 to 2015 for pipeline gas, bearing in mind that contracts signed to deliver pipeline gas through the Trans-Mediterranean gas pipeline could not start the deliveries until 1983, when the pipeline became operational. For the IOCs purchasing LNG, the French GDF has been the main client during these 50 years in light of the absence of physical interconnections between the two countries,

whereas for the purchasing of pipeline gas Italian and Spanish IOCs have become the main clients.

Unlike the LNG long-term contracts that have seen their duration reduced overtime due to the changes favouring the spot market over the “take-or-pay” contracts, in the case of the pipeline gas, the contract duration continues to be rather stable along the timeline, depending on the capacities to import pipeline gas. In contrast, the total volumes contracted have been lowered over time, which is the result of further diversification in the sources of origin of natural gas imports, particularly for Italy, but also Spain. In this regard, Italy has considerably increased imports of pipeline gas from Russia, whereas Spain has increased LNG imports from different sources (Qatar, US, Nigeria...), in many cases, at the expense of the pipeline gas to be imported from Algeria. In the case of Portugal, LNG imports have mainly come from African and Asian destinations, leaving little margin for pipeline gas imported from Algeria. On the other hand, the absence of physical interconnections from Algeria to France (directly or via Spain) has caused French imports of Algerian gas to be transported by LNG, as noted. An alternative gas pipeline, which could have brought Algerian pipeline gas to France, the South Transit East Pyrenees (STEP), aimed to connect the Spanish and the French natural gas systems through the regions of Catalonia and Occitanie. It started its construction works on the Spanish side by the end of 2010, but in 2019 it was finally rejected by the French and Spanish authorities.

The next section reviewed the asymmetric development of the natural gas markets in Italy, Spain and France, being the main consuming markets of natural gas in the downstream segment of the natural gas value chain in the Western Mediterranean. The development of these three markets has been very uneven. Whereas Italy became a pioneering country in the consumption, as well as production, of natural gas after the Second World War to become the second largest EU consumer of natural gas after Germany, Spain was a latecomer and did not change significantly until the mid-1990s, when the Spanish government was able to stimulate a burgeoning gas market by opening the Spanish gas and electric power markets to new investments, particularly in gas-fired power generation (Hayes, 2006; Mañé-Estrada, 2009). In the case of France, the development of the natural gas market was characterised by the slowdown in the rise of natural gas consumption due to the priority given to the use of nuclear power in electricity generation (Chevalier, 1993).

Yet, the three countries have maintained their trade relations of natural gas with Algeria overtime, in spite of diversifying their sources of origin since the beginning of the 21st century with the expansion of LNG and Norwegian and Russian pipeline gas. In terms of infrastructure built, whereas Spain has strongly relied on the prospects for LNG by building a system of six LNG import terminals scattered across its territory with the highest import capacity of LNG across Europe, both Italy and France, especially the former, have relied more on the capacity to import pipeline gas by building numerous physical interconnections with neighbouring transit countries. In the case of Italy, with Algeria via Tunisia, with Austria, Switzerland, Libya and Slovenia. In the case of France, with Norway, Germany, Belgium, Switzerland and Spain.

The final section sought to determine the characteristics of the micro-integration process taking place along the natural gas regional energy chain, while suggesting the potential for macro or institutional integration. The applied methodology, which stems from the GCC approach and is based on the previous works found in Mañé-Estrada et al. (2012), has revealed the relational nature of the different companies involved in the energy chain. By this, one can infer the degree of existing symmetrical patterns in the energy cooperation scheme, while assessing the degree (or quality) of integration of Algeria into the rest of the region. A symmetrical energy cooperation scheme might facilitate higher degrees of integration at the macro level, but the outcome of the exercise leads to inconclusive results. Whereas for the Algerian “New” NOC Sonatrach, the “Western” IOCs like Eni, Total, Repsol, Cepsa, Engie, Galp and the “Western ROC” like Gas Natural (later, Naturgy), Enagas and Snam Rete Gas intervening in the energy chain the conditions under which they become integrated into the energy value chain seem more equitable and symmetric, with the passing of time, this apparent symmetry in power relations might become more asymmetrical. As for the transit ROCs from Tunisia and Morocco, the result seems to be clearer to the extent that their integration is very subordinated to the interests of Sonatrach. Considering that the results are not conclusive enough, in Chapter 4 new quantitative analyses are conducted to better understand the nature of the natural gas value chain in the Western Mediterranean.

CHAPTER 4: Value Chain Analysis: Implications and Effects for Algeria as a Rentier Economy

CHAPTER 4: Value Chain Analysis: Implications and Effects for Algeria as a Rentier Economy

4.1 Introduction

The previous chapter described the historical development of the natural gas value chain in the Western Mediterranean by looking separately into the three segments of the chain: the upstream segment, mainly developed in Algeria with a key role performed since 1971 by the Algerian National Oil Company (NOC) Sonatrach but also by other International Oil Companies (IOCs) since the moment that the Algerian hydrocarbon law allowed it in 1991; the midstream segment, with the evolution of the two activities involved in the value chain, namely the liquefied natural gas (LNG) industry and the cross-border gas pipelines across the Western Mediterranean; and finally, the downstream segment, examining the surge of the natural gas consuming markets in the three countries better integrated in the chain – Italy, Spain and France –, as well as their trade relations of natural gas with Algeria. The qualitative exercise conducted at the end of the last chapter does not provide conclusive results.

Against this backdrop, the present and final chapter aims at concluding the research carried out throughout this thesis by conducting quantitative and evidence-based exercises that test the hypothesis set out at the beginning of this work. In this vein, the chapter begins (section 4.2) by providing a fully-fledged analysis of the Global Value Chain (GVC) into which the Algerian gas sector is integrated. The exercise carried out stems from the methodology mostly used by Koopman et al. (2011 and 2014) and Pahl et al. (2021), among others, which aims to evaluate the capacity of power and influence of each of the countries and agents involved in the energy chain (companies and governments of the countries where the natural gas value chain's activity takes place).

In this regard, it assesses the relations of dependence and intensity of integration in the value chains as described in Chapter 3. In order to determine the degree of energy integration between Algeria and the rest of the Western Mediterranean countries, specifically Italy, France and Spain, within the natural gas value chain, a number of tests are conducted. The latter will feature the power position of Algerian agents compared to their European counterparts in the natural gas industry from 1990 to 2015 and shows how each country is integrated into the natural gas value chain, highlighting Algeria's relations of dependence on the other three countries. This analysis

is complemented by examining the exposure of all the countries embedded in the Western Mediterranean's GVC to shocks of natural gas supply and demand to test the degree of dependence between countries. We have picked 1990 as the starting point of the quantitative analysis because it is not until 1991 that Algeria's hydrocarbon law was reformed to allow the participation of IOCs in the natural gas sector.

The use of the aforementioned GVC methodology as a quantitative tool to describe the natural gas value chain in the Western Mediterranean is complemented with qualitative analyses that seek to determine the relational nature of the agents embedded in the energy chain. The resulting outcome may prove to be consistent to determine how the existing linkage between the domestic and regional sides helps to explain the relations of power along the natural gas value chain. Significant conclusions are drawn from this exercise (section 4.3).

In the following section (section 4.4), the question of hydrocarbon rent accruing to the Algerian state becomes central. The underlying idea is to directly respond to the research hypothesis by better understanding how the type of integration of Algeria into the natural gas value chains, which has been previously assessed, determines the rentier nature of the Algerian state. In this vein, the research tries to elucidate whether greater integration in natural gas value chains could mitigate or not the degree of rentierism of a hydrocarbon-rich economy such as the Algerian one, and thus modify its relations of power asymmetry in the Western Mediterranean area.

A large body of literature (Gurria, 2013; Gill & Kharas, 2007; Giri et al., 2019; among others) emphasises the importance of integration into GVCs as a means of fostering economic growth and development by offering new opportunities for firms in developing countries to become part of regional and global networks, thereby promoting growth and job creation. Moreover, if natural gas were integrated into the international market – not just as a commodity export, but as crude oil has been within the framework of GVCs –, it would be a factor that could provide beneficial elements to prompt economic development, attract investments, foster knowledge transfer, strengthen the sustainability and business model of the hydrocarbon industry, and therefore, could lead to a higher degree of power (sovereignty) in the relationship of its hydrocarbon industry with counterparts in other countries. In this section, by way of an epilogue, an analysis is carried out to determine whether or not we can infer a correlation between rent

generation and GVC participation, and ultimately a panel data model is defined to evaluate whether not only correlation but also a causal relationship exists between these two variables.

Finally, the last section (section 4.5) serves as a corollary to the previous two sections in the sense that as a result of the direction and intensity in which the natural gas value chain in the Western Mediterranean area has been shaped and the rentier nature of Algeria, the absence of the former has hindered the possibility for Algeria to become much less dependent on the hydrocarbon rents, thereby enhancing the rentier nature of the Algerian economy.

4.2 Analysis of the integration of Algeria's sector into the natural gas value chain

The previous chapter has described the historical development of the Western Mediterranean natural gas value chain in the three segments involved: the upstream, the midstream, and the downstream. It has looked into how the production of hydrocarbons has evolved in Algeria since 1971, with a special focus on natural gas. It has analysed the diachrony of the two activities linked to the midstream phase, namely the LNG industry and the Trans-Mediterranean Gas Pipelines, in the Western Mediterranean area, while examining the evolution of Algeria's natural gas exports. Finally, it has also analysed the creation of the three main downstream markets in the region, notably in Italy, Spain and France.

In order to determine the role that Algeria has had as a rentier economy, we now assess the ongoing dynamics of integration of its natural gas industry in the value chain from 1990 to 2015. We selected 1990 as the starting point for the quantitative analysis because it was not until 1991 that Algeria's hydrocarbon law was reformed to permit the participation of IOCs in the natural gas sector.

The exercise carried out is twofold: on the one hand, we perform a full analysis of the GVC in the natural gas industry in the Western Mediterranean that encompasses both quantitative and qualitative assessments of the position and participation of the natural gas producing country, Algeria, in the gas value chain, as well as the participation of “consuming” countries – Italy, Spain and France – in the gas value chain. The analysis of the Gas Value Chain also allows us to determine the backward and forward linkages inherent in the participation of these countries in the global chain. We also estimate indicators of GVC participation, as well as the

decomposition of trade between GVC-related and traditional trade (not GVC-related). GVC-related trade accounts for the share of exports which crosses at least another border with respect to the one considered, which implies that if country A produces output that is exported to country B that consumes it, then the latter is not GVC-related but traditional trade. Hence, we try to determine whether Algerian natural gas exports can be better considered traditional trade rather than a result of an integration into a regional or global natural gas value chain.

Secondly, we examine the exposure of all the countries embedded in the Western Mediterranean's GVC to shocks of supply and demand of natural gas. This will help us assess the degree of integration, and therefore infer the degree of power asymmetry within the GVC configuration. In the context of this research, it provides us with the basis to understand which of the economies in the region is more dependent on the others with regards to natural gas, and hence more exposed to the others, meaning that the power it exerts in the energy chain is lower, or higher.

4.2.1 *GVC analysis. A quantitative methodology*

There is an extensive body of literature (Hummels et al. [2001], Koopman et al. [2011 and 2014], Foster-McGregor et al. [2016], Antràs et al. [2012], Del Prete et al. [2016], Ayadi, Giovannetti et al. [2021], Pahl et al. [2021], World Bank [2014], Borin [2019]) that provides guidance on measuring the extent of GVCs and of agents' involvement in such chains, and eventually of individual countries, with the use of Input-Output (IO) tables, which describe the sale and purchase relationships between producers and consumers. The reduction in transport and communication costs, coupled with the overall decline of trade barriers, have boosted trade and capital flows since the 1990s. This process of globalisation has triggered a shift in the way goods and services are produced. In this vein, production is increasingly organised within GVCs and Global Production Networks (GPN), whereby a lead firm relies or several lead firms rely upon a complex network of suppliers across the world or a geographical region, made up of different and diverse economies that are increasingly more dependent on one another (Gereffi et al., 2005; Bridge & Bradshaw, 2017).

In addition, one of the major implications of the growth of trade in fragmented GPNs is the increasing number of aggregate export figures. This results from the double and triple counting of intermediates as they cross over national borders in the process of coming together to form an end product (Engel et al., 2016). As a result, understanding a country's gross exports as well

as exports and imports of value added is important for understanding trade performance and GVC participation. It provides an insight into the critical issue of how trade performance contributes to the domestic economy in terms of output, industry linkages, and employment.

The starting point for the GVC quantitative analysis can be found in Robert Koopman et al. (2011), in which the authors develop a full set of indicators of GVC participation that allows the foreign and domestic value-added content of exports to be split up. The three indicators that Koopman et al. define in order to decompose, and better understand, countries' participation and position in GVCs, along with specific sectors within these countries, are the following: (1) the foreign value added (FVA) share or "import to export", which measures the share of a country's exports that consist of inputs produced in other countries. This is often referred to as the backward linkages, or participation in the downstream sector, and it determines the degree of backward integration; (2) the indirect value-added exports (DVX) or "export to re-export", which measures the share of a country's value-added exports embodied as intermediate inputs in other countries' exports. This is often referred to as forward linkages or participation in upstream sectors, and it determines the degree of forward integration; (3) the domestic value-added (DVA) share of gross exports, which is an estimation of the value-added created by an economy in producing goods and services for exports.

Based on these definitions, the sum of FVA and DVA of a country or a sector within a country, in absolute terms, corresponds to gross exports:

$$\text{Exp} = \text{DVA} + \text{FVA}$$

The difference between these two indicators (DVA and FVA) is that while more DVA means more total value added exported and hence more GDP, FVA does not add to the GDP of the country of interest because it relates to the value added of inputs produced in other countries. Taglioni et al. (2016) define a country's ability to benefit from its integration into GVCs to be better reflected by the evolution of its DVA embodied in gross exports over time. Therefore, an increase in the latter means greater value addition within the country itself. However, a quick integration into GVCs might result in lower DVA as a share of gross exports, given that the first also means higher levels of FVA, which is a substitute of DVA in percentage terms.

Moreover, in countries with large hydrocarbon exports like Algeria, growth in hydrocarbon exports and changing global hydrocarbon prices might impact the DVA measures quite substantially, considering that higher unit prices in exports might produce higher figures of DVA percentages regardless of whether these exports are within GVCs (Engel et al., 2016). In addition, even if DVA indicator better reflect value addition within the country, hydrocarbon exports might entail high DVA despite weak contribution to domestic labour markets and supply chains (Taglioni et al., 2016).

Similarly, one can capture the overall participation of countries in GVCs, and specific sectors within these countries, by combining the FVA and DVX indicators, that is by summing up the FVA used in a country's (or specific sector within that country) own exports and the value added supplied to other countries' exports. This sum is often expressed as a ratio to gross exports:

$$\text{GVC Participation} = \frac{\text{FVA}}{\text{Exp}} + \frac{\text{DVX}}{\text{Exp}}$$

The former indicates the extent to which a country's exports (or a sector within a country) comprise value added created abroad (FVA), and thus captures the magnitude of GVC participation in downstream industries, but it also captures the contribution of the country's domestic sector to the export of other countries (DVX), thus indicating the magnitude of GVC participation for relatively upstream sectors. At first sight, higher FVA or DVX in exports implies that countries increasingly use foreign inputs for their exports or export intermediate inputs in other countries' exports, and thus are more integrated into GVCs.

Finally, Koopman et al. (2011) establish the position of a particular country (or of a sector within that country) along the GVC as the log-ratio of a country's supply of intermediates (or of a sector within that country) used in other countries' exports to the use of imported intermediaries in its own production:

$$\text{GVC Position} = \text{Log} \left(1 + \frac{\text{DVX}}{\text{Exp}} \right) - \text{Log} \left(1 + \frac{\text{FVA}}{\text{Exp}} \right)$$

If the country (or the sector within that country) is positioned upstream in a supply chain, the first term of the equation will tend to be large, whereas if it is positioned downstream in the

chain the second term of the equation will be larger, and the result of the GVC position will be negative.

The calculation of FVA in trade, alongside the other indicators explained, requires a multi-region input-output (MRIO) table, which builds upon national IO tables by breaking down the use of products by origin. In the MRIO table used, there are 190 countries reflected, and each country encompasses a number of industries that we are considering. While the rows in an MRIO table indicate the use of gross output from a particular industry in a country, the columns provide information on the technology of production, as they indicate the amounts of intermediates needed for the production of the gross output whose use is then decomposed along the row. Building on this info, we can translate the MRIO table for multiple countries and industries into a standard IO matrix form, expressed as:

$$\mathbf{x} = \mathbf{Z}\mathbf{j} + \mathbf{y}$$

$$\mathbf{x} = \mathbf{A}\mathbf{x} + \mathbf{y}$$

$$\mathbf{x} = (\mathbf{I} - \mathbf{A})^{-1}\mathbf{y} = \mathbf{L}\mathbf{y}$$

where $\mathbf{x}$ represents the gross output $n \times 1$ vector of n countries, $\mathbf{Z}\mathbf{j}$ the total intermediate demand vector (with $\mathbf{Z}$ being the intermediate demand matrix and $\mathbf{j}$ an all-one vector), $\mathbf{y}$ the total final demand vector ($\mathbf{y} = \mathbf{Y}\mathbf{j}$, with $\mathbf{Y}$ being the final demand matrix), $\mathbf{I}$ the identity matrix, $\mathbf{A}$ is the technical coefficient matrix and $\mathbf{L}$ is the Leontief inverse matrix. Total value added is obtained from the vector $\mathbf{w} = \mathbf{x} - \mathbf{Z}\mathbf{j}$ as the difference between gross output and intermediates use. To calculate value added trade, we start with the share of value added per unit of output by country, combined with the Leontief inverse matrix $\mathbf{L}$ and aggregate exports by country as retrieved by the sum of the intermediates and final goods sold abroad. The value-added trade matrix can then be written as $\mathbf{T}^v = \mathbf{V}\mathbf{L}\mathbf{E}$, as:

$$\begin{pmatrix} T_{11}^v & \cdots & T_{1n}^v \\ \vdots & \ddots & \vdots \\ T_{n1}^v & \cdots & T_{nn}^v \end{pmatrix} = \begin{pmatrix} v_1 & \cdots & 0 \\ \vdots & \ddots & \vdots \\ 0 & \cdots & v_n \end{pmatrix} \begin{pmatrix} L_{11} & \cdots & L_{1n} \\ \vdots & \ddots & \vdots \\ L_{n1} & \cdots & L_{nn} \end{pmatrix} \begin{pmatrix} e_1 & \cdots & 0 \\ \vdots & \ddots & \vdots \\ 0 & \cdots & e_n \end{pmatrix}$$

where the left-hand side matrix $\mathbf{T}^v$ describes how the value added contained in the exports of each country (and industry) is generated (by column) and distributed (by row) across the 190 countries that we are considering.

In fact, the columns of the matrix $\mathbf{VL}$ indicate the amount of value added required from the different row-countries for the column-country to produce one unit of gross output and all the columns sum up to one. Similarly, under the assumption of homogeneity between output and export, the columns of the matrix $\mathbf{T}^v$ represent the value-added content of exports of the column-country, which is then composed of two parts: on the main diagonal, the term $\mathbf{T}^{vi}$ denotes the **DVA** of country i outside the main diagonal, the term $\mathbf{T}^v = \mathbf{v}_k \mathbf{G}_{ki} \mathbf{e}_i$ denotes, instead, the FVA generated by row-country k and incorporated in the exports of column-country i . The (column) sums of DVA will yield the total exports of countries. The trade in value added $\mathbf{T}^v$ matrix also provides information on how much of each country's domestic value-added enters as an intermediate input in the value added exported by other countries. Hence, by reading the matrix along the row (and excluding the diagonal term), it is possible to measure the **DVX**.

To capture the overall participation of countries and industries in GVCs, we combine the FVA and DVX measures, by summing up the FVA used in a country's own exports and the value-added supplied to other countries' exports, and taking the sum as a ratio of gross exports.

4.2.2 *A quantitative analysis of the natural gas value chain in the Western Mediterranean*

In line with the explanations offered in the previous sub-section, in this one we use the full EORA database of UNCTAD to construct $\mathbf{T}^v$ matrices on a yearly basis for the period 1990-2015²⁰⁰ and provide a comprehensive description of the participation of Western Mediterranean countries in the GVC of the sector in question. The beginning of the 1990s has a very important meaning for the region as it precisely coincides with the consolidation of the changes that the region undertook during the second half of the 1980s: the implementation of schemes of LNG and cross-border Mediterranean pipelines from Algeria to Southern Europe, the surge of Europe's appetite to diversify its natural gas supplies within broader geopolitical and economic frameworks, as well as the boost of gas demand amongst Southern European markets, as has been explained thoroughly in Chapters 2 and 3.

Whereas one of the objectives of this research thesis is to assess the degree of integration of the natural gas sector from the Western Mediterranean by using the GVC methodology, we propose

²⁰⁰ Annex II contains the results for all indicators and other measures used in this subsection for each year in the time series (1990–2015).

a matrix approach that helps us disentangle the proposed measures for the countries in the Western Mediterranean. Considering that the $\mathbf{T}^v$ matrix uses input-output (IO) data for all 190 countries, and for each country several industrial sectors, the results revealed reflect the nature of the participation of Western Mediterranean countries in the Global Value Chain of the industrial sector that is being examined, and not only the participation of those countries in the Western Mediterranean's GVC. In the next sub-section, we will examine the dynamics of dependence between the countries that take part at the Western Mediterranean's Gas Value Chain.

In this vein, we will now analyse the basic indicators for Algeria's gas sector in relation to the natural gas GVC (FVA, DVA, DVX, position and participation). Once we have obtained some conclusions for Algeria, being the "producing" country in the regional value chain, we will repeat the exercise for Italy, France and Spain, and compare the results with those obtained for Algeria. We will do this for the timespan 1990-2015, enabling us to observe the evolution for these indicators over time.

During the initial calculations, other countries in the Western Mediterranean area such as Tunisia and Morocco in the south and Portugal in the north of the Mediterranean were embedded in the matrix but the results obtained showed a very low percentage in both backward and forward integration with Algeria (below 0.5), which means that these three countries are in reality not part of the natural gas value chain. They might benefit from traditional gas trade with Algeria, but they do not participate in meaningful GVC-related trade. Therefore, they were excluded from the final calculations. Conversely, the exclusion in particular of Tunisia and Morocco from the natural gas value chain in the Western Mediterranean does not mean that these two countries might not play a relevant role in the trade of natural gas between Algeria and the three north Western Mediterranean countries. As explained in detail in Chapter 3, these two countries play a meaningful role as transit hubs in the transportation of pipeline gas between Algeria and Italy, as well as Spain,²⁰¹ therefore under this scheme both countries consume Algerian gas and they might exert power by strategically interrupting the flow of natural gas.

²⁰¹ See footnote 152.

Figure 25. Foreign Value Added (FVA) component in all Algerian industries and the Algerian hydrocarbon (natural gas industry), 1990-2015



Source: Author's own elaboration based on UNCTAD-Full Eora GVC Database. Figures reported are the ratio of FVA used in Algeria's own exports to gross exports

Figure 25 reports the FVA component in all Algerian industries that trade with other countries, and also in Algeria's natural gas industry, for the timespan 1990-2015. For both, all Algerian industries, and particularly for the natural gas industry, the FVA component as a share of gross exports reflects very low values. In particular, for the natural gas industry, the highest value of 8 percent of gross exports is reached in 2009,²⁰² whereas for all Algerian industries the highest value of 11 percent of gross exports appears in 1995. Low values of FVA (below 15 percent) entails low levels of backward integration. This is a sign of low participation in GVCs, for both Algerian industries and particularly Algeria's natural gas industry.

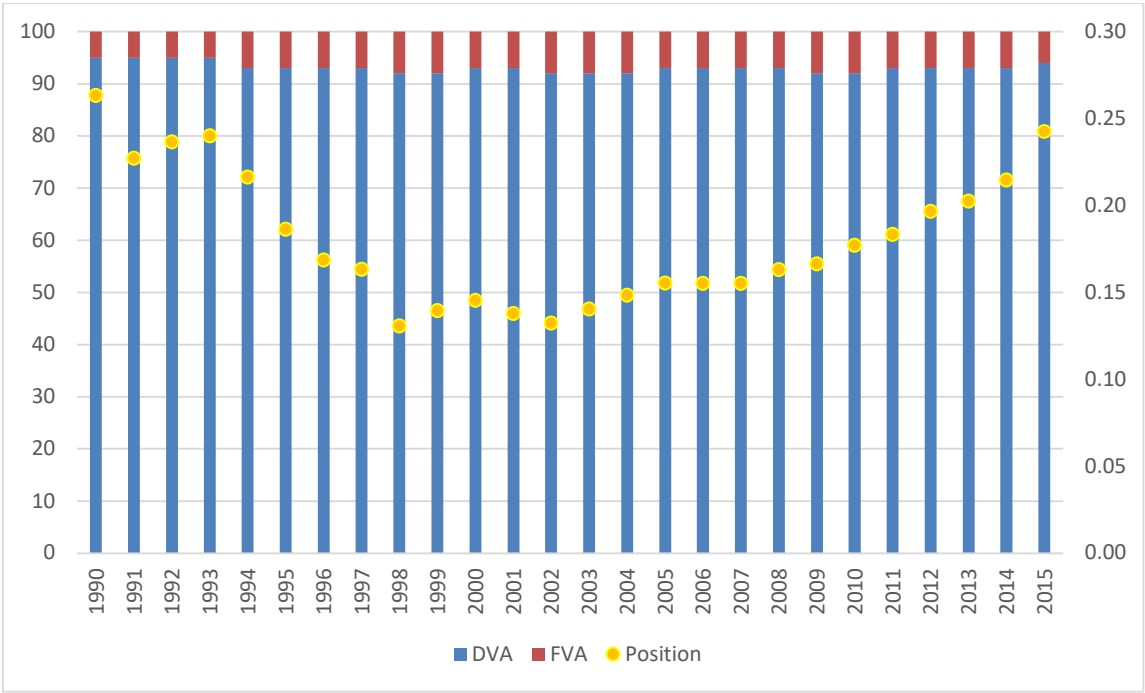
Yet, despite low levels of FVA as a share of gross exports throughout the entire historical data series, there is a rapid increase between 1993 and 1995, which can be explained by the significant boost of Algerian natural gas exports during that same period. As reflected in Chapter 3, from

²⁰² With the decline of gross exports of natural gas in 2009 as a result of the global great recession, the share of FVA to gross exports might have increased. That might be the reason why we witness a surge in 2009, which is later corrected.

1993 to 1999 Algeria experiences the fastest growth of natural gas exports since the nationalisation of the hydrocarbon industry in 1971. Part of this natural gas trade boost is integrated into the natural gas GVC, which is also reflected in a relative growth of the FVA indicator embodied in gross exports.

Nonetheless, relatively small and stagnant values of the FVA indicator throughout the historical data series reinforce the view that Algeria, including the natural gas industry, continues to struggle to break into downstream production and that much of its involvement in GVCs is upstream (natural resource production). Obviously, this feature will be underpinned by the following indicators.

Figure 26. Foreign and domestic value-added trade in Algeria’s hydrocarbons (natural gas industry). Algeria’s position in the hydrocarbons (natural gas) GVC, 1990-2015



Source: Author’s own elaboration based on UNCTAD-Full Eora GVC Database. Left axis is expressed in percentage and reflects the figures reported of the DVA and FVA as ratios to gross exports. Right axis reflects the results of the position of Algeria in the GVC

Figure 26 decomposes Algerian gross exports of natural gas into their domestic and foreign components. For the period 1990-2015 we observe rather stagnant values when it comes to the DVA-FVA decomposition of total gross exports of natural gas, in particular from 1995 onwards.

As explained in the previous sub-section, gross export values can be divided between FVA or “import to re-export”, which measures the share of a country’s exports that consist of inputs produced in other countries, and DVA, which is an estimation of the value added created in producing goods for exports. Overall, the domestic component always represents more than 90 percent of gross exports of natural gas, which suggests that their participation in GVCs is low.

In this vein, it is worth noting that countries that are more dependent on commodity exports, as in the case of Algeria with hydrocarbon resources, often fare well in terms of DVA but they perform less well when measuring GVC participation (Engel et al., 2016). In Figure 26 we observe a very high value of DVA as percentage of gross exports, which suggests that although Algeria is Africa’s top natural gas exporter, its economy captures most of the value added of natural gas exports and is poorly integrated into the GVC. Whenever we observe a declining DVA as percentage of gross export, we might infer that natural gas exports are suffering from declining commodity prices during that period of time. In contrast, if we observe a growing DVA percentage, natural gas exports might benefit from rising prices (Duan et al., 2018).

As noted, Koopman et al. (2011) propose a GVC position indicator that suggests if a country specialises in the first or last steps of production. If a country is upstream in the production network (first stages of production), it is likely that it has a high value of forward participation relative to backward. If a country specialises in the last steps of production (downstream), it is likely that it imports a lot of intermediate goods from abroad and therefore has high backward participation. The GVC position indicator is constructed in such a way that countries with high forward relative to backward participation record a positive value. These countries lie relatively more upstream in a supply chain, which is the case for Algeria and for Algeria’s natural gas industry, as shown in Figure 26.

Considering that this indicator takes negative values for country-sectors that lie in the downstream segment of the production chain, the values reported for Algeria’s natural gas industry indicate that it clearly positions in the upstream segment. Not only this, but if we take a look at the dots in Figure 26, they suggest that this upstreamness has intensified since the beginning of the 20th century as they take a higher value. The latter is a consequence of the boost given in the upstream segment of Algeria’s natural gas industry by increasing the involvement of Sonatrach in a number of new exploitations of gas fields destined to supply more

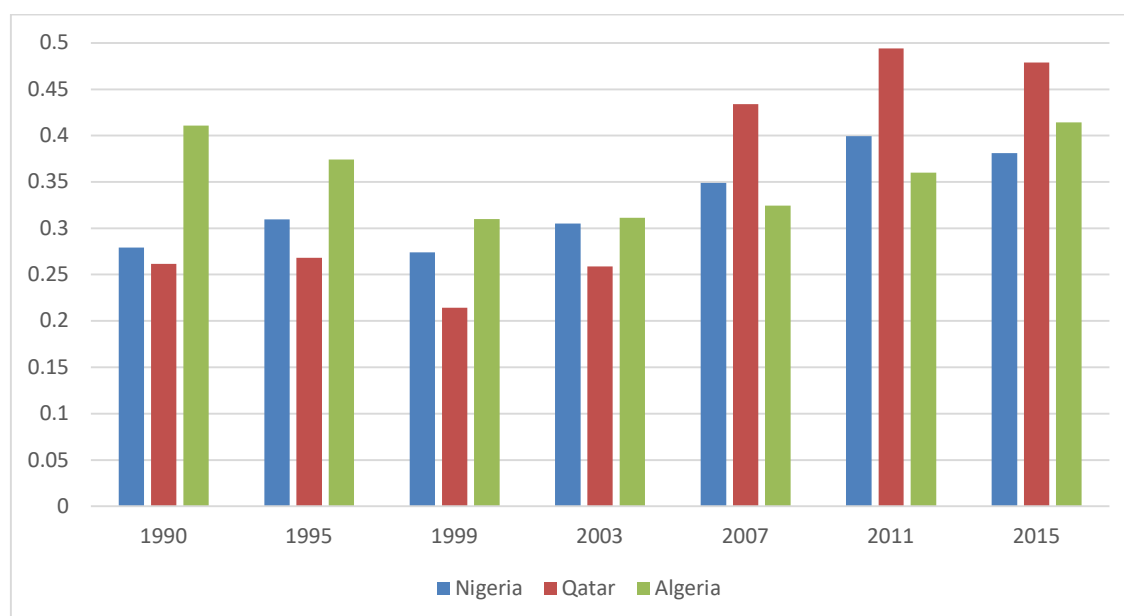
natural gas for export, as thoroughly explained in Chapter 3, where the upstream segment of the value chain is described.

However, in the period 1993-1998 we also observe a weakening of the upstreamness in the positioning of Algeria in the natural gas GVC, which can be explained by the decline of forward integration and the increase of backward integration. As the GVC position indicator is constructed as the log ratio of a country's sector supply of intermediates used in other countries' exports (DVX) to the use of imported intermediates in its own production (FVA), as noted in the previous sub-section, the decline of DVX as a share of gross exports explains why the levels of upstreamness in the GVC are lower. This process occurs in the period (1993-1999) when Algeria experiences the fastest growth of natural gas exports since the nationalisation of the hydrocarbon industry in 1971, as noted in Chapter 3, but also a period characterised by growing backward integration rather than forward integration in the natural gas GVC, which can be explained by the process of gas liberalisation taking place in the European Union (EU) and the surge of demand in this respect.

Alongside Algeria for North Africa, we have chosen two additional countries that are also leading both natural gas reserves and exports in their respective regions (the Middle Eastern and Sub-Saharan regions): Qatar is today a world leading exporter, and certainly the main gas exporter in the Middle East, while Nigeria is the second largest gas exporter in the African continent after Algeria and the largest in Sub-Saharan Africa. We can obtain some useful results by comparing the natural gas sectors from these three countries. In Figure 27 we report the GVC participation during the timespan 1990-2015 for Algerian, Nigerian and Qatari natural gas industries.

A number of interesting facts emerge from this figure. As has been explained, in the case of Algeria's gas industry, FVA has been rather stagnant over time. During a first period (1990-2001) we observe a declining trend in GVC participation, which is later recovered during a second period (2001-2015). The turning point coincides with the partial attempts by the administration of Algerian President Abdelaziz Bouteflika to open up the hydrocarbon sector to foreign investment and boost hydrocarbon exports, as reported in Chapter 2. From a quantitative point of view, the reason why a boost in GVC participation can be noticed from 2001 onwards is due to an increase in forward integration, whereas backward integration has remained stagnant over time.

Figure 27. GVC participation of Algeria, Qatar and Nigeria's hydrocarbons (gas industry), 1990-2015



Source: Author's own elaboration based on UNCTAD-Full Eora GVC Database. Figures reported are the portion of the country-sector's exports that are part of a multi-stage trade process with 189 countries

Similarly, the evolution of the GVC participation indicators for Qatar and Nigeria follows analogous patterns but with a different intensity. In the case of Qatar, its participation in the GVC starts from a lower level as compared with the other two countries in the 1990s, but as soon as the country's gas industry gains strength with new export infrastructure and takes off at the beginning of the 2000s, its participation in the GVC increases quite significantly. The latter reports an increasingly higher GVC participation from the side of Qatar that can be explained by the structure of its gas sector, underpinned by the LNG industry, which has become world leader in its sector, and the fact that it has managed to better export gas that is then used to produce new products that are re-exported.

Having analysed the main GVC indicators for Algeria, we now extend the analysis to the other Western Mediterranean economies embedded in the regional natural gas value chain, namely Italy, France and Spain.

When comparing the participation of Algeria's in the natural gas industry in the GVC with that of the other Western Mediterranean countries, in particular those that trade significantly with Algeria in this sector, the result is reported in Tables 23 and 24 for the years 1990 and 2015. These two tables reflect the decomposition of the sector's exports for these four countries. As already argued, Algeria's data shows how the natural gas industry is the least integrated into the GVC, for both 1990 and 2015. The decomposition of GVC into backward and forward integration remains almost invariable after this 25-year time period, whereas traditional gas trade (that is, outside any sort of GVC) remains the vast majority of all gas trade, in stark contrast with the cases of Italy and France, which during this 25-year period have better integrated into GVCs and have improved quite considerably both backward and forward integration into GVCs (Italy increasing the GVC-related trade by 4.5 points and France by 20 points). The evolution achieved by France in this regard is remarkable, with a rise of 20 points in GVC-related trade, in which by the end of the period analysed its traditional gas trade was very low in comparison with the GVC-related gas trade. This figure is much higher than the increase of 4.5 points by Italy, 0.3 points by Algeria, and the decrease of 0.5 points by Spain.

Table 23. Western Mediterranean's hydrocarbon (natural gas) exports decomposition (1990)

	Algeria	Italy	Spain	France
Domestic content	95.2	92.6	91.9	84.3
Foreign content	4.8	7.4	8.1	15.7
Total	100	100	100	100
of which				
GVC-related trade (in percent; GVC)	41.1	69.2	59.1	64.8
GVC backward (in percent)	4.8	7.4	8.1	17.7
GVC forward (in percent)	36.3	61.8	51	47.1
Traditional gas trade	58.9	30.8	40.9	35.2

Source: Author's own elaboration based on UNCTAD-Full Eora GVC Database

Table 24. Western Mediterranean's hydrocarbon (natural gas) exports decomposition (2015)

	Algeria	Italy	Spain	France
Domestic content	93.9	88.3	85.9	82.3
Foreign content	6.1	11.7	14.1	17.7
Total	100	100	100	100
of which				
GVC-related trade (in percent; GVC)	41.4	73.7	58.6	84.8
GVC backward (in percent)	6.1	11.7	14.1	17.7
GVC forward (in percent)	35.3	62	44.5	67.1
Traditional gas trade	58.6	26.3	41.4	15.2

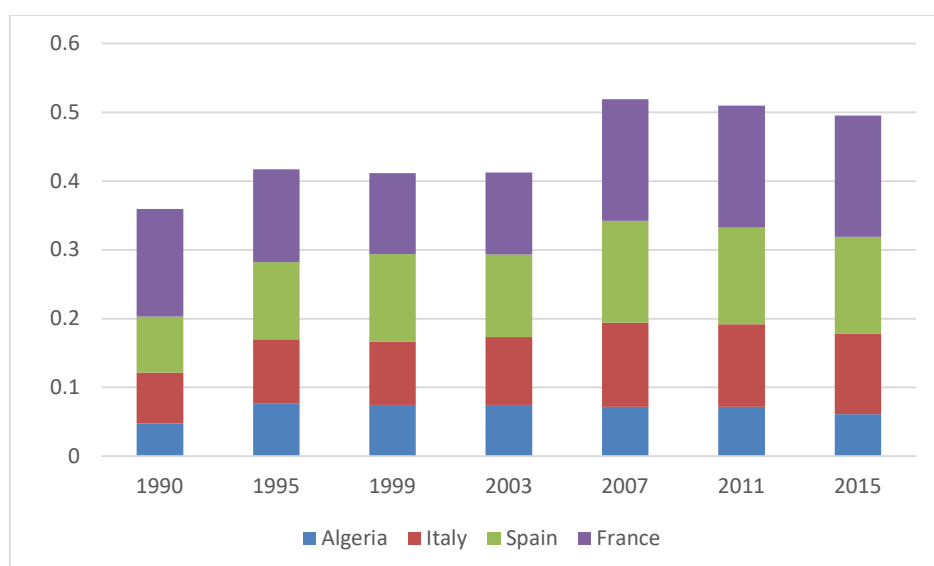
Source: Author's own elaboration based on UNCTAD-Full Eora GVC Database

It is worth noting that the natural gas industry, just like any other extractive sectors, is typically dominated by forward GVC integration rather than backward GVC integration. That explains why the values of FVA are generally so low. Yet, one can conclude that whereas GVC integration in the sector has increased by 30 percent in France and 6 percent in Italy over the period 1990-2015, it has remained stagnant in Algeria and it has slightly declined in Spain. Interestingly, these results show that although Algeria is a leading natural gas exporter, this is not coupled with an equivalent integration into the GVC, due to the very high relative volume of natural gas traded outside the GVC (58.6 percent in Algeria in comparison with 26.3 percent in Italy and 15.2 percent in France).

Figures 28 and 29 go into detail in order to better understand the sources of backward integration (Figure 28) and forward integration (Figure 29) for the sector of Algeria, Italy, Spain and France. Thus, it is confirmed that especially forward integration, but to a lesser extent backward integration in the Western Mediterranean's natural gas industry is driven by countries like France and Italy. In contrast, Algeria remains the country in the region least integrated into GVCs, even though the DVX component has been growing since 2007 when the same component for other countries like France and Italy has decreased in this very same period. Data suggests that countries like France and Italy, as well as Spain to a lesser extent, are more integrated into GVCs because their respective networks are connected towards other international partners, some linkages in the gas industry that Algeria does not seem to have, or at least with the same strength and intensity. It is worth noting that none of three countries has remarkable levels of natural gas

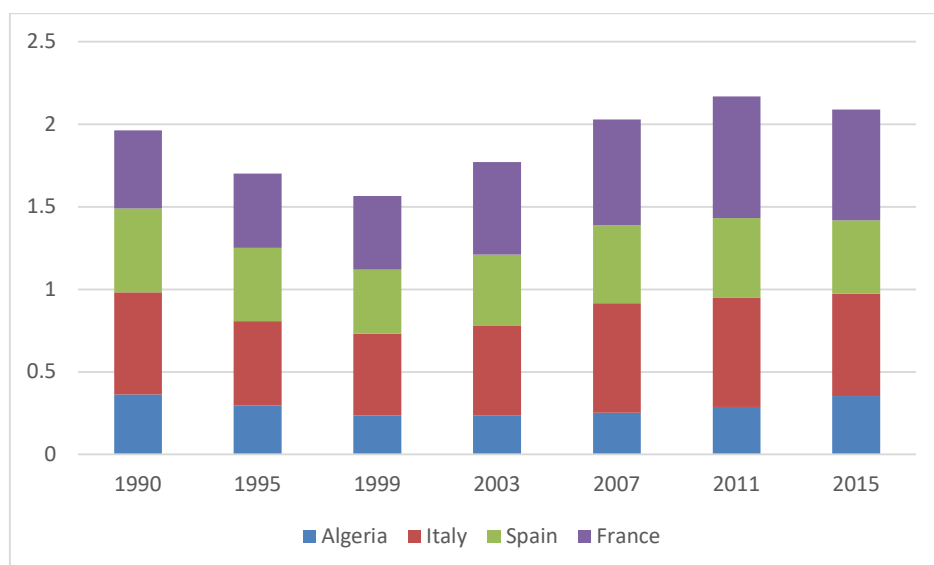
production, as noted in Chapter 3, even though they are better integrated into the natural gas value chain

Figure 28. Accumulation of Foreign Value Added (FVA) component in hydrocarbons (natural gas industry) of Algeria, Italy, Spain and France, 1990-2015



Source: Author's own elaboration based on UNCTAD-Full Eora GVC Database

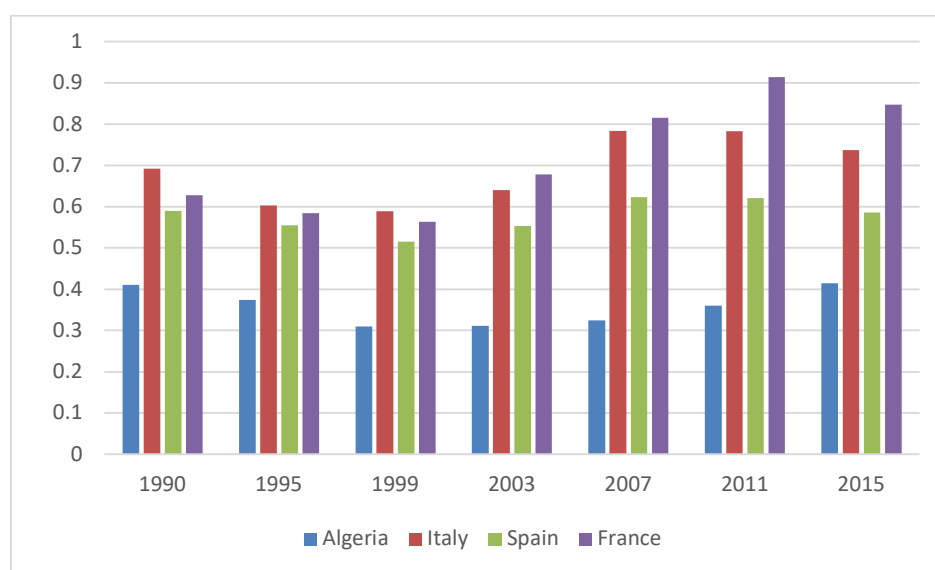
Figure 29. Accumulation of Indirect Value Added (DVX) component in hydrocarbons (natural gas industry) of Algeria, Italy, Spain and France, 1990-2015



Source: Author's own elaboration based on UNCTAD-Full Eora GVC Database

Finally, Figure 30 illustrates the evolution of GVC participation for the sector of the four countries from the Western Mediterranean, which suggests an increase in GVC participation from the year 1999 until 2011, and then a certain decline (or stagnation), in particular for the north-western Mediterranean countries but not for Algeria, as already explained. However, the level of GVC participation for Algeria's natural gas industry has always been much lower than for the other countries. It is also worth noting that before 2000 Italy had a leading position among these four countries in terms of GVC participation. Indeed, Italy was a pioneer country in the European context in boosting the natural gas industry, not only from the consumption perspective but also as a producer of natural gas, as noted in Chapter 3, even though the volumes of gas production have been reduced over time.

Figure 30. GVC Participation of hydrocarbons (natural gas industries) of Algeria, Italy, Spain and France (1990-2015)



Source: Author's own elaboration based on UNCTAD- Full Eora GVC Database

Algeria's participation in the GVC of the sector has remained lower than the other three Western Mediterranean countries despite Algeria's position as a world leading natural gas exporter. This is the unequivocal result of both low levels of forward and backward integrations, being the former more dominant than the latter due to the nature of the traded good – natural gas –, which is a natural resource. We continue now by examining the relations of dependence between the countries embedded in the natural gas value chain in the Western Mediterranean.

4.2.3 *Assessment of regional linkages*

In light of the results presented in the previous sub-section, it is pertinent to examine the relations in the natural gas industry between these four countries, and whether in the past decades we have witnessed a dynamic of greater regional integration in the natural gas value chain in the Western Mediterranean. In order to see if this has occurred, we will analyse the transmission of supply and demand shocks in the natural gas industry among these four countries, and how the latter has evolved over time, in the period 1990-2015. The approach that we will use is close to Pahl et. al (2021), in which they use trade in value-added data for a sample of different countries to quantify their dependence on demand and supply as a consequence of the COVID-19 pandemic, which triggered a major disruption in the GVCs. In this context, by transmission of supply and demand shocks one understands how an unexpected event suddenly changes the supply and demand of natural gas along the value chain of the Western Mediterranean countries. By inferring the extent to which the gas industry in each country responds to supply and demand shocks, we aim to determine the degree of exposure between these countries, and thus their respective dependence.

Whereas one of the objectives of this research thesis is to assess the dynamics of dependence in the natural gas sector of the Western Mediterranean by using the GVC methodology, we propose a matrix approach that helps us disentangle the proposed measures for the countries in the Western Mediterranean. In the previous sub-section, we analyse the nature of the involvement in the GVC by the respective sectors in the Western Mediterranean, whereas in this sub-section we analyse the dynamics of dependence between these respective sectors, which is key to better understanding how this integration into the GVC happens. In particular, we will be looking at the supply side by focusing on the source of value-added used in exports, as well as the value-added exports embodied in other countries' exports. Additionally, we will also be looking at the demand side by focusing on the destination of value-added absorbed in final demand by other countries from the Western Mediterranean area.

Supply-side exposure

In order to estimate the supply-side exposure of the natural gas value chain in the Western Mediterranean, we calculate a T^v matrix of the sector in question, as we already did in the previous sub-section, which describes how the value-added contained in the exports of natural

gas for each country is generated (by column) and distributed (by row) across countries. On the basis of the columns and rows in the matrix, the DVA, FVA and DVX can be equally calculated.

We obtain each country's supply dependence by calculating each country's share of “Total FVA” (or “Total backward GVC”), if we assess the backward integration into the GVC, and also by calculating each country's share of “Total DVX” (or “Total forward GVC”), if we assess the forward integration into the GVC. We define a GVC as dependent on a specific area if that area generates at least 10 percent (Pahl et al., 2021) of value-added in production of the respective final good (defined by country of completion and sector grouping).

Although we have calculated the T^v matrices of the sector for each year from 1990 to 2015, we only feature four years attempting to reflect major legislative evolutions in Algeria and regional events as introduced in Chapters 2 and 3: 1990 (Table 25), 1998 (Table 26), 2007 (Table 27), 2015 (Table 28)²⁰³. The results for each year are divided into two tables (*A* and *B* in each case), whereby Table *A* features the dependence ratios in the backward integration, and Table *B* features the dependence ratios in the forward integration.

The four countries in each table are interconnected through supply linkages. In each Table *A*, which measure the dependence ratios between countries through backward integration, countries in the rows represent countries that source value-added, further exported by countries in the columns. The intersection between countries in each Table *A* singles out the impact of a shock in the country in the row on the exports of the country in the column.

Similarly, in each Table *B*, which measure the dependence ratios between countries through forward integration, countries in the rows represent the source of value-added supplied to countries in the columns. The difference between Tables *A* and *B* is that whereas in the case of backward integration countries in the column source FVA from countries in the rows, in the case of forward integration, countries in the rows export value-added to countries in the columns, and this value added is absorbed abroad.

If we closely examine all tables from the entire historical data series we will conclude firstly that whenever an intersection between two countries reports a value above 10 percent (signalled in

²⁰³ Annex III contains the T matrices of the time series (1990–2015), which were used to estimate Tables 25, 26, 27, and 28.

grey), which is the threshold that we have assumed (Pahl et al., 2021) from which dependence is generated, Algeria always features as one of the two countries intersected. This suggests that the integration in the Western Mediterranean value chain is profoundly asymmetric, whereby Algeria has developed bilateral relations of dependence with the other three countries, but the latter have not managed to equal these relations of dependence with each other. This conclusion is also reached when looking at the aggregates of the rows and columns, where we can assess the total exposure of countries to the Western Mediterranean area. There, we will notice that the values for the case of Algeria are always higher than for the other three countries, which means that Algeria is much more vulnerable to the dynamics of dependence within the Western Mediterranean value chain than the other three countries.

A second general consideration is that integration is rather limited in the Western Mediterranean value chain in what concerns the supply side. Exposure of countries to both backward and forward integration in the Western Mediterranean area is generally below 25 percent, making the exposure to the rest of the world (outside the Western Mediterranean countries) at least 75 percent. There is, however, an exception during the timespan 1996-2003 in which the values of exposure, for both backward and forward integration of Algeria, surpass the value of 30 percent, reaching a peak in exposure in 1998-1999. In any case, these relations of dependence within the Western Mediterranean area that fluctuate over time have never reached the total of 50 percent, thus equalling the relations of dependence with the rest of the world. In many cases, exposure to the rest of the world (outside the Western Mediterranean countries) accounts for 100 percent of the whole exposure to the Western Mediterranean exposure.

As we already highlighted, Algeria's relations of dependence on the other two Western Mediterranean countries of the south, Tunisia and Morocco, in what these Tables report are negligible, which confirms the idea that even though these two Southern Mediterranean countries benefited from Algerian gas sales, they are not part of any gas chain in the Western Mediterranean. Therefore, integration within the Western Mediterranean area is driven by bilateral linkages of Algeria with the other three Southern European countries. As far as the latter are concerned, their fluctuations suggest that their integration into this specific value chain has varied over time, which means that their network is also connected towards other international partners, hence their dependence on Algeria is lower than the dependence that Algeria professes for each and all of them.

Table 25 represents the supply exposure to the Western Mediterranean value chain in 1990. For instance, in light of the results reported in Table A, we infer that 10 percent of Algeria's natural gas exports contain FVA from France, whereas 12 percent of France's natural gas exports and Spain's natural gas exports contain FVA from Algeria. As for the results in Table B, 17 percent of Algeria's value-added in exports of natural gas is supplied to France.

Table 25 A/B. Supply exposure in percentage to the Western Mediterranean value chain (1990)

(Table A)

	Algeria	France	Italy	Spain
Algeria	-	12	3	12
France	10	-	7	2
Italy	4	3	-	2
Spain	9	2	5	-
Rest of the world	77	82	85	84
Percentage Backward West. MED	23	18	15	16

(Table B)

	Algeria	France	Italy	Spain	Rest of the world	Percentage Forward GVC West. MED
Algeria	-	17	2	5	77	23
France	9	-	2	1	88	12
Italy	2	2	-	0	95	5
Spain	12	4	2	-	82	18

Source: Author's own elaboration based on UNCTAD- Full Eora GVC Database

Reading the results of exposure to the Western Mediterranean area for both backward and forward GVC integration, data from 1990 suggest that this limited integration is more symmetric than data calculated for 2015 (Table 28), where more differences arise between Algeria on the one hand, and the remaining three countries on the other, particularly in terms of backward GVC integration.

Table 26 represents the supply exposure to the Western Mediterranean value chain in 1998, and as mentioned, in the period comprised between 1996-2003, data suggests a sharp increase in the relations of dependence between the three European countries and Algeria in both backward and forward GVC integration. Algeria's exposure to the GVC with the three Western Mediterranean countries almost equals that of the rest of the world, especially for backward GVC integration, even though less for forward GVC integration in which most of the supplied value added goes to France.

Indeed, during the period 1995-2002 Algeria witnessed the sharpest increase in both net marketed production and exports of natural gas²⁰⁴ of the whole historical data series (1971-2015). Many new important contracts of exploitation of gas fields with IOCs and ROCs were signed²⁰⁵ in Algeria. In addition, before 1995 increases also took place in net production of natural gas but not as steady as the other period, and from 2004 onwards natural gas gross exports decreased while marketed production stagnated. On the other hand, in the midstream segment of the GVC, this period (1995-2002) also coincided with the coming into operation of new physical interconnections between Algeria and other Western Mediterranean countries. In particular, at the end of 1996, the Maghreb-Europe Gas Pipeline came into operation supplying 11 bcm per year into Spain (via Morocco), and in 1997 a second line was built next to the existing Trans-Mediterranean Gas Pipeline supplying an additional 7 bcm per year into Italy (via Tunisia).

Therefore, based on the data reported in Table 26 and the additional calculations for the remaining years, we can conclude that during this period of time (1995-2002) the Western Mediterranean value chain experienced the highest degree of integration, for both backward and forward GVC integration, in the entire historical data series (1990-2015).

²⁰⁴ See Figures 17 and 19 to assess the evolution of net marketed production and exports of natural gas.

²⁰⁵ See a comprehensive list of long-term natural gas contracts of Sonatrach in Tables 8 (for LNG) and 9 (for pipeline gas).

Table 26 A/B. Supply exposure in percentage to the Western Mediterranean value chain (1998)

(Table A)

	Algeria	France	Italy	Spain
Algeria	-	6	1	5
France	15	-	9	2
Italy	16	3	-	2
Spain	13	2	3	-
Rest of the world	56	89	86	90
Percentage Backward West. MED	44	11	14	10

(Table B)

	Algeria	France	Italy	Spain	Rest of the world	Percentage Forward GVC West MED
Algeria	-	31	2	6	61	39
France	13	-	3	1	83	17
Italy	12	3	-	1	85	15
Spain	23	4	2	-	71	29

Source: Author's own elaboration based on UNCTAD- Full Eora GVC Database

Tables 27 and 28 represent the supply exposure to the Western Mediterranean value chain in 2007 and 2015 with data that shows similar trends for the supply exposure of all the countries involved. As noted, integration dynamics in the Western Mediterranean have weakened in comparison with the previous period for both backward and forward GVC integration. Algeria continues to be the most dependent economy in the value chain, while during the 1990s and early 2000s France was more dependent on the GVC, in many cases ahead of Italy and Spain, and has been relegated during the last decade to a third position. Indeed, other countries like Spain have increased their dependence on the Western Mediterranean value chain, especially in forward integration. This suggests that countries like France have expanded their natural gas trade networks towards other international partners, a possibility that cannot be excluded for countries like Spain, but in which case it has not reduced the intensity of GVC participation in the Western Mediterranean.

Table 27 A/B. Supply exposure in percentage to the Western Mediterranean value chain (2007)

(Table A)

	Algeria	France	Italy	Spain
Algeria	-	6	2	6
France	5	-	5	1
Italy	12	2	-	1
Spain	9	2	3	-
Rest of the world	74	89	90	92
Percentage Backward West. MED	26	11	10	8

(Table B)

	Algeria	France	Italy	Spain	Rest of the world	Percentage Forward GVC West. MED
Algeria	-	13	2	8	77	23
France	9	-	3	1	87	13
Italy	16	2	-	1	81	19
Spain	21	3	2	-	74	26

Source: Author's own elaboration based on UNCTAD- Full Eora GVC Database

Table 28 A/B. Supply exposure in percentage to the Western Mediterranean value chain (2015)

(Table A)

	Algeria	France	Italy	Spain
Algeria	-	8	2	7
France	5	-	4	1
Italy	12	2	-	1
Spain	11	2	2	-
Rest of the world	72	88	91	91
Percentage Backward West. MED	28	12	9	9

(Table B)

	Algeria	France	Italy	Spain	Rest of the world	Percentage Forward GVC West. MED
Algeria	-	11	2	9	78	22
France	11	-	4	1	84	16
Italy	17	2	-	1	80	20
Spain	21	2	2	-	75	25

Source: Author's own elaboration based on UNCTAD- Full Eora GVC Database

In conclusion, the results show that integration within the Western Mediterranean area is driven by bilateral linkages of Algeria with the other three Southern European countries, even if their integration into the sector's specific value chain has varied over time. Throughout the entire data series (1990-2015), in the period comprised between 1995 and 2002, the Western Mediterranean's GVC experienced the highest degree of integration for both backward and forward GVC integration, given that Algeria's exposure to the Western Mediterranean countries accounted for around 40 percent of all foreign supply exposure, which nearly doubles 2015.

Demand-side exposure

If we consider the demand-side exposure, we are essentially interested in examining the degree of dependence between Algeria and the other three countries involved in the Western Mediterranean value chain, but from the demand side. In this regard, we need to calculate an F matrix, in which instead of using as a basis the primary inputs table (also called value-added) that gives us the gross output, we will use the final demand block, which enables us to obtain a $G \times G$ GDP matrix reporting the GDP by country pairs of source (rows) and absorption (columns). Each row will single out the part that is absorbed at home and the part that is finally consumed abroad. In other words, this new matrix helps us to single out the impact of a shock in a country j (in column) demand on country i (in row), which means that country j absorbs the value-added produced in country i . Consequently, shares are computed by row, since we are interested in a shock of demand from j to i .

Unlike in the calculations on the supply exposure, raw data embedded to calculate the GDP matrix is not only specific to the sector in question of each country, but aggregates all country sectors. Therefore, the results on the foreign demand exposure are only a proxy of the natural

gas industry. Considering that trade relations between Algeria and the other three Western Mediterranean countries have been dominated by the hydrocarbon industry, we have only shown two tables, the first one for 1990 and the second for 2015, and we only assess those intersections in which one of the two countries is Algeria.

Table 29 represents the foreign demand exposure between Western Mediterranean countries in 1990 (Table A) and 2015 (Table B). In 1990 Algeria was producing value-added, 28 percent of which was absorbed by France. Twenty-five years afterwards, this relation of dependence on France had dropped to 15 percent only, reducing by 50 percent the overall demand exposure of Algeria to the Western Mediterranean. On the other hand, Algeria absorbed negligible amounts of value-added from the other three countries of the area, confirming the asymmetry of relations between Algeria and the other three countries that has been highlighted in the supply-side exposure.

Table 29 A/B. Foreign demand exposure in percentage between Western Mediterranean countries (1990 and 2015)

(Table A)

	Algeria	France	Italy	Spain	Rest of the world	Percentage GDP West. MED
Algeria	-	28	7	7	58	42
France	1	-	10	7	82	18
Italy	1	11	-	5	83	17
Spain	1	17	10	-	72	28

Source: Author's own elaboration based on UNCTAD- Full Eora GVC Database (1990)

(Table B)

	Algeria	France	Italy	Spain	Rest of the world	Percentage GDP West. MED
Algeria	-	15	5	8	72	28
France	1	-	7	7	85	15
Italy	1	8	-	5	86	14
Spain	1	12	7	-	80	20

Source: Author's own elaboration based on UNCTAD- Full Eora GVC Database (2015)

As the previous analysis on the supply side has suggested, Table 29 also shows a limited integration within the Western Mediterranean characterised by relations of dependence that Algeria mainly has on the other three countries, with very little integration between the three European countries themselves in light of a growing globalisation process that has prompted a diversification of the networks of these countries towards other international partners outside the Western Mediterranean.

4.3 Discussion on the analysis of GVC integration

The previous section underscores the evolution of the participation and position of Algeria and the other three Western Mediterranean countries in the GVC of natural gas. In this vein, the section analyses the evolution of FVA and DVA components in their respective gross exports of natural gas, and also assesses the nature of this integration and whether the latter entails more forward or backward integration. In fact, Algeria's participation in the GVC of natural gas has remained lower than of the other three Western Mediterranean countries. This is the unequivocal result of both low levels of forward and backward integrations, being the former more dominant than the latter due to the nature of the traded good – natural gas –, which is a natural resource. This feature is also reflected in the upstreamness of Algeria's natural gas industry in the GVC. Overall, the previous section shows that, although Algeria is a leading natural gas exporter, the latter is not coupled with an equivalent integration into the GVC, due to the very high relative volume of natural gas traded outside the GVC.

It is worth highlighting that, in the case of Algeria, when we decompose its GVC into backward and forward integration, it remains almost invariable after this 25-year time period (1990-2015), whereas traditional gas trade (outside any sort of GVC) remains the vast majority of all gas trade, in stark contrast with the cases of Italy and France, which during this 25-year period have improved quite considerably both backward and forward integration into GVCs. In this context, whereas GVC integration in the natural gas industry has increased by 30 percent in France and 6 percent in Italy over the period 1990-2015, it has remained stagnant in Algeria and has slightly declined in Spain. This proves that although Algeria is a leading natural gas exporter, it is not coupled with an equivalent integration into the GVC, due to the very high relative volume of natural gas traded outside the GVC. In essence, this result shows that countries like France and Italy have managed to build their trade networks better connected towards other international

partners, thus reducing their exposure to linkages with one single country and mitigating their risk dependence.

This section has also drawn comparisons with other leading natural gas exporters in the Middle Eastern and Sub-Saharan regions, like Qatar and Nigeria. In this case, the results are also consistent with the role that these two economies have been playing in the GVC of natural gas. For Algeria, during a first period (1990-2001) we observe a declining trend in GVC participation, which is later recovered during a second period (2001-2015). The turning point coincides with the partial attempts by the administration of Algerian President Abdelaziz Bouteflika to open up the hydrocarbon sector to foreign investment and boost hydrocarbon exports. From a quantitative point of view, the reason why an increase in GVC participation is noticeable from 2001 onwards is due to an increase of forward integration, whereas background integration has remained stagnant over time. The evolution of the GVC participation indicators for Qatar and Nigeria follows similar patterns but with a different intensity. Particularly for its global importance, in the case of Qatar, its participation into the natural gas GVC starts from a lower level as compared with the other two countries in the 1990s, but as soon as the country's gas industry gains strength with new export infrastructure and takes off in the early 2000s, its participation in the GVC increases quite significantly.

Following this first analysis, the section also examines the exposure between the countries embedded in the GVC in the Western Mediterranean with the aim of determining the relations of dependence between them, and thus infer the degree of power asymmetry within the GVC configuration. The results show that integration within the Western Mediterranean area is driven by bilateral linkages of Algeria with the other three Southern European countries, even though their integration into the specific natural gas value chain has varied over time. In this context, data reports that due to the increasing network towards other international partners outside the Western Mediterranean economies, the dependence on Algeria is lower than Algeria's dependence on each of them. Furthermore, as we compare data from 2015 with that of 1990, we can conclude that this limited integration was more symmetric across countries in 1990 than in 2015.

In addition, based on the calculations conducted in this section, we can also conclude that throughout the entire data series (1990-2015), in the period comprised between 1995 and 2002,

the Western Mediterranean's GVC experienced the highest degree of integration for both backward and forward GVC integration, given that exposure of Algeria to the Western Mediterranean countries accounted for around 40 percent of all foreign supply exposure, which is nearly double 2015. During this period of time, Algeria witnessed the sharpest increase in both net marketed production and exports of natural gas since the nationalisation of hydrocarbon resources in 1971. Many new important contracts of exploitation of gas fields with IOCs and ROCs were signed in Algeria. In addition, before 1995 increases also took place in net production of natural gas but not as steady as the other period, and from 2004 onwards natural gas gross exports decreased while marketed production stagnated. On the other hand, in the midstream segment of the GVC, this period (1995-2002) also coincided with the coming into operation of new physical interconnections between Algeria and other Western Mediterranean countries.

The next section discusses whether greater integration in natural gas value chains could mitigate the degree of rentierism of a hydrocarbon-rich economy such as Algeria, and thus modify its relations of power asymmetry in the Western Mediterranean area. There is a large body of literature that has emerged to demonstrate the need for and benefit from diversification in both exports and output as a key determinant of growth (IMF, 2014; Giri et al., 2019; Imbs and Warczag, 2003). In this context, further integration into GVCs has given developing economies new opportunities in this respect (Gill & Kharas, 2007), enabling new activities or new markets, and thus diversifying their exports because different stages of the production process can be conducted in different countries, hence reducing their exposure to a single commodity being exported. More specifically, as Gurriá (2013) states, if natural gas were integrated into the international market – not just as a commodity export, but similarly to crude oil within the framework of GVCs –, it would be a factor that could provide beneficial elements to prompt economic development, attract investments, foster knowledge transfer, strengthen the sustainability and business model of the hydrocarbon industry, and therefore perhaps lead to a higher degree of power (sovereignty) in the relationship of its hydrocarbon industry with counterparts in other countries.

4.4 Increased integration into natural gas GVCs as a mitigator of rentierism

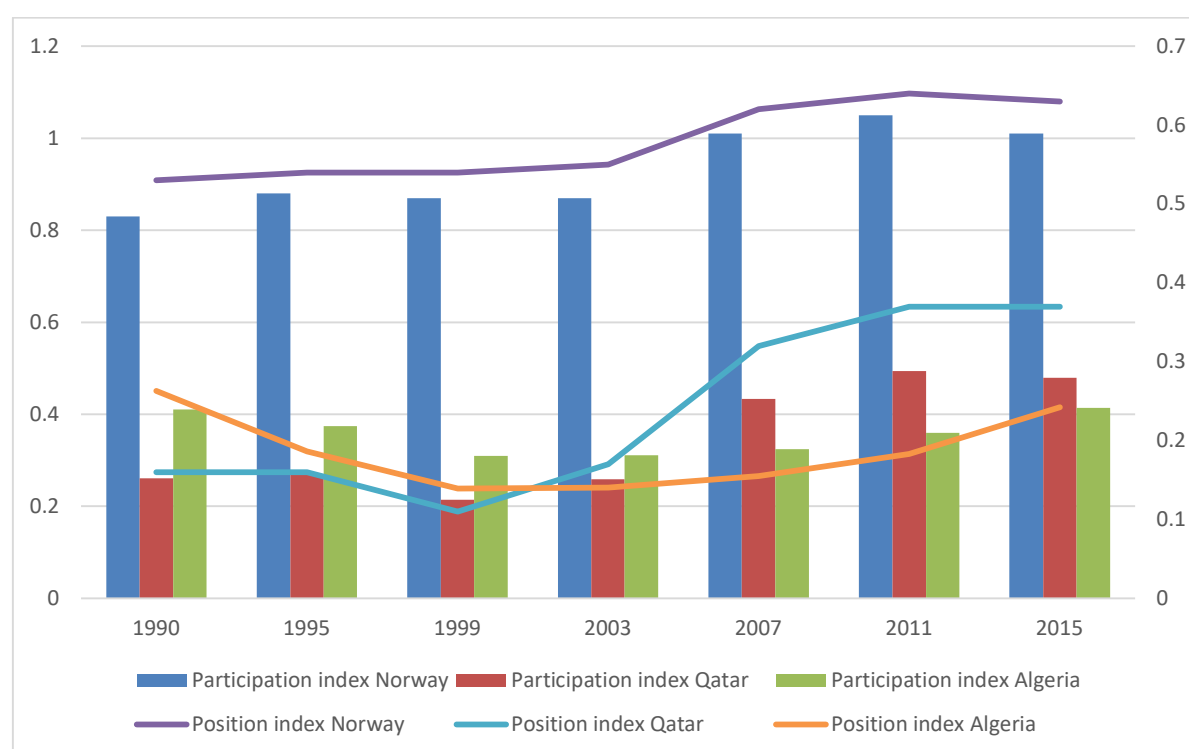
As explained in Chapter 1, the theory of the rentier state has been criticised as reductionist (Talahite, 2012) because it broadly categorises all state-distributed revenues as rent, equating them with hydrocarbon rents. This critique arises for three main reasons: first, it conflates the cause (rents generated in a unified international market) with the effects (rents created in domestic markets); second, it overlooks the fundamental differences in the nature of these rents; and, third, it portrays rents derived from international markets as effortless windfalls, described by Beblawi and Luciani (1987) as “flows like manna from heaven.”

Hydrocarbon rents are accrued by the owners of the resource (the Algerian state, in the case of Algeria) as a foreign income on the value generated in a unified international market. Hence, this rent is captured by the hydrocarbon taxation, and a part of it goes to the national company Sonatrach as it enjoys a monopoly position in the exploitation of such hydrocarbon resources. After the analysis of the integration into the GVC, we now assess how the degree of integration of natural gas industries into GVCs can influence the economic model of hydrocarbon-rich economies that are characterised by natural gas exports. This is the case of Algeria along with other economies such as Qatar and Norway. As mentioned, both Algeria and Qatar are considered natural gas rentier economies, while Norway is not. In fact, Qatar and Algeria were two largest gas exporting countries from the Middle East and North Africa (MENA) region in the period 2000-2015 and Norway the second largest exporting country to the EU, being Algeria the third one, in the period 2000-2015.

In order to carry out this exercise, we will use the same indicators as in the previous section when assessing the respective natural gas sectors in the GVC configurations of Algeria as well as the other three consuming countries of the Western Mediterranean area, namely the participation and position indicators within the natural gas GVC. To this end, we attempt to capture the overall participation of countries in GVCs, and specifically of the natural gas sector within these countries, by combining the FVA and DVX indicators; that is, by summing up the FVA used in the natural gas sector of a country's own exports and the value-added of this country's natural gas sector supplied to other countries' exports. Furthermore, we will endeavour to capture not only the magnitude of GVC participation, but also the position of the natural gas industry of a particular country along the GVC, be it more upstream or downstream.

Figure 31 describes the results for both indicators and the three countries in the period 1990-2015. Interestingly enough, Norway appears very distanced from both Algeria and Qatar. In fact, the Nordic economy reflects very high values in the participation and position indicators in comparison with the other two, indicating that they are the main suppliers of natural gas to firms in other countries, which use it to produce other goods that are also exported to third countries. The latter is also strongly correlated with the upstreamness in the production network (very strong forward integration), which is also much higher than in the case of the other two countries. To conclude, the case of Norway fits the purpose of this exercise perfectly given that it shows a much greater intensity in the participation of the natural gas GVC in comparison with Algeria.

Figure 31. Participation and position indicators in hydrocarbons (natural gas industries) GVC for Norway, Qatar and Algeria (1990-2015)



Source: Author's own elaboration based on UNCTAD-Full Eora GVC Database. Left axis is expressed as an indicator and reports the results of the participation of these countries in the GVC. Right axis is expressed as an indicator and reports the results of the position for the three countries in the GVC

In the case of Algeria and Qatar in Figure 31, the results were extensively described in the previous section, but they report for Algeria a declining trend in GVC participation during a first period (1990-2001), which is later recovered during a second period (2001-2015). The turning point coincides with the partial attempts by the administration of Algerian President Abdelaziz Bouteflika to open up the hydrocarbon sector to foreign investment and boost hydrocarbon exports. While in the case of Qatar, its participation in the natural gas GVC starts from a lower level, but as soon as the country's gas industry gains strength with new export infrastructure and takes off in the early 2000s, its participation in the GVC increases quite significantly. Nevertheless, neither of the two cases can be compared to that of Norway, which presents a robust and sustained participation in the natural gas GVC over the examined period.

Although the example of these countries is not representative enough among the natural gas exporting countries, it seems difficult not to establish an intuitive correlation between higher values in the integration of a country's natural gas sector in GVC and lower chances for this specific country of developing a rentier economy. In this context, Table 30 summarises the characteristics of the natural gas sector in each of the three countries in terms of GVC participation and position, pre-eminence of pipeline natural gas versus liquefied natural gas (LNG), as well as hydrocarbon revenues accruing to the state, which is a precondition to develop a rentier economic model. Conclusions can be drawn on how the pre-eminence of liquefied gas over pipeline gas is normally conducive to higher revenues accruing to the state, but also on the fact that enhancing higher integration in GVCs leads to better developmental outcomes (Kowalski et al., 2015). The assessment on whether these indicators show low, medium or high values is qualitative and approximate.

Table 30. Characteristics of natural gas GVC participation

	Algeria	Qatar	Norway
GVC participation	Low	Medium low	High
GVC position	High	High	Very high
NG vs. LNG	NG	LNG	NG
Hydrocarbon revenues accruing to the state	Medium high	High	Low

Source: Compiled by the author

The academic literature is already vast in connecting GVC integration with export diversification (IMF, 2014; Tran et al., 2020), and ultimately determinant of economic growth. The latter can be materialised in the generation of additional employment opportunities and a rise in productivity of the workforce (Taglioni & Winkler, 2016), and in an increase in the share of manufacturing in GDP by improving productivity of firms and promoting technology transfer (Stöllinger, 2018), and promotion of competition (Topalova & Khandelwal, 2011). In addition, a very wide range of literature has given evidence that industrial diversification and sophistication are critical for sustainable development (Herzer et al., 2006, Ben Hammouda et al., 2009). This is mainly because economies with more diverse production structures can shield themselves from fluctuations in commodity prices and can also more easily take advantage of emerging opportunities in the global market (Page, 2008).

By way of an epilogue, with the aim of strengthening the empirical evidence of the relational nature between rent generation and GVC participation, as a final step of the analysis we will examine this relationship in two exercises: the first will consist of an analysis to test whether or not these two variables are correlated; while, in the second exercise, we will estimate a panel data model to evaluate whether not only correlation but also a causal relationship exists between these two variables.

To carry out both exercises we will use a sample of 16 economies for the period 2000-2015. We are selecting this timespan as 2000 marks a turning point in the evolution of the LNG industry, and LNG exports have accelerated since then with the irruption of Qatar as a major supplier. In this context, the sample includes Algeria, Australia, Canada, Egypt, Indonesia, Iran, the Netherlands, Nigeria, Norway, Qatar, Russian Federation, Saudi Arabia, Trinidad and Tobago, Turkmenistan, United Arab Emirates and the United States. The selection of sample countries reflects the largest worldwide exporters of natural gas in both pipeline gas and LNG (reference year is 2015), among those that are also leading hydrocarbon exporters, which include not only natural gas but also crude oil. Given that the variables used report figures of the hydrocarbon industry, the selection has been taken on the basis of the natural gas industry but within the broader hydrocarbon sector. This research is mostly focused on the gas industry, but many of these economies are also leading oil exporters. The only notable exception is Saudi Arabia, which was the world's largest exporter of crude oil in 2015, accounting for a significant portion of global trade, but not so significant as a natural gas exporter.

To this end, Table 31 illustrates the mean of their GVC participation indicator for the period 2000-2015 for each of these economies, as well as the mean of the ratio of the hydrocarbon rent to GDP also for the same period (2000-2015). Considering that oil rents accruing to the state are much higher than natural gas rents, we will use the combined hydrocarbon rent; and similarly, we also use the GVC participation indicator of the hydrocarbon sector, which we define as the combination of both natural gas and crude oil sectors.

Table 31. GVC participation indicator and Rent to GDP of the largest natural gas exporting economies

Largest hydrocarbon (gas) exporting economies (in alphabetical order), 2015	Rent to GDP in percent (2000-15)	GVC participation (2000-15)
Algeria	26.41	0.34
Australia	4.97	0.67
Canada	3.12	0.67
Egypt	10.26	0.48
Indonesia	7.87	0.69
Iran	26.15	0.57
Netherlands	0.70	1.35
Nigeria	15.04	0.35
Norway	9.31	0.97
Qatar	35.81	0.39
Russian Federation	15.95	0.31
Saudi Arabia	42.54	0.40
Trinidad and Tobago	14.71	0.23
Turkmenistan	40.96	0.33
United Arab Emirates	23.11	0.30
United States of America	1.00	0.58

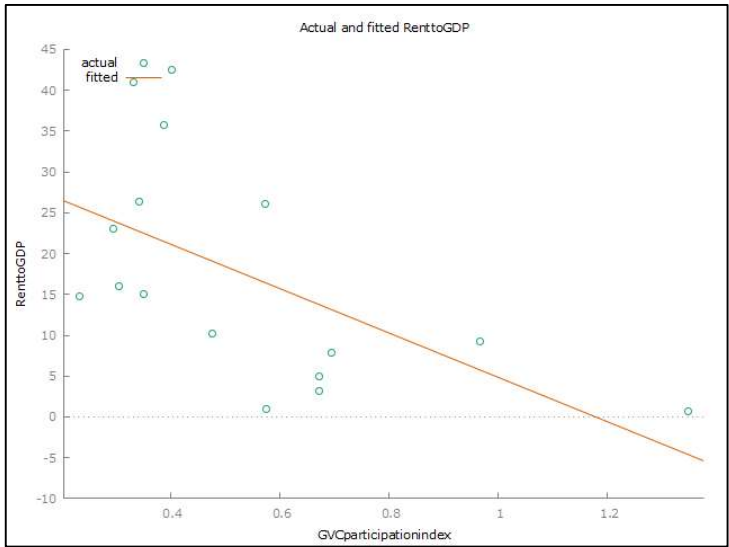
Source: Compiled by the author based on calculations with data retrieved from the UNCTAD-Full Eora GVC Database and on data retrieved from the World Bank database

In the exercise we define our independent variable (*GVC*) as the GVC participation indicator, whereas the dependent variable (*Rent*) as the ratio of rent accruing to the state in relation to the GDP. The objective is to confirm the idea suggested by Table 30 whereby higher values in the integration of a country's natural gas sector in GVC trigger lower chances of this specific country of becoming a rentier economy, especially when considering that higher integration into GVCs favours greater export diversification (IMF, 2014; Tran et al., 2020), and subsequently, less

dependence on single export commodities. Following the exercise that we have conducted in Table 30, we would expect these two variables to be negatively associated.

In order to assess whether GVC participation and Rent to GDP are correlated, Figure 32 illustrates the scatter plots between the two variables on the sample of 16 countries, which reflect the mean of the values in both variables considered – GVC participation and Rent to GDP – for the timespan 2000-2015. Negative correlation can be appreciated in such a way that the countries with higher hydrocarbon GVC participation are less dependent on the hydrocarbon rent, whereas those with the lowest GVC participation tend to result in much higher Rent to GDP values.

Figure 32. Scatter plot of GVC participation vs. Rent to GDP



Source: Author's own elaboration based on data retrieved from the UNCTAD-Full Eora GVC Database and on data retrieved from the World Bank database

^aValues report the mean for the period 2000-2015 of GVC participation and Rent to GDP of a sample of 16 hydrocarbon exporting economies

In this vein, as presented in Chapter 1, the literature on the theory of rentier state highlights how hydrocarbon rents create economic incentives that prioritise competition for resource revenues over engagement in productive activities, especially in systems marked by ambiguous political rights and significant political discretion. This dynamic underscores the potential for resource wealth to distort economic priorities and foster rent-seeking behaviours, often at the expense of

long-term development. However, attempts in the academic literature to classify hydrocarbon-exporting economies in order to identify the determinants and varying degrees of rentierism remain contentious (Eifert et al., 2003).

Some scholars challenge the utility of such classification systems, arguing that country-specific outcomes are highly idiosyncratic, shaped by unique combinations of sociological factors, political leadership, and even random historical events (Haggard, 1990). These critics emphasise the unpredictability and context-specific nature of rentierism, which resists reduction to a universal typology. In contrast, other researchers – particularly political scientists (Andrain, 1988; Leftwich, 1995) – advocate for the importance of institutional context in understanding variations in rentierism. They suggest that observable differences in political systems, such as whether a country operates as a mature democracy, a paternalistic autocracy, or a predatory autocracy, offer valuable insights into how hydrocarbon wealth influences governance, policy-making, and economic structures.

In the quantitative analysis presented here, we adopt the first approach (Haggard, 1990) for two reasons: on the one hand, due to the difficulties in quantitatively approximating the political and sociological factors that may influence the level of rentierism in an economy, and, on the other, due to the intention to focus the analysis on the economic factors that determine it.

In spite of these debates, this particular exercise seeks to shift the focus from political typologies to an economic perspective, examining the relationship between two critical phenomena: integration into hydrocarbon GVCs and the ratio of hydrocarbon rents to GDP. By adopting this approach, we aim to explore how deeper integration into GVCs might influence the reliance on hydrocarbon rents and the broader economic dynamics of resource-exporting economies. This perspective provides a nuanced understanding of the interplay between global economic integration and domestic rent-seeking behaviour, offering insights into the potential pathways for resource-dependent economies to diversify and achieve more sustainable development outcomes.

After confirming the correlational nature between these two variables, as a final step of the analysis we considerably increase the size of the sample by estimating a panel data model to evaluate the causal relationship between GVC participation and Rent to GDP, and thus the relevance of the independent variable for the dependent one. The main advantages of panel data

estimation are the generation of more robust results due to combining cross-sectional and time series data, as well as the possibility of measuring individual and unobserved heterogeneity. Sometimes the dependent variable is influenced by its past values. In such situations, the econometric model becomes dynamic (Arellano & Bond, 1991). Moreover, by controlling for unobserved heterogeneity and tracking changes over time, panel data helps mitigate endogeneity issues and provides stronger evidence for causal relationships.

We employ a panel data²⁰⁶ of 16 economies for the period 2000-2015. The sample includes the same list of countries as previously considered. The panel data reflects the GVC participation indicator, as well as the ratio of hydrocarbon rent to GDP. Both variables reflect 256 values distributed along 16 countries in a timespan of 16 years.

In order to run the model, equation (1) describes a linear dynamic panel model that explains hydrocarbon rent in the selected countries through the GVC participation and the dependent variable lagged one period, as a regressor that provides dynamic adjustment in the model:

$$Rent_{it} = \alpha Rent_{i,t-1} + \beta' GVC_{it} + \mu_i + \delta_t + \gamma_{it} \quad (1)$$

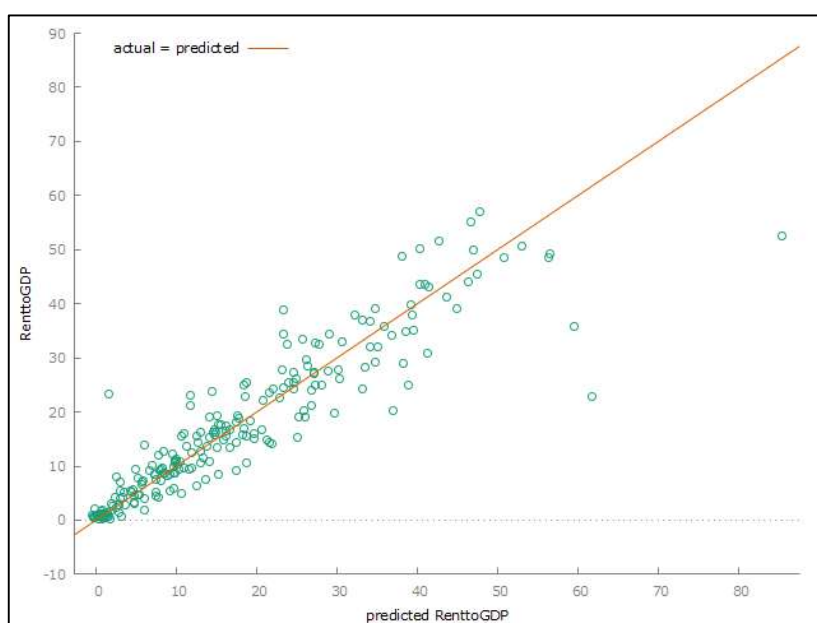
where countries are indexed by i and years by t , μ and δ represent country and year fixed effects respectively, and γ is a random shock.

In the model, apart from the dependent variable $Rent$ and the independent variable GVC , in addition, the variable $Rent_{i,t-1}$ appears in the regression as being a lagged explanatory variable, as it seems to provide an adequate characterisation of the dynamic adjustment process. Moreover, α and β' designate parameters to be estimated; μ_i and δ_t constitute individual heterogeneity, and γ_{it} is the stochastic term. Finally, we have also decided to cluster standard errors in countries as we sense that in this panel errors might be correlated across time in each country but independent across countries. By clustering standard errors at the country level, the analysis acknowledges and adjusts for the likelihood that errors are correlated across time within countries, ensuring more reliable and robust statistical inference. This method effectively balances the dynamic nature of the model and the need for valid inference in panel data.

²⁰⁶ Raw data used to estimate the dynamic panel data model can be found in Annex IV.

At first sight, Figure 33 illustrates the relationship between the actual values of the dependent variable (*Rent to GDP*) and the predicted values derived from the estimation of equation (1). It visually corroborates the statistical results shown immediately after (in Table 32), suggesting that the dynamic panel model performs well in explaining the variation in *Rent to GDP*. The majority of points are clustered close to the diagonal, indicating that the model predicts *Rent to GDP* relatively well.

Figure 33. Predicted vs. actual values for Rent to GDP



Source: Author's own elaboration based on data retrieved from the UNCTAD-Full Eora GVC Database and on data retrieved from the World Bank database.

The results obtained from the dynamic panel data estimation of equation (1) are shown in Table 32, which reveals the significance of the independent variable in explaining the dependent variable, alongside the expected direction of causality between the considered variables. The use as regressor of the lagged dependent variable in the model could be partially capturing the effect on the dependent variable of other unobserved regressors, reflecting the dynamic nature of the underlying process.

Table 32. Estimates for equation 1

. xtreg rent L.rent gvc, cluster (countryname)						
Random-effects GLS regression			Number of obs	=	240	
Group variable: num			Number of groups	=	16	
R-sq: within	=	0.3858	Obs per group: min	=	15	
between	=	0.9984	avg	=	15.0	
overall	=	0.8987	max	=	15	
Random effects u_i ~ Gaussian			Wald chi2(2)	=	3732.16	
corr(u_i, X) = 0 (assumed)			Prob > chi2	=	0.0000	
(Std. Err. adjusted for 16 clusters in countryname)						
rent	Coef.	Robust Std. Err.	z	P> z	[95% Conf. Interval]	
rent L1.	.9079789	.0206424	43.99	0.000	.8675206	.9484373
gvc	-1.360171	.5727516	-2.37	0.018	-2.482744	-.2375987
_cons	1.606618	.6612008	2.43	0.015	.3106887	2.902548
sigma_u	0					
sigma_e	4.5148616					
rho	0	(fraction of variance due to u_i)				

Source: Author's own elaboration

However, the introduction as regressor of the lagged dependent variable, as has been done in equation (1), can produce inconsistent standard estimators. To avoid this, we can use the Generalized Method of Moments (GMM) approach as described by Arellano and Bond (1991), which implies transforming the equation into first differences and then using lagged values of the endogenous variables as instruments, the number of instruments being different in each time period. The results are shown in Table 33, indicating that parameters are again statistically significant. There is strong persistence in rent values over time, as indicated by the significant positive coefficient of the lagged dependent variable. Increased integration into the GVCs appears to reduce rents, which might be indicative of a structural adjustment in the economy or diminishing reliance on resource-based rents. Lastly, Table 33 also presents no significant evidence of serial correlation in the first-differenced errors at order 1 and 2.

Table 33. Estimates for equation 1 using the GMM approach

. xtabond rent gvc, lag (1) noconstant						
Arellano-Bond dynamic panel-data estimation			Number of obs	=	224	
Group variable: num			Number of groups	=	16	
Time variable: year			Obs per group:	min =	14	
				avg =	14	
				max =	14	
Number of instruments = 106			wald chi2(2)	=	122.60	
			Prob > chi2	=	0.0000	
One-step results						
rent	Coef.	Std. Err.	z	P> z	[95% Conf. Interval]	
rent L1.	.6223684	.0577962	10.77	0.000	.50909	.7356469
gvc	-11.31831	5.25541	-2.15	0.031	-21.61873	-1.017899
Instruments for differenced equation						
GMM-type: L(2/.)rent						
Standard: D.gvc						

Arellano-Bond test for zero autocorrelation in first-differenced errors

Order	z	Prob > z
1	-5.6228	0.0000
2	-.38128	0.7030

Source: Author's own elaboration

The results obtained from this analysis strongly suggest a causal relationship between GVC participation and rent to GDP ratios, in line with the literature linking integration into GVCs and greater export diversification (IMF, 2014; Tran et al., 2020), in reducing reliance on single export commodities and decreasing rents derived from these commodities. The results also align with previous findings that highlight how greater GVC participation can lead to improved developmental outcomes (Kowalski et al., 2015). For resource-dependent economies, this relationship is particularly significant as it highlights the potential of GVC integration to mitigate the structural challenges posed by dependence on a narrow range of export commodities, offering new avenues for engaging with global markets and expanding economic and productive structures.

Economic diversification, enabled by deeper GVC participation, often entails structural transformation and a reallocation of resources toward higher value-added sectors, fostering long-

term development and growth (Tran et al., 2020). For economies dependent on resource rents, this diversification plays a critical role in reducing vulnerability to price volatility and external shocks, both of which have historically hindered their economic stability and growth potential (Harding & Venables, 2016). Moreover, integration into GVCs can help countries escape the resource curse by facilitating technology transfer, knowledge spillovers, and access to larger markets, thus driving innovation and industrial upgrading.

In summary, the findings underscore the importance of fostering policies that promote GVC participation as a pathway to diversify economic activities, reduce dependence on resource rents, and achieve sustainable and inclusive growth. This is especially pertinent for economies where a reliance on resource exports has limited their resilience to external shocks and constrained their developmental trajectories.

We will now look at the consequences of this relational nature between GVC participation and share of the hydrocarbon rents in the GDP in the case of Algeria.

4.5 Algeria in the context of low integration into natural gas GVCs

Higher GVC integration leads to the benefit of greater export and economic diversification, foreign direct investment (FDI) attractiveness, and hence to higher economic growth in the long run (IMF, 2014; Tran et al., 2020). Furthermore, it might open up opportunities to engage in global markets and enlarge the scope of the economic and productive structure of the economy, which can lead to better developmental outcomes (Kowalski et al., 2015). Finally, it encompasses a structural transformation and reallocation of resources that lie behind the path of development and growth (Tran et al., 2020), mitigating price volatility and external shocks, which end up hindering the potential for economic growth in the long term (Harding & Venables, 2016).

However, data shows that the Algerian economy has followed a different direction; despite robust efforts to increase industrial capacity after independence, manufacturing as a share of GDP declined from 20 percent in 1980 to 6 percent by 2014 (Gasmi, 2017). Similarly, in June 2015 hydrocarbon exports accounted for 94 percent of Algeria's total exports making the country one of the least diversified countries worldwide (World Bank, 2017).

As noted in Chapter 2, after independence in 1962, and especially during President Boumédiène's administration, significant efforts were made to diversify the productive capacity

of the economy by particularly directing hydrocarbon rents to promote manufacturing capacities and diversify the economy away from primary resource production (Lowi, 2011). However, although economic growth was very high during those first years, by the end of the 1970s it became obvious that the rapid industrialisation path undertaken by Boumédiène had resulted in remarkable economic imbalances that triggered a substantial budget deficit (Entelis, 1992), which had to be managed by Boumédiène's successor, President Bendjedid. In addition, the collapse of oil prices in 1986 and of hydrocarbon rents (see Figure 2) caused a drastic reduction of investments in heavy industry before these matured, which prevented the Algerian economy from consolidating the model promoted in the 1960s-70s (El-Kenz, 1992; Abdesselam, 1991). The priorities of the Bendjedid administration shifted to obtaining the maximum amount of rent from the exploitation of the hydrocarbon resources, based on a policy that was the result of agreements adopted within the framework of the Organization of the Petroleum Exporting Countries (OPEC), which prevent unilateral and bilateral decisions given that commitments on production are adopted unanimously by their members. As OPEC is an umbrella organisation that brings together oil producing countries, Algeria, being a preeminent natural gas exporting country, has ended up subordinating its national gas policy to the one of oil forged in the framework of OPEC.

The latter is the basis for understanding the historical background from which the Algerian rentier economic model originated. If the country had pursued a model of economic diversification, enhancing a competitive private sector, opening up its energy sector to further attract foreign investment, limiting the use of hydrocarbon rents in the public economy, avoiding the clientelist management of hydrocarbon rents for political survival of the elites (Werenfels, 2007), among others, Algeria's economy would look very different by 2015.

One possible path to mitigate rentierism in Algeria could have been by better integrating into GVCs, for instance by boosting forward linkages and integration, which implies the possibility for Algerian gas exports to be embodied as intermediate inputs in other countries' exports instead of exporting this gas in the form of traditional trade. As pointed out in the exercise conducted among the 16 largest gas exporting economies, more integration into GVCs allows the gas industry to obtain more value from their exports rather than only rent. Arguably, the participation alone in GVCs does not guarantee that the economy diversifies away from primary resource production nor away from rent generation, but evidence points to the fact that it helps

create incentives for structural reforms that pave the way for a more diversified economy. A diversified economy is key to ensuring a diversified source of state's revenue, which reduces the appetite for rentier behaviours (Harding & Venables, 2016).

The empirical exercises conducted in the previous section corroborated the hypothesis that steers this research thesis, which is that in spite of strong trade links of natural gas between Algeria and the rest of the Western Mediterranean countries – namely Italy, France and Spain –, the degree of their integration into the natural gas value chain remains asymmetric, which has exacerbated the anti-developmental nature of Algeria's rentier economy. The latter was underpinned by the fact that Algeria's participation in the GVC of natural gas has remained lower than that of the other three Western Mediterranean countries, which is the unequivocal result of both low levels of forward and backward integrations. In this regard, whereas GVC integration in the natural gas industry has increased by 30 percent in France and 6 percent in Italy over the period 1990-2015, it has remained stagnant in Algeria and it has slightly declined in Spain, being Algeria a worst-case scenario due to the relative volume of natural gas trade integrated into GVCs. In essence, this result showed that countries like France and Italy had managed to build their trade networks better connected towards other international partners, thus reducing their exposure to linkages with one single country and mitigating their risk dependence. Additionally, the previous section also drew conclusions in terms of the exposure between the countries embedded in the Western Mediterranean's GVC in order to determine the relations of dependence between them, and thus infer the degree of power asymmetry within the GVC configuration. To this end, the results showed that integration within the Western Mediterranean area was driven by bilateral linkages of Algeria with the other three Southern European countries, and that due to the increasing network towards other international partners outside the Western Mediterranean economies, the dependence on Algeria was lower than Algeria's dependence on each of them.

Arguably, by leveraging Algerian natural gas participation into GVCs, not only could the country have been less dependent on the rent and obtain more value from its natural gas exports, for instance by increasing its forward integration into the natural gas value chain, but Algeria could have gained bargaining power in the regional value chain configuration. Therefore, the power asymmetry that has been asserted in the previous section between Algeria and the other three

Western Mediterranean countries could have been rebalanced in order to build a more symmetric power relationship in which Algeria would have certainly gained decision-making capacity.

4.6 Conclusions

This chapter has attempted to corroborate both quantitatively and qualitatively the hypothesis that steers this research thesis. With the full analysis of the natural gas value chain and the correlation between GVC integration and the hydrocarbon rent to GDP conducted in this chapter, it has been possible to confirm the increasing asymmetries existing in the GVC in the Western Mediterranean during the period 1990-2015, and the effect that this configuration entails for the rentier nature of the Algerian economy.

The first section of the chapter highlighted the participation and positioning of Algeria and other Western Mediterranean countries – France, Italy and Spain – within the GVC of natural gas. Specifically, it examines the evolution of FVA and DVA components in their gross natural gas exports. The analysis also assessed the nature of their integration, focusing on whether it is primarily forward or backward. Algeria, despite being a leading natural gas exporter, shows relatively low GVC integration compared to the other three Western Mediterranean countries. Its exports are predominantly outside GVC structures, driven by the nature of natural gas as a resource.

Algeria's forward integration surpasses its backward integration, reflecting the upstream nature of its natural gas industry. However, this integration remained nearly unchanged between 1990 and 2015. The majority of Algeria's natural gas trade occurs outside GVC frameworks, contrasting sharply with France and Italy, which significantly improved their GVC participation during the same period. France, for instance, increased its GVC integration by 30 percent, while Italy's integration grew by 6 percent. In Spain, GVC integration slightly declined, whereas Algeria's stagnation highlights its limited diversification into broader international trade networks.

The stagnation of Algeria's GVC integration is notable when compared with other major natural gas exporters, such as Qatar and Nigeria. These countries also rely heavily on natural gas but have demonstrated differing trends. Algeria experienced a decline in GVC participation between 1990 and 2001, followed by a recovery from 2001 to 2015. This recovery coincided with partial

reforms under President Abdelaziz Bouteflika's administration, which aimed to open Algeria's hydrocarbon sector to foreign investment and boost exports. The recovery primarily stemmed from increased forward integration, as backward integration remained stagnant.

In contrast, Qatar's integration into the natural gas GVC began at a lower level in the 1990s. However, with the development of new export infrastructure and the rapid growth of its gas industry in the 2000s, Qatar's GVC participation increased significantly. Nigeria followed a similar pattern, although with varying intensity.

The section also investigated dependence relationships and power asymmetry within the Western Mediterranean value chain. Algeria's trade relationships are primarily bilateral with France, Italy and Spain. However, as these countries have diversified their international trade networks, their dependence on Algeria has decreased. Conversely, Algeria remains highly dependent on these Southern European countries. A comparison of data from 1990 and 2015 reveals that GVC integration within the region was more balanced in 1990 than in 2015.

During the period from 1995 to 2002, the Western Mediterranean GVC reached its peak integration levels for both backward and forward linkages. At this time, Algeria's exposure to Western Mediterranean countries accounted for approximately 40 percent of its foreign supply exposure, nearly double the figure in 2015. This period saw Algeria achieve significant increases in net marketed production and natural gas exports, largely due to the signing of major contracts with international and regional oil companies. These developments followed Algeria's nationalisation of its hydrocarbon resources in 1971.

From 2004 onwards, however, natural gas gross exports decreased, and marketed production stagnated. In the midstream segment of the GVC, the peak period of integration (1995-2002) was marked by the establishment of new physical interconnections between Algeria and other Western Mediterranean countries, further facilitating trade.

Overall, the analysis revealed Algeria's limited integration into the GVC compared to its Western Mediterranean counterparts and other global exporters like Qatar. Despite its status as a leading natural gas exporter, Algeria's reliance on traditional gas trade outside GVC frameworks limits its economic diversification and international trade connectivity. Meanwhile, countries like

France and Italy have successfully enhanced their GVC participation, reducing dependence risks and establishing more balanced trade relationships within the region and beyond.

The next section sought to shed light on the possible relationship between the themes addressed in the previous two sections: whether higher (or lower) GVC integration entails or not any effects on the rentier development of an economy. The starting point for this exercise was a very practical comparison of Algeria with two leading gas exporting economies, namely Norway and Qatar, which reveals very distinct features in the way they have integrated into their own GVCs. Norway, which mostly exports pipeline gas like Algeria, accounts for very high GVC participation, but low dependence on hydrocarbon rents accruing to the state, whereas Qatar, which mostly exports LNG, shows a medium low GVC participation and very high dependence on hydrocarbon rents.

The academic literature extensively links GVC integration with export diversification (IMF, 2014; Tran et al., 2020), positioning it as a crucial driver of economic growth. However, limited research explores the relationship between GVC participation and the rentier nature of an economy. This section addressed this gap through two empirical exercises. The first involves a correlation analysis to assess whether these variables are interrelated, while the second employs a panel data model to evaluate the existence of a causal relationship.

The findings strongly indicate a causal link between GVC participation and rent-to-GDP ratios. These results align with studies connecting GVC integration to enhanced export diversification (IMF, 2014; Tran et al., 2020), reduced reliance on single export commodities, and lower rents derived from these resources. Furthermore, the outcomes support earlier evidence (Kowalski et al., 2015) that greater GVC participation can improve developmental outcomes. For resource-dependent economies, this relationship is particularly meaningful, as it underscores the potential of GVC integration to address structural challenges associated with dependence on a narrow range of export commodities. By engaging more effectively with global markets, such economies can expand their economic and productive structures. In conclusion, these findings highlight the importance of policies that promote GVC participation as a strategy to diversify economic activities, diminish reliance on resource rents, and foster sustainable and inclusive growth.

Finally, the last section of the chapter pointed out to how Algeria's limited integration into the natural gas GVC has entrenched its rentier economic model, whereas deeper GVC participation

could foster diversification, reduce dependence on hydrocarbon rents, and enhance its regional economic influence. Algeria's economic trajectory has diverged from this path, remaining highly dependent on hydrocarbon exports, which accounted for 94 percent of total exports in 2015 (World Bank, 2017), whereas manufacturing, once 20 percent of GDP in 1980, fell to just 6 percent by 2014 (Gasmi, 2017). Algeria pursued economic diversification under President Boumédiène, using hydrocarbon rents to promote industrialisation. However, by the late 1970s, this rapid industrialisation led to severe economic imbalances and a significant budget deficit (Entelis, 1992). The 1986 oil price collapse further weakened Algeria's industrial sector, which never fully matured. Subsequent administrations, including President Bendjedid's, prioritised maximising hydrocarbon rents within the framework of OPEC agreements, which subordinated Algeria's natural gas policy to broader oil policies.

This dependence on hydrocarbon rents fostered a rentier economic model. Structural challenges such as limited private sector development, insufficient foreign investment, and a clientelist approach to resource management (Werenfels, 2007), prevented Algeria from building a diversified economy. The latter not only triggered an increasingly financial dependence on the foreign economic rents generated by this industry and, a bad economic performance, but also curtailed its decision-making capacity to take decisions at the domestic level. By 2015, these choices had entrenched Algeria's reliance on hydrocarbon rents and deepened its economic vulnerabilities. One potential remedy for Algeria's rentierism lies in integrating more deeply into GVCs. Increasing forward linkages, such as exporting natural gas as an intermediate input for other countries' exports, could enhance the value derived from natural gas trade. Evidence suggests that GVC participation, while not a guarantee of diversification, incentivises structural reforms that support economic transformation and reduce reliance on primary resource exports (Harding & Venables, 2016).

CONCLUSIONS

This PhD thesis has aimed to address the following general hypothesis: *despite the steady outflow of natural gas exports via pipeline and Liquefied Natural Gas (LNG) from Algeria to most Western Mediterranean countries, the characteristics of Algeria's rentier economy have been further exacerbated by its limited integration into the broader natural gas value chain.* Against this backdrop, this research has revealed that Algeria, in spite of being a leading natural gas exporter, has limited integration into the natural gas Global Value Chain (GVC) – particularly within the Western Mediterranean value chain –, which has intensified the rentier characteristics of its economy.

This limited integration has resulted in increased financial dependence on foreign economic rents generated by the hydrocarbon industry and a weakened domestic economic performance. Furthermore, it has constrained Algeria's capacity for autonomous decision-making, deepening its economic and political vulnerabilities. In this vein, several constraints on Algeria's hydrocarbon sector and its economic evolution have been identified in Chapters 2 and 3: (1) Algeria's integration into the Organization of the Petroleum Exporting Countries (OPEC) and adherence to international oil governance frameworks have limited its policy autonomy, reinforcing dependence on hydrocarbon rents and the subordination of its natural gas policy to its crude oil policy; (2) external factors including competition from other natural gas producing economies and shifting energy consumption patterns in Europe have constrained Algeria's possibility of increasing hydrocarbon revenues; and (3) domestic policy challenges such as inefficient central planning, delayed legislative reforms, and limited infrastructure have hindered the natural gas sector's growth.

This thesis has been structured into four chapters that respond to the objectives outlined in the Introduction.

Chapter 1 has critically reviewed theoretical frameworks and methodologies central to understanding Algeria's integration into the hydrocarbon industry and its implications for the rentier state model. The discussion spans historical, theoretical and methodological perspectives, offering key insights into the dynamics of resource-abundant economies, with particular focus on hydrocarbons. The chapter has specifically revisited the Theory of Rentier States (TRS) for its narrow focus and has proposed alternative frameworks that better capture the complexities

of international hydrocarbon governance. In doing so, this thesis has developed new quantitative and qualitative analytical methodologies, which were applied in Chapters 3 and 4.

Chapter 2 has explored the historical development of Algeria's hydrocarbon sector and its role in establishing a rentier economic model. By examining the evolution of public policies and structural transformations in the sector, the analysis has underscored the enduring centrality of hydrocarbons in Algeria's economic framework, particularly focusing on natural gas. The chapter has highlighted the fact that while Algeria has functioned as a rentier state, deriving the majority of its rents from the international oil market, natural gas has emerged as the dominant hydrocarbon industry reshaping the country's production and export profile.

Chapter 3 has delved into the development and configuration of the natural gas value chain in the Western Mediterranean, centred on Algeria's pivotal role as a supplier and its relationship with regional energy markets. Algeria's natural gas industry is foundational to the emergence of a regional gas value chain, providing a local, reliable energy source for north Western Mediterranean countries, which shifted consumption patterns towards natural gas in search of energy security. The chapter has confirmed the critical role of physical interconnection infrastructure in shaping the region's micro-integration dynamics. This focus has revealed significant implications for institutional evolution, energy geopolitics, and the advancement of infrastructure systems.

Chapter 4 has presented a quantitative and qualitative analysis of the natural gas value chain in the Western Mediterranean, focusing on Algeria's integration into this structure and its economic implications, and with the aim of assessing the integration dynamics. It has confirmed increasing asymmetries within the regional value chain from 1990 to 2015 and has explored their impact on Algeria's rentier economy.

From the findings in these four chapters, five clustered conclusions can be drawn.

First, this research has been strongly motivated by what has been defined as shortages in some of the theories underpinning development economics, as noted in Chapter 1. The "resource curse", a central theme in development economics, exhibits a negative correlation between resource abundance and economic growth. For hydrocarbon-rich countries, the TRS provides a framework for understanding the socioeconomic impacts of resource rents. Within this

framework, according to Beblawi and Luciani (1987), rentier economies are characterised by elites who rely on externally generated rents rather than productive activities. This lack of productive behaviour reinforces economic stagnation and perpetuates rentierism. However, TRS has been criticised for its reductionist perspective (Talahite, 2012; Mañé-Estrada & Albinyana, 2023). It combines rents from international markets with domestic redistribution and often portrays rents as flows disconnected from structural constraints imposed by international governance. By focusing solely on elite behaviour, TRS overlooks the external dimension and systemic limitations faced by resource-dependent economies like Algeria.

This external dimension, shaped by the international governance of hydrocarbons, has been significantly influenced by organisations such as OPEC, which Algeria joined in 1969. As described in Chapter 2, Algeria's membership of OPEC underscores its subordination to collective decision-making, which prioritises international oil governance, leaving less room for individual strategies, particularly in the natural gas industry.

To bridge the methodological gaps arising from the lack of relational articulation between the external and domestic dimensions of rent, this thesis has incorporated the Global Commodity Chain (GCC), GVC and Global Production Network (GPN) frameworks in its analytical approach. As outlined in the study, these frameworks appraise the fragmentation and transnational distribution of production processes, offering a more complex perspective on hydrocarbon industries contrary to traditional analytical methods, while better capturing the interconnectedness of international hydrocarbon industries, particularly in the LNG sector and gas pipeline dynamics. In this context, this integration complements the TRS by ensuring that the external dimension is thoughtfully incorporated into the analysis. By analysing Algeria's integration – or lack thereof – into these networks, researchers can identify the structural barriers preventing economic diversification and sustainable development in the domestic context, which contributes to the academic research methodologies. In this respect, this thesis has used this hybrid approach as a novel contribution to the academic literature in the field of hydrocarbons, and particularly the study of natural gas.

Second, as outlined in Chapter 1, the concept of rent is underpinned by four fundamental components (Mañé-Estrada & Albinyana, 2023): first, rent arises from resources tied to land ownership; second, the disparity in “productivity” across resource deposits – such as mines -

creates variation in profits; third, the scarcity of the resource demands the exploitation of less productive (and less profitable) deposits with higher extraction costs; and, finally and very importantly, these dynamics operate within the context of a unified market, where a single price prevails. This single price forces the output from highly productive deposits to be sold at the same rate as less productive ones, with the latter setting the market price. Similarly, as we have evidenced in this research, to generate hydrocarbon rents – an essential condition for rentierism – two critical factors must align (Mañé-Estrada & Albinyana, 2023). First, objective conditions must exist: varying qualities of resource fields, inherent scarcity, and properties of the resource. Second, a unified market, or its counterpart, a unified price, must emerge. Additionally, for these rents to flow and benefit specific stakeholders in the international oil economy, a geopolitical and legal framework – governance – is required to legitimise and regulate the process.

As revealed in Chapters 1 and 3, hydrocarbon rents in Algeria constitute nearly all the natural resource rents produced by the country. Over 85 percent of these rents have historically been derived from oil, despite data showing a different production and export profile for hydrocarbons. During the 1990s, natural gas production and exports were roughly equivalent to crude oil in terms of volume (Mañé-Estrada, 2009). However, by the year 2000, natural gas export volumes surpassed those of crude oil (BP Statistical Review of World Energy, 2020). This shift in volume, nonetheless, has not been matched by export values or hydrocarbon rents accruing to the state (OPEC Statistical Bulletins; World Bank Database, 2020), which could paradoxically be perceived as a world leading natural gas exporter whose hydrocarbon rents accruing to the state do not come mostly from the exploitation of natural gas but from crude oil. The latter corroborates the fact that hydrocarbon rents are generated in the international oil market.

For that matter, this disparity arises because the natural gas market does not fully satisfy the conditions necessary to generate significant rents, namely scarcity, quality differentials in reserves, and the establishment of a unified international price. In contrast, the oil market meets these criteria. Consequently, Algeria has functioned as a rentier state by mostly generating rents in the international oil market, where its crude oil has been integrated into a broader institutional framework, primarily through its membership of OPEC. In essence, Algeria's transition to a rentier state pivoted on its crude oil's integration into the international market under the OPEC system, which operates with a unified pricing mechanism. Since the 1970s, this pricing structure

has been shaped by the power dynamics within the dual governance framework of OPEC and the International Energy Agency (IEA), serving a central role in the international capitalist system. This dynamic extends far beyond any simplistic notion of a rentier state mentality, reflecting a complex interaction of market, governance, and geopolitical forces (Mañé-Estrada & Albinyana, 2023).

Third, as noted in Chapter 3, Algeria's transformation from an emerging producer in the 1960s to Africa's leading natural gas exporter by 2015 is very much related with substantial progress in production and infrastructure in the Western Mediterranean region, and notably in its trade relations with Italy, Spain and France. By 2015, the country was the ninth-largest world producer, with proven reserves exceeding 4,500 bcm (Oil & Gas Journal, 2015). Major investments led to the development of extensive pipelines, LNG terminals, and fields such as Hassi R'Mel, which accounted for most production. Nonetheless, the industry has faced challenges, as explained in Chapter 3, such as stagnating export capacity since the mid-2000s due to domestic consumption growth, competition from global LNG producers, and reliance on aging fields. Efforts to diversify production through partnerships with International Oil Companies (IOCs) and new field development as a result of the 1991 hydrocarbon law reflect Algeria's strategy to sustain export capacity while managing resource depletion, as the following hydrocarbon laws of 2005 and 2013 do, as explained in Chapter 2.

As evidenced in Chapter 3, the turnaround that increased demand for Algerian natural gas came at the end of the 1980s with a historical shift of disproportionate consequences: the fall of the Berlin Wall in November 1989, followed by the dissolution of the USSR in December 1991, which paved the way for the emergence of a new concept of long-term energy security in Western Europe (Aïssaoui, 2001). The European Communities (EC, later the European Union [EU]) enlargement to Spain and Portugal in 1986 and the establishment of the Arab Maghreb Union in 1989 facilitated the necessary impetus to deepen the bilateral EU-Algeria energy dialogue and exploit the emerging European gas markets.

The latter triggered the development of a bold midstream segment – comprising pipelines and LNG infrastructure – that has been integral to Algeria's ability to export natural gas to Europe. The construction of pipelines like the Trans-Mediterranean (1983), Maghreb-Europe (1996), and Medgaz (2011) pipelines facilitated long-term energy ties with Italy, Spain and other markets.

Simultaneously, LNG terminals at Arzew and Skikda allowed diversification of export routes, particularly to France. In this context, this thesis has compiled two comprehensive lists of long-term contracts, covering all those signed by Algeria from 1963 to 2015 for LNG and from 1977 to 2015 for pipeline gas, bearing in mind that contracts signed to deliver pipeline gas through the Trans-Mediterranean Gas Pipeline could not start the deliveries until 1983, when the pipeline became operational. For the IOCs purchasing LNG, the French GDF has been the main client during the last fifty years in light of the absence of physical interconnections between the two countries, whereas for the purchasing of pipeline gas, Italian and Spanish IOCs have become the main clients.

Unlike the LNG long-term contracts that have seen their duration reduced over time due to the changes favouring the spot market over the “take-or-pay” contracts, in the case of pipeline gas, the contract duration continues to be rather stable along the timeline, depending on capacities to import pipeline gas. In contrast, the total volumes contracted have been lowered over time, which is the result of further diversification in the sources of origin of natural gas imports, particularly for Italy, but also for Spain. In this regard, Italy has considerably increased imports of pipeline gas from Russia, whereas Spain has increased LNG imports from different sources (Qatar, US, Nigeria...), in many cases at the expense of the pipeline gas being imported from Algeria. In the case of Portugal, LNG imports have mainly come from Africa and Asia, leaving little margin for pipeline gas imported from Algeria.

On the other hand, the absence of physical interconnections from Algeria to France (directly or via Spain) has caused French imports of Algerian gas to be transported by LNG, as noted. An alternative gas pipeline, which could have brought Algerian pipeline gas to France, the South Transit East Pyrenees (STEP), sought to connect the Spanish and French natural gas systems through the regions of Catalonia and Occitanie. Construction on the Spanish side began in late 2010, but in 2019 it was finally rejected by the French and Spanish authorities.

Despite their differences, all three countries have maintained long-standing natural gas trade relations with Algeria, fostering a process of physical micro-integration within the natural gas market of the Western Mediterranean. However, their growing diversification of supply sources presents long-term risks to Algeria’s market share, a conclusion that contributes to the debate on the interdependence between consuming countries and producing economies. And more

importantly for this research, this process of physical micro-integration – while involving Algeria – does not appear to have translated into Algeria’s meaningful integration into the Western Mediterranean natural gas value chain, which remains notably weak, as we further explain in the following point.

Fourth, the analysis of the integration dynamics within the regional value chain carried out in Chapter 3 highlights relational complexities among stakeholders, including Algeria’s National Oil Company (NOC) Sonatrach, Western IOCs (e.g., Eni, Total, Repsol, Cepsa...), Regional Oil Companies (ROCs) such as Gaz de France, later Engie, and Gas Natural, later Naturgy, and transit countries like Tunisia and Morocco. While upstream partnerships exhibit relative symmetry between Sonatrach and Western firms, transit countries face subordinated roles, heavily influenced by Algerian interests. This asymmetry reflects broader geopolitical and economic disparities within the region. In this vein, the study finds that symmetrical energy cooperation could enhance macro-level integration, yet persistent asymmetries hinder deeper institutional integration. As noted in Chapter 3, structural factors such as geopolitical tensions between Algeria and Morocco, Algeria’s dependence on outdated infrastructure, the dominance of Western IOCs in technology and capital, and regional market diversification trends exacerbate these asymmetries. Considering that the results of this first study reflected in Chapter 3 have not been conclusive enough, quantitative analyses have been additionally conducted in order to better understand the nature of the natural gas value chain in the Western Mediterranean.

Hence, the extensive analysis of Algeria’s integration into the natural gas GVC carried out in Chapter 4 reveals stark contrasts with the integration trajectories of other Western Mediterranean and global natural gas exporters. The following six main conclusions can be drawn from this quantitative analysis:

a) Limited GVC participation and integration

Despite its status as a leading natural gas exporter, Algeria’s integration into the GVC remains notably limited compared to France, Italy, and even global economies like Qatar. This low participation is due to the dominance of traditional gas trade, which lies outside GVC structures. Between 1990 and 2015, Algeria’s forward integration in the GVC – reflecting the upstream nature of its exports – remained nearly static, while backward integration stagnated altogether. In contrast, France and Italy significantly increased their GVC participation by 30 percent and 6

percent, respectively, highlighting the comparative stagnation of Algeria's integration. Interestingly, these results show that although Algeria is a leading natural gas exporter – unlike the other three consuming economies from the region –, this is not coupled with an equivalent integration into the global and regional value chains, due to the very high relative volume of Algerian natural gas traded outside the value chain.

b) Dependence and power asymmetry

Algeria's trade relationships within the Western Mediterranean area demonstrate a pronounced dependence on Southern European countries (France, Italy and Spain). While these countries have diversified their international trade networks and reduced reliance on Algeria, the reverse is not true. By 2015, Algeria's dependence on these economies had become disproportionately high, exacerbating power asymmetries within the regional value chain. Data reports that the exposure values in the case of Algeria are always higher than for the other three countries (and sometimes above 10, which is the threshold that we have assumed from which dependence is generated), which means that Algeria is much more vulnerable to the dynamics of dependence within the Western Mediterranean value chain than the other three countries.

c) Temporal dynamics of GVC integration

From 1990 to 2001, Algeria experienced a decline in GVC participation, followed by recovery during 2001-2015. This recovery coincided with partial economic reforms under President Bouteflika, aimed at attracting foreign investment in the hydrocarbon sector. The observed peak in forward integration during this period underscores Algeria's reliance on exporting natural gas, but backward integration remained unchanged, limiting its broader participation in value-added activities. In contrast, in the comparisons drawn with other leading natural gas exporters in the Middle Eastern and Sub-Saharan regions like Qatar and Nigeria, they followed distinct trajectories. Qatar, starting from a lower base in the 1990s, significantly expanded its GVC participation in the early 2000s by developing new export infrastructure and enhancing its gas industry. Nigeria exhibited a similar trend with varying intensity, further highlighting Algeria's relative stagnation.

d) Peak period of integration (1995-2002)

The Western Mediterranean natural gas value chain achieved its highest integration levels between 1995 and 2002. Algeria's exposure to Western Mediterranean countries during this period accounted for nearly 40 percent of its foreign supply exposure, twice the level in 2015. This peak coincided with significant increases in Algeria's net marketed production and natural gas exports, facilitated by major contracts with IOCs and ROCs. Additionally, new physical interconnections strengthened Algeria's trade relations with its Mediterranean neighbours. However, after 2004, Algeria's gross exports declined, and marketed production stagnated, reflecting the country's failure to sustain integration momentum.

e) Comparative asymmetry across time

Comparing data from 1990 and 2015, the integration of the Western Mediterranean value chain was more balanced in 1990 than in 2015. By 2015, countries like France and Italy had strengthened their GVC participation and diversified their trade relations, reducing reliance on Algeria. Algeria, on the other hand, had not achieved similar diversification, leading to increased dependence and greater asymmetry within the GVC configuration.

f) Structural barriers to GVC integration

Algeria's integration challenges are grounded in structural factors, including the upstream focus of its natural gas industry, which emphasises raw resource exports, a lack of investment in midstream and downstream activities, limiting backward integration, dependence on traditional trade frameworks that exclude GVC structures, and insufficient policy reforms to diversify the economy and expand value-added activities.

In summary, empirical findings demonstrate the general hypothesis of this PhD thesis by which Algeria's participation in the natural gas GVC has been minimal compared to Western Mediterranean countries like France and Italy, with the latter diversifying their trade networks and reducing dependence on single partners, while Algeria's bilateral linkages with Southern European countries underscore its asymmetric dependency.

Fifth, Algeria's stagnation in GVC integration exacerbates its rentier economic model, characterised by dependence on hydrocarbon rents, as outlined in Chapters 1 and 4. Limited

engagement in GVCs hampers opportunities for structural economic reforms, export diversification, and value chain development. Within this framework, this thesis has established a correlation between the degree of GVC participation and Algeria's rentier economic model, corroborated by both correlation analysis and a dynamic panel data model to explore the nature and causality of the relationship between GVC participation and Rent-to-GDP ratio. First, the study has drawn comparisons with Norway and Qatar to illustrate how differing GVC integration levels influence economic structures. Norway, with robust GVC participation, demonstrates reduced reliance on hydrocarbon rents, whereas Qatar, in contrast, with moderate GVC involvement, shows high rent dependence. In this line, Algeria, with limited GVC participation, remains entangled in rentierism, reliant on hydrocarbon exports for 94 percent of its total exports in 2015.

Second, the results of the econometric exercise corroborate this very same idea. Scatter plots and statistical results confirm that economies with higher GVC participation have lower Rent-to-GDP ratios. This pattern highlights that deeper integration into GVCs corresponds to reduced reliance on hydrocarbon rents. The dynamic panel data model, run by the Generalized Method of Moments (GMM) approach, indicates a causal relationship between these two variables: higher GVC integration significantly reduces hydrocarbon rent dependence over time. The lagged Rent-to-GDP variable further underscores the persistence of rent dependence but shows potential for structural adjustment through GVC participation.

This brings us to our final conclusion. Contrary to the traditional literature on TRS, both external and internal factors account for the exacerbation of Algeria's rentier economic model over time. Historically, efforts to diversify Algeria's economic structure, particularly under President Boumédiène, sought to leverage hydrocarbon rents for industrialisation. However, rapid industrial growth created economic imbalances, and the collapse of oil prices in 1986, further exposed the country's vulnerabilities. Subsequent administrations prioritised increasing hydrocarbon rents, sidelining diversification efforts. In this regard, by 2015, Algeria's manufacturing sector contributed only 6 percent to GDP, a stark decline from 20 percent in 1980. Nonetheless, this trend cannot be understood without acknowledging that Algeria's integration into international oil governance has reinforced its subordination to collective decision-making processes, thus leaving less room – or even no room whatsoever – for

individual strategies, particularly in enhancing participation in regional and global value chains within the natural gas industry.

Hence, the findings in this PhD thesis underscore Algeria's need to pursue policies that enhance the participation in and integration into natural gas value chains, particularly through investment in downstream and midstream segments. By leveraging GVC integration, Algeria could reduce its reliance on rents, obtain greater value from natural gas exports, and rebalance power dynamics within regional value chains. In this scenario, this approach could foster a more equitable and influential role for Algeria in the Western Mediterranean economic configuration of the natural gas market. Alternatively, if Algeria were to perpetuate its rentier model, it could only become a natural gas rentier economy if the conditions of the international natural gas market were to align with those of the international crude oil market.

As we navigate a world economy marked by increasing confrontation, fragmentation and polarisation, this PhD thesis has adopted the premise that greater integration into GVCs (Gurria, 2013; Kowalski et al., 2015; Tran et al., 2020) can foster shared prosperity, stability, and improved developmental outcomes, and it is therefore preferable to a business-as-usual scenario of confrontation.

Against this backdrop, this research has aimed to broaden the understanding of the interplay between macro- and micro-integration in the natural gas sector in the Western Mediterranean and its effects on rentier economic models. It has done so by introducing new analytical tools, some of which have seldom been applied to the hydrocarbons sector, particularly to natural gas. This study comes at a decisive moment when natural gas continues to play a pivotal role in ensuring energy supply and security, as well as in facilitating the green energy transition. These dynamics have become especially significant in the aftermath of Russia's invasion of Ukraine and Algeria's unilateral decision to interrupt the flow of natural gas through the Maghreb-Europe gas pipeline. While preparing these conclusions, we witnessed the cessation of Russian gas exports via Soviet-era pipelines running through Ukraine in December 2024. These

developments underscore the complex interplay of market, governance and geopolitical forces, which this thesis seeks to better understand from an academic perspective.

Yet, the implications of this work for the research previously conducted in this field, as well as the difficulties inherent to its accomplishment as outlined in the Introduction, call for further research in this realm. Given the limited analytical research on the interaction between rentier economies and their participation in hydrocarbon GVCs, we plan to publish this study in an academic journal. Our goal is to continue exploring how deeper integration into GVCs may influence dependence on hydrocarbon rents and reshape the broader economic dynamics of resource exporting economies. This approach aims to provide a nuanced understanding of the relationship between global economic integration and domestic rent-seeking behaviour, offering insights into potential pathways for resource-dependent economies to diversify and achieve sustainable development.

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APPENDIX

Brief historical overview of Sonatrach

When Sonatrach was established in 1963 it did under the post-independence Franco-Algerian cooperation frameworks (the Évian Accord and the 1965 Franco-Algerian agreements), which entailed a co-existence and co-operation groundwork with French counterparts. In those years, the Algerian company was one among several players in major hydrocarbon projects, but very limited to the transportation phase, until 1966 when the mission of the company was extended to encompass all hydrocarbon activities, including exploration, development and marketing. The 1971 nationalisation process, coupled with the adoption of the 1976 National Charter, under the leadership of president Boumédiène changed drastically the objectives and the functions of the company.

Under the leadership of president Boumédiène, and with Bélaïd Abdesselam as minister of industry and energy (1965-1977), Sonatrach became a large NOC in charge of not only hydrocarbon exploration and development, distribution, refining and processing, but also of industry engineering. As we have extensively referred to previously, the company was utilised as the cornerstone of the industrial development policies, which were paired with the establishment of a dozen affiliates in joint ventures with foreign companies in particular in the upstream and midstream phases of the industry. The size²⁰⁷ and centralised nature of the company hindered a sound decision-making, but as a result of the inflow of revenues from the 1973 oil shock (hydrocarbon rents reached a peak of 30 percent of GDP in 1974), the company managed to absorb much of the industrial investment resources that the government allocated through the successive four-year and five-year Plans. The objective was therefore to achieve investment targets rather than sound management of the company. This decade consolidated the role of the company as the most important economic instrument, and thus it also became subjected to stricter political control, even if the rules on socialist management to state-owned companies were never equally applied to Sonatrach (Mekideche, 1983).

The new administration of president Bendjedid, alongside Belkacem Nabi as minister of energy (1979-88), embarked on a radical transformation of the big state-owned companies during the

²⁰⁷ In the 1970s Sonatrach employed more than 100,000 workers representing 25 percent of the overall industrial labour force.

1981-83 period. Thus, the core objective was to decentralize Sonatrach without denationalizing it (Entelis, 2011), aiming to maximise government revenues to better address the growing social needs of an expanding young population. To this end, several new companies²⁰⁸ were set up from divisions of Sonatrach, some of which are still up to date as shown in Figure 1 of the appendix, pursuing greater decentralisation in the industry. Nevertheless, the new conglomerate of state companies around Sonatrach grew into big entities with concentrated structures and centralised management, which triggered economic inefficiencies and financial imbalances (Entelis, 1999).

Despite the 1986 National Charter promoted by president Bendjedid gave a broader margin to private sector development in the country, Sonatrach remained fully attached to the state and its control (Aïssaoui, 2001). Despite other state-owned companies embarked on a process of de-integration from the late 1980s onwards by transforming them into commercial entities with increasing managerial autonomy, the case of Sonatrach was different precisely because of the strategic role it developed for the state. During this period of political instability between 1986 and 1992, the company underwent alternating phases of de-integration and re-integration reflecting the country's political struggles (Entelis, 2011).

In the country's energy governance, a National Energy Council (NEC) was established in 1981 under the direct control of president Bendjedid with the aim to decide at the highest possible level about energy policies and strategies, as well as coordinate the implementation and the execution of such policies and strategies. It is worth noting that the chairman of the FLN Economic Commission was a member of the aforementioned Council, signalling the unchallenged strong influence exerted by the FLN on energy issues, and that Sonatrach was subject to the strategic decision making of the NEC. In 1989 with the separation of the FLN from state institutions after the Constitutional reform, then Prime Minister Merbah set up a new governance institution entitled the National Advisory Committee on Energy, which interfered less politically and ideologically in policy coordination and execution as compared with the

²⁰⁸ *Entreprise Nationale de Raffinage et de Distribution de Produit Pétroliers (ERDP); Entreprise Nationale de Grands Travaux Pétroliers (EGTP); Entreprise Nationale de Plastiques et Caoutchoucs (ENPC); Entreprise Nationale de Forage (ENAFOR); Entreprise Nationale des Travaux aux Puits (ENTP); Entreprise Nationale de Géophysique (ENAGEO); Entreprise Nationale de Génie Civil et de Bâtiment (GCB); Entreprise Nationale de Services aux Puits (ENSP); and Entreprise Nationale de Canalisations (ENAC).*

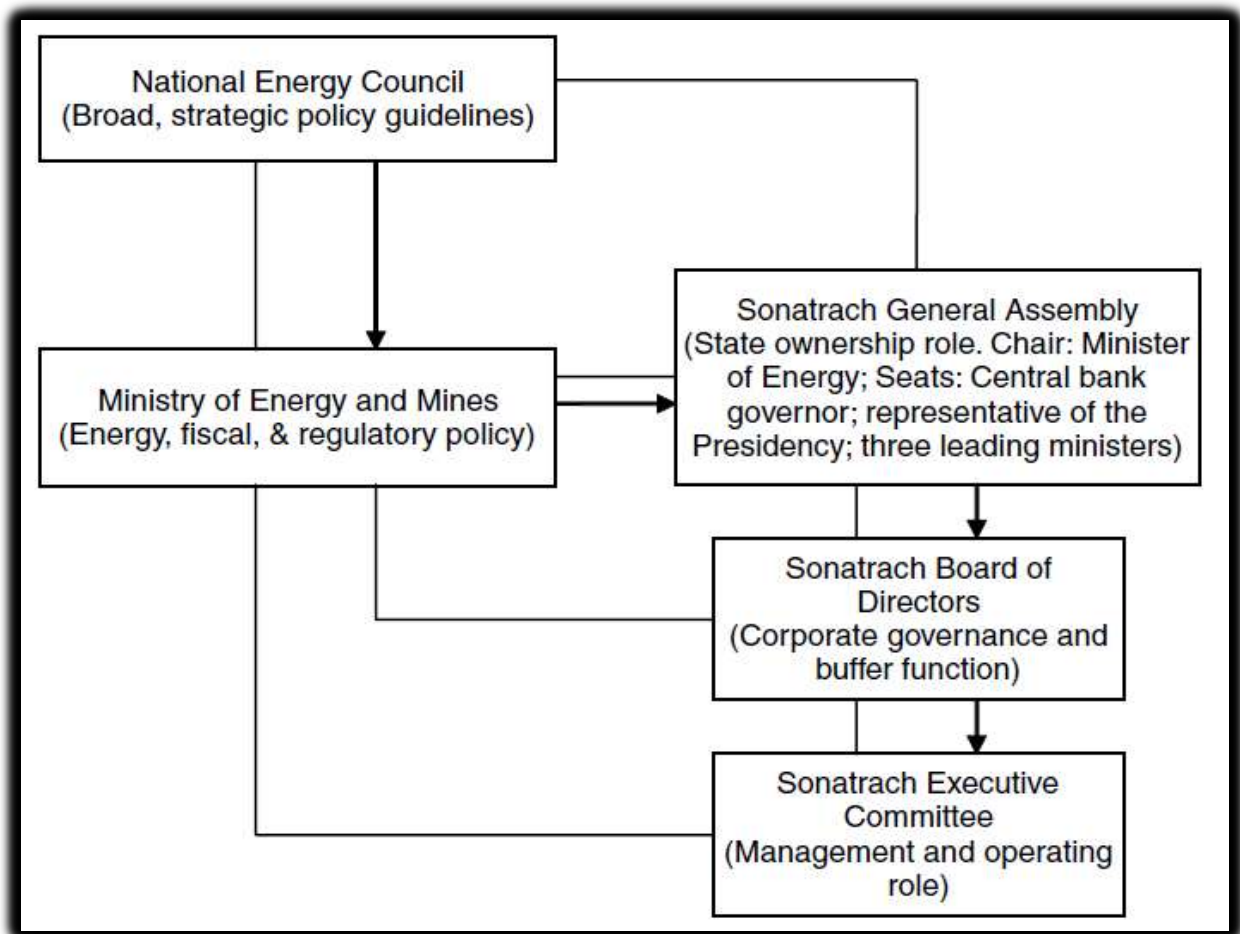
previous institution, while it also excluded FLN from its composition. It acted as an advisory council to decisions taken by the government.

When General Zéroual emerged as the army-appointed president he initiated a process of modernisation of Sonatrach as to make the company more competitive at the global scale (Entelis, 2011). He decided to launch a programme entitled Promos (*Projet de modernisation de Sonatrach*), which aimed at transforming the company into a commercial entity with separate subsidiaries that would compete under the control of the state. The programme envisaged three subsequent phases of transformation, in which during the first phase (1993-95) the company would improve its core upstream and downstream business activities, during the second phase (1995-2000), it would seek enhanced internationalisation of its energy and chemical industry, while in the third phase (beyond 2000), the company would expand its hydrocarbon and energy activities to mining and other type of services. Hence, the underlying idea was to equip the company with better management skills, improve business practises, catch up with technological advances and pursue objectives other than boosting the rents, as it had been the case during the previous three decades (Aïssaoui, 2001).

In 1998 new Statutes of Sonatrach were approved with the establishment of five organisational bodies involved with Sonatrach's decision making and which have persisted up to date (see Figure 2 of the appendix). The only significant change is the role of the National Energy Council, as reinstated by president Zéroual in 1995²⁰⁹, given that president Bouteflika decided to freeze this Council as from 1999. As shown in Figure 2 of the appendix, the Ministry of Energy chairs the General Assembly of Sonatrach and appoints the senior management of the company.

Figure 1. Institutional and energy policy framework from 1998 onwards

²⁰⁹ The National Energy Council (NEC) was reinstated by president Zéroual by presidential decree 95-102 of April 1995. Initially, the NEC was established in 1981 by president Bendjedid with different functions and composition. In January 1989 it was transformed into a National Advisory Committee on Energy, and later in October 1990 into a National Committee for Energy.



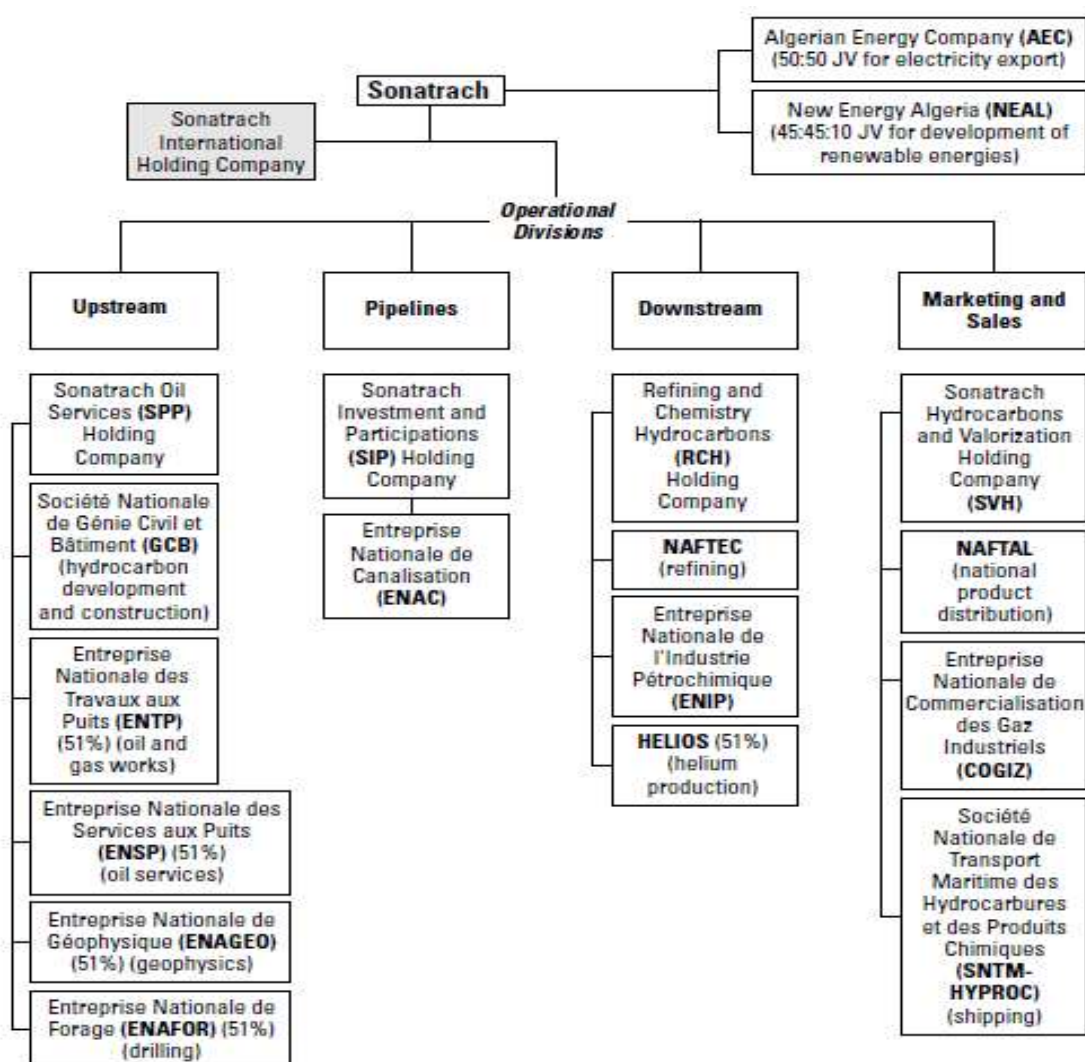
Source: Aïssaoui, 2001

As in other state enterprises where the government is the sole or dominant shareholder, Sonatrach's Board of Directors comprises representatives from various Algerian ministries, along with the CEO and four senior managers.

The election of president Bouteflika in 1999, and the appointment of Chakib Khelil as minister of energy and mines (1999-2010), prompted a new restructuring phase of Sonatrach starting from September 2000 by announcing a new macro-structure (Aïssaoui, 2001). The new structure aimed at integrating its domestic and international activities with the aim of quickly adapting the company to a more competitive global stage and it set up a new international holding group division, among others. Furthermore, Sonatrach managed to escape from the direct control of the government through the NEC, thus acquiring more autonomy vis-à-vis this body, but on

the other hand, president Bouteflika decided to directly appoint²¹⁰ all senior officials and managers within Sonatrach, and not only its CEO, signalling that the company was still under a different set of control by the state.

Figure 2. Structure of Sonatrach and its subsidiaries



Source: Marcel, 2006

²¹⁰ Under the terms of the presidential decree 2000/271 from September 2000, which amends the statutes of Sonatrach from 1998, the appointment of the CEO by the president is now extended to all vice-presidents and deputy general managers.

Figure 2 of the appendix illustrates the structure of Sonatrach with all its subsidiaries as of 2015, a structure that has prevailed since the changes introduced in the beginning of the Bouteflika era. The structure encompasses the four main organisational divisions, along with the holding companies that can be entangled with each of the organisational divisions.

The reformist approach of the new administration was jeopardised during the process that led to the adoption of the 2005 hydrocarbon law. Minister Chakib Khelil was the main architect of this structural reform by tabling a first draft proposal in 2001 that intended to liberalise the hydrocarbons sector, primarily by relieving Sonatrach of its regulatory role, and thus place it in equal footing with foreign companies when they bid for exploration and exploitation contracts within the Algerian territory. Should the law have finally been adopted in these terms, Algeria would have become the first country in the whole Arab region to adopt such an approach to allow freer competition in the upstream, midstream and downstream phases of the hydrocarbon sector. Moreover, the initial plans from minister Khelil also envisaged a partial privatisation of Sonatrach, which would have threatened to disrupt the flow of rents between various groups and their supporters (Entelis, 2011).

The close ties between the Algerian state and Sonatrach²¹¹, sustained through various legislative changes, led to a major corruption scandal in 2010. This scandal resulted in the unprecedented

²¹¹ Since the establishment of Sonatrach in 1963 it has been very common to see movements of senior officials between the government and Sonatrach. It has been the case of the following ones:

- Bélaïd Abdessalam was the first CEO of Sonatrach between 1963-65 and Minister of Energy between 1965-77 (later, he was also Prime Minister)
- Belkacem Nabi was president of SN Repal between 1964-65 and Minister of Energy between 1979-88
- Sid Ahmed Ghazali was CEO of Sonatrach between 1966-67 and Minister of Energy between 1977-79 (later, he was also Prime Minister)
- Nordine Aït Laoussine was senior Vice-President of Sonatrach in charge of upstream activities and downstream activities between 1970-79, and Minister of Energy between 1991-92
- Youcef Yousfi was Vice-President and Director-General of Sonatrach between 1979-88, and Minister of Energy between 1997-99 and between 2010-15. He was also acting Prime Minister
- Chakib Khelil was CEO of Sonatrach between 2001-03, while he was also Minister of Energy between 1999-2010. Before joining the World Bank he was also in Sonatrach during the 1970s
- Mohamed Meziane was CEO of Sonatrach between 2003 and 2010 and he also served as director general of hydrocarbons in the Ministry of Energy between
- Salah Khebbi developed several positions within Sonatrach before becoming Minister of Energy between 2015-16

dismissal of Sonatrach's CEO, Mohamed Meziane, along with three of the company's four Vice Presidents, all accused of corruption. The investigation, which involved the secret services²¹², remains shrouded in secrecy, with the underlying motives and circumstances behind the scandal still classified²¹³ (Entelis, 2011).

Throughout these fifty years of history of Sonatrach, while several key initiatives were introduced to encourage a more "market-style" hydrocarbon sector (i.e. hydrocarbon reforms of 2005 and 2013), they were never fully implemented because they threatened a symbol of national independence, whilst also endangered the power of the ruling elite. Indeed, these reforms threatened the system of political patronage that governed the country for so long and they threatened to disrupt the flow of hydrocarbons rents from Sonatrach to the government that helped so much to preserve a clientelist system in Algeria. In this vein, all the various elite factions agreed that to lose the source of their political influence -hydrocarbon rents- would be contravening. This explains the strong and widespread resistance to the idea, first introduced in 2001, of using the hydrocarbons reform law, drafted by the minister Khelil, to privatise Sonatrach, which would directly affect the distribution of rents because it would undermine the patron client networks in which this type of state-owned companies is embedded. Hence, it is reasonable to conclude that as long as Algeria continues to keep this form of clientelism whereby the bulk of its rents from oil and gas revenue is accrued to the government, Sonatrach will continue to be used as a way to channel funds to those in power, and thus will remain heavily controlled by the state.

²¹² *Département de renseignement et de sécurité (DRS).*

²¹³ In an open letter addressed to the DRS investigators of this corruption scandal published to the media in January 2010 by Hocine Malti, former vice-president of Sonatrach, the latter deplored the fact that the ongoing investigations stopped "at the top floor of technocracy (...), as if the very high political figures and military personnel were immune from any attempt of corruption". He suggested that "corruption was widespread" in Algeria, going much beyond the cases proved by the DRS.

ANNEXES

Annex I: Typology of contracts, tax regime and transportation, processing and storage activities (2005 hydrocarbon law as amended in 2006 and 2013)

Type of contracts: E/P activities (upstream)	
Prospecting permits	Permit granted: ALNAFT under the approval of the Ministry
	Object: any company intending to perform works in order to discover hydrocarbons in one or several prospecting areas
	Duration of the permit: 2 years, renewable once
	Proceedings: a prospecting permit does not grant the holder any rights over discovered deposits, should they be found on the course of a prospection. In case a deposit is found, companies with prospecting permits in that perimeter will have preferential rights in a call for tenders issued by the Algerian state.
Exploration and/or production contract	Permit granted: tender process to a contracting party, which may be Sonatrach on its own, or Sonatrach and one or several foreign companies. In the latter, Sonatrach must hold at least 51 percent of the project's shares
	Object: granting of exclusive rights over exploration and production in the perimeter
	Duration: production contracts last 25 years as of the date the contract takes effect. Exploration and production are divided into two phases: first phase (exploration) is 7 years as of the date the contract takes effect; while the second phase is 25 years as of the date the ALNAFT approves the development plan.
	Proceedings: if at the end of the exploration phase the contracting party has declared no discovery, the contract is terminated. If it has declared a discovery, the commercial party must seek an approval to declare a commercial deposit, along with a proposed development plan. Upon the contract's expiry, all works and facilities will recert to the state free of charge. In case of abandonment the restoration costs are covered by the contracting party.

Source: Consolidated hydrocarbon law of 2005 and African Upstream Oil and Gas (Globe Law and Business 2015)

Tax regime: E/P activities (upstream)	
Land Tax	It is payable by the operator on behalf of the contracting authority in Algerian dinars or US dollars. Its calculation is based on the area of the perimeter of the field
Royalties	It is payable to ALNAFT by the operator on behalf of the contracting authority on a monthly basis The rate varies from 5,5 to 20 percent of the value of the hydrocarbons produced, depending on the location of the contract perimeter (fields in areas less accessible in terms of exploitation or in terms of conditions of extraction were charges a lower rate)
Tax on hydrocarbon revenue	It is monthly payable to the Treasury by the operator on behalf of the contracting authority. The tax is calculated on the basis of the production value, minus authorised deductions such as investments. The tax rate is determined on the basis of the project profitability.
Other taxes	Other taxes may apply for the use of water from public domains, as well as an additional income tax for individual partners of the contracting authority, and any entity transferring rights and obligations in the framework of an exploration and/or production contract is subject to the payment of a 1 percent tax on the value of the transaction

Source: Consolidated hydrocarbon law of 2005 and African Upstream Oil and Gas (Globe Law and Business 2015)

Transportation, processing and storage activities (midstream and downstream)	
Transportation	Transportation of hydrocarbon production within the Algerian territory is the sole responsibility of Sonatrach or its subsidiaries. However, concessions to foreign companies might be granted for international pipelines that enter from outside the territory, as well as for international pipelines that originate from the national territory.
Processing	Processing (along with refining) are activities undertaken by Sonatrach that it can perform alone or in association with foreign companies, in which case Sonatrach must hold at least 51 percent of the project's shares.
Storage	The ARH might grant authorisation for the storage and distribution of hydrocarbon products

Source: Consolidated hydrocarbon law of 2005 and African Upstream Oil and Gas (Globe Law and Business 2015)

Annex II

The results for all indicators and other measures used in the sub-section 4.2.2 for each year in the time series (1990-2015) can be found here.

<https://shorturl.at/o6DCd>

Annex III

Calculations of sectoral T matrices utilised in the sub-section 4.2.3 and raw calculations conducive to the supply and demand exposures can be found here:

<https://shorturl.at/o6DCd>

Annex IV

Raw data used to estimate the dynamic panel data model used in section 4.4 can be found here:

<https://shorturl.at/o6DCd>