

The long run development of Chile and the
Natural Resources curse. Linkages, policy
and growth, 1850-1950

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Abstract: This chapter analyses the effects of Natural Resources on the Chilean economy in the long run (1850 - 1950). Specifically, the authors focus their attention on the mining cycles (nitrates and copper) and their impact on the mining activity. We also compare it with the evolution of the industry and whole economy, and how this has affected the economic growth of the country. In that sense, the industrial performance in Chile at the end of the 19th century until the Great Depression is still under debate. The optimistic view of Kirsch (1977) forehead the pessimistic view of Lagos (1966) and Palma (1979). The new data and its analyses shows a neutral effect of the Natural Resources in the industrial development.

JEL Codes: N56, Q33, Q37.

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1. Introduction

The implications of Natural Resources in long-run growth remain as an open question (van der Ploeg 2011; Barbier 2011, pp. 367–462). On one hand, extended literature on the idea of Natural Resource curse points out that a country with plenty of commodities to export will fail to achieve development because economic agents have better incentives to specialize on Natural Resource activities or favour the emergence of rent-seeking attitudes adopted by elites.⁴ Other work focused on global analysis also found a degree of correlation between high resource intensity and slow growth as Gregory (1976), Sachs (1999) and Sachs and Warner (2001). On the other hand, historical evidence shows that some countries escaped from Natural Resource curse and have achieved success in Natural Resource management.⁵ Australia, New Zealand, Norway or the US are examples of strong forward and backward relationship between natural resources and the rest of the economy, which have allowed them to avoid the curse.⁶

In this discussion, we consider the analysis of Chile from a historical perspective, in hope it could shed some light about the curse of natural resources in those middle income countries which have benefited from Natural Resource boom cycles. In order to do so, first we describe the long persistence and importance of Natural Resources in Chilean economy:

- 1) Nitrate cycle from mid-19th century up to the Great Depression (1880 – 1930) characterized by being labour intensive and highly concentrated.
- 2) A copper cycle from 1910 and onwards, geographically dispersed, with high levels of capital and technology requirements and a strong effort towards a higher degree of mineral manufacturing with the objective of adding value to exports.

Secondly, we want to analyse the differences among mining cycles and how they affected the characteristics and intensity of forward and backward relationship in Chilean economy.⁷ Thirdly, we review the literature surrounding the impact that public policies

⁴ The term ‘Natural resource curse’ is used frequently to explain the poor growth performance of resource-rich countries during second half of the 20th century (Sachs and Warner 2001). Nevertheless, other work goes beyond the analysis of less developed countries analysing other countries such as Australia, following the discussion initiated by Gregory (1976) who defends the negative implications of Natural Resources on non-tradable sector and continued by Snape (1977), who was more sceptical about problems in a macro-level dimension.

⁵ See David and Wright (1997) for the US, Greasley and Oxley (2010) for New Zealand, Mideksa (2013) for Norway and Ville and Wicken (2013) for Australia. For other countries see also Robinson *et al.* (2006) and Auty (1997).

⁶ Sachs and Warner (2001) points out the importance Natural Resources had on some economies during the 19th century. Nevertheless, natural resource intensity observed for Sweden, Australia and US earlier never approached the level of natural resource intensity we see today in the Gulf-States. In that sense, the argument presented in Habakkuk (1962) could be accepted for earlier periods when access to cheap power was essential. With the emergence of petroleum-based economy and global transport revolution, cheap energy could be easily accessed (Topik *et al.* 2006).

⁷ Labour intensive mining cycles, as Nitrates, associated to relatively higher working-wages, pushed domestic demand (both external demand and consumer goods manufacturing). In that sense, many course cases we observe an expansion of export demand due to the appreciation of exchange rate (one of the effects of the so-called ‘Dutch Disease’). What could nuance the curse is the capacity of domestic industry to satisfy it. During the copper cycle, some of the mining activities were able to add some degree of

(or the lack of it) were implemented into economy to manage the appearance of a NNRR boom. The appearance of tax surplus contributed to Natural Resource exploitation and thus their impact on infrastructure construction and on economic boom in the long run.⁸ Last of all, we want to analyse economic performance of Chilean economy during this period and discuss the hypothesis of the existence (or not) of a Dutch Disease problem during this period (Ville and Wicken 2013).

Corden and Neary (1982) and van Wijnbergen (1984) point out in their seminal work that countries with a Natural Resource boom experienced a strong process of de-industrialization due to the fact that an increase in the export sector attracted labour and investment and at the same time, the service sector experienced a strong impulse due to the boom on the level of income. Parallel to that, higher wages on natural resources and sectors added to the appreciation on exchange rate reduced competitiveness of 'traditional' export sector. In the end, the result is a less diversified economy, strongly dependent on evolution of natural resource prices (more volatile) and less potential growth. Interesting work on this issue has been published since then and interesting contributions were done on different countries.⁹ From all of them, we highlight those studies with a more optimistic view as the one done by Davis (1995) on positive performance of mineral-export and less developed countries compared with other less developed countries, and Mikesell (1997) who highlights that not all export booms imply Dutch disease. Considering this framework, we shed some light on the hypothesis that put the backwardness of the country in failure on Natural Resource management (Pinto 1996). To accomplish these objectives, we are going to describe the export booms and check possible existence of backward and forward relationship among natural resources and the rest of the economy, specifically the manufacturing sector and how this has affected economics in the long run.

2. Natural resources and economic development in Chile before 1950

Natural Resource curse literature have identified a negative correlation between the share of Natural Resource sector in the GDP and evolution of the economic performance in the long run (Barbier 2011, pp. 5–6). First, we have to confirm that Chilean economy may be considered as a dependent economy.¹⁰ In Figure 1 export figures show that before the War of the Pacific and the beginning of the Nitrate Cycle, mineral exports were the main item. More than 50% of total exports were minerals from 1850 to 1875 reaching levels up to 70% during the 1860s when the first cooper cycle appeared. During this period, agricultural products (mainly wheat) and livestock were also important. The expansion of grain production in Australia and their exports to the west coast in US where the main market for Chilean wheat exports.¹¹ After that, cereal exports decreased and Chilean

transformation. This could strengthen some linkages to the industry, as the expansion of foundry and melting mineral, and to the service as expansion of the financial sector.

⁸ The positive view of Mamalakis (1976), Palma (2000b) or Cariola and Sunkel (1983) were shaded by the analysis of Lüders and Wagner (2003), Frank (1967) and, more recently by Gallo (2008) whose work found a turning point of the effectiveness of natural resource taxation after World War I.

⁹ Alvarez and Fuentes (2006) and van der Ploeg (2011) have presented interesting surveys on this topic considering some of the most important approximations on this field and list part of the case studies in the world. For the oil boom cases, we could see Usui (1997).

¹⁰ Sachs (1999) considered a boom export economy when occurred '...a rise on natural resource exports to GDP of at least 4% of GDP, from the beginning to the peak of the boom, with a duration of at least three years.'

¹¹ Collier and Sater (2004) points out that wheat exports (and the product diversification of exports) ended around 1880, with the arrival of new competitors in the USA (mainly Argentina and Australia). At this

production was oriented to the domestic market. The result was that the level of concentration on mineral products increased up to more than 80% of total exports until 1950 (see Figure 1 and Figure 2) and resulting in an extremely high level of product concentration (Badia-Miró *et al.* 2012; Bulmer-Thomas 2003).

<Figure 1 – about here>

Product specialization was also accompanied by geographical specialization. During the 1870s Bolivia and Peru imported around 25% of Chilean exports. The War of the Pacific changed this pattern deeply. Thereafter, up to the end of the 19th century, Germany, France, United Kingdom and the US became Chile's most important partners and concentrated approximately 90% of our export. Exports to northern neighbours went down to less than 5%. The expansion of nitrate cycle in the following decades supported a light spatial diversification of exports with the incorporation of other destinations, such as Belgium, the US or Germany as main partners until the beginning of the IWW (Badia-Miró *et al.* 2012).

<Figure 2 – about here>

Two minerals: one metallic, Copper and one non-metallic, Nitrates, were the main players in Chilean mining cycles. Nitrate is related to the expansion of international demand as an agrarian fertilizer, in the 19th century (Miller and Greenhill 2006), and copper due to the electricity revolution in the 20th century. Although the nitrate cycle was shorter, it had an impressive effect over economy due to the importance as a fiscal resource supplier for Chilean state.

The appropriation of northern territories by Chilean state, crowded out investment and copper exports. The economic activity was centred in saltpetre production boosting mineral exports and, as we can see in Figure 2, forced a process of deeper specialization (more than 80% of total exports were mining exports). As a result, there was an important decrease in total copper production and in the copper ore grade when we compare 1870s and 1880s figures with the ones observed during 1890s and the 1900s.¹²

Huge profits were obtained during the nitrate era. As Sunkel (2011) points out, the effects of nitrate over Chilean economy (and its fiscal capacity) was enormous. Between 1890 and 1920, nitrate exports represented a minimum of 57% of total exports and a maximum of 79%. Considering fiscal revenues, by 1895, nitrate exports represented 56% of State income and reached 60% in 1915. Because of the War of the Pacific, Chile was able to obtain a stream of revenues that would have been difficult, if not impossible, to achieve otherwise.¹³ The importance of fiscal impact forced a discussion among the elites around the possibility of keeping state monopoly over nitrates (Miller and Greenhill 2006). Nitrates also expanded those activities strongly linked with their exports. Examples of that: 1) Expansion of railways to transport nitrates to the coast. 2) Supply goods and inputs to the offices. 3) Expansion of imports and the demand from other zones of the country, mainly Valle Central and the South (Cariola and Sunkel 1983). 4) The expansion of those industries connected to nondurable manufactured goods produced in the Nitrate's regions of Tarapacá and Antofagasta. Those firms were oriented to supply domestic demand

time, Chile lost its competitive advantage. Ortega (1981) also explained in details the end of the first copper cycle.

¹² See Sociedad Nacional Minera (1903). We also found a warning about the decrease of copper production, especially when it was compared with what happened in countries such as the U.S. or Australia.

¹³ For a contra factual study of effects of the War of the Pacific, see Sicotte *et al.* (2009).

expansion, which had relatively high wages, and all services were oriented to the transport of this product overseas as banking, insurances and sea transport. As we can see in Figure 1, the effects of nitrate boom were notably clear during the period 1880-1905, when copper production started a new cycle pushed by the effects of world electrification.

Copper extraction has been present in Chilean economic history since its origins (Méndez Beltrán 2004). The aborigines, the Spaniard conquerors and the new independent country entrepreneurs used it. Copper trade had a big push with the arrival of industrial revolution due to their extensively use in several industries.¹⁴ The first boom, at mid-19th century, finished at end of depletion of the higher-grade ores (Ortega and Pinto 1990). Then, the nitrate cycle started after the War of the Pacific (1879 -1884), a territorial dispute between Chile, Bolivia and Peru because of Tarapacá and Antofagasta regions, both rich on nitrate minerals and Copper, (but this mineral was not the mineral in dispute). The territorial dispute ended with Chile occupying this zone as well as the region of Tacna.¹⁵

As we said, there were two main cycles of copper extraction and exports in Chile; the first one: a long cycle starting with the Spanish conquest of Latin America until 1880, and the second cycle started in 1906 with '*El Teniente*', an underground mine located in the O'Higgins region 80km south from Santiago. The first cycle was linked to a traditional mineral exploitation, with high ores and labour-intensity rather capital-intensity firms. This copper exploitation was concentrated on the northern part of the country, especially Huasco-Copiapó (Méndez Beltrán 2004). The main demand of copper was related to international commerce, with the uses of copper as ship sheathing, as stated by Staniforth (1985) and Harris (1966).

The second cycle was completely different both in production structure of the mining sector as well as the demand behind it. First, the labour intensive production of the 19th was replaced by capital-intensive firms, most of them from the US. Secondly, exports of raw materials during the nitrate cycle were replaced by a different sort of products with different levels of transformation and with differences in relative value per ton of mineral (see figure 3 and tables 1 and 4); the axis production (ore between 45%-55%) was progressively replaced by bars and raw mineral production. By 1938, close to 95% of copper production was concentrated in bars (Statistical Yearbook of Chile. Mining Section, 1939).

<Table 1 – about here>

This change in yield composition had a direct impact over linkages. There was an improvement in technology exploiting mineral, with more capital-intensive technology applied. However, as we will see in the following sections, those improvements did not have an impact in other sectors of economy.

The end of the War of the Pacific in 1884 was the starting point of Nitrate cycle and the occupation of Tacna's provinces Tarapacá and Antofagasta in the Atacama Desert, meant for Chile a virtual monopoly on world's nitrates production. This monopoly gave government the possibility to tax nitrate exports and also the capacity to found a bigger

¹⁴ Before the electrical revolution, copper was extensively used as coating for ships to protect them from worm ravages and encrustations of weed and barnacles (Harris 1966).

¹⁵ The War of the Pacific is still an issue of debate for the countries involved (Bolivia, Chile and Peru) and its legacy has created great problems for political and economic integration of the region. Chilean historical explanation about the war (Bolivia did not accomplish a legal agreement between the states and Chile defends its rights) is opposed to Bolivian and Peruvian explanation (an aggressive attack by Chile in order to appropriate Saltpetre region). Opposite of those visions, Sater (2007) considered the war as a British movement to establish saltpetre business in a more 'friendly' environment for British companies (The Chilean government).

state.¹⁶ Even during the civil war in 1891, between parliamentary forces and the presidential power, country's economy and nitrate production was not affected (see Table 2). However, the labour productivity of this industry declined at the end of the 19th century. In 1884 labour productivity reached 1.015 quintals per worker. Twenty years later, this value was transformed in half of the value reflecting one of the main problems of the nitrate sector. This, together with the fact that there was a lack of backward linkages to other sectors (only railway and transport sector), dismissed the possibility to expand the industry and diversify Chilean economy. Nitrate industry requires less machinery for its extraction and transformation than copper; there were no foundries or smelters; neither steam motors.¹⁷ Key inputs for nitrate industry were labour, TNT, water, coal, wood and transport to be exported. On the other hand, if we consider forward linkages, the situation is different. Home-market effects on nitrate zones (relatively higher wages and concentration of demand in Northern provinces) relied heavily on evolution of nitrates prices (Ortega 2005; Cariola and Sunkel 1983; Badia-Miró 2008; Badia-Miró and Yáñez 2015).

<Table 2 – about here>

Why didn't nitrate activity generate a sustainable boom for Chilean economy? Following the Dutch Disease framework, the result of an export boom is based on a simple premise: natural resource activity generates an enormous surplus for the economy but at the same time, this profit does not materialize a structural change of economy or incorporation of more value added in pre-existent sectors. At the same time, natural resource exports produce an exchange rate appreciation, hurting competitiveness of non-tradable sectors. Nitrate production was the main export in Chile during the period of 1880 – 1930 and its influence over exchange rate was revisited by Palma (1979; 2000b) and Lüders and Wagner (2003). These authors confirm that there was never a clear relation between exchange rate and Chilean dependency on saltpetre.

The failure in turning Chilean economy into sustainable economic boom during predominance of nitrates must be analysed in a broader perspective. We have to consider its effect on the industry, in non-tradable sectors, the induced demand effect on domestic production (industrial and agrarian demand) and public investment derived by the boom of improvement of fiscal capacity due to nitrate taxation. When we observe government tax policy before and after the War of the Pacific, we could conclude that:

- 1) A severe decline in government revenues is observed during 1870s,
- 2) As a consequence, Chile raised import rates and enacted an income tax and an inheritance tax (Sater 1986).

However, between 1880 and 1900, the average import rate (import rate revenues divided by value of imports) fell by more than 25%. Finally, income tax and inheritance tax, which never raised more than 200,000 pounds per year, were repealed in 1890.

Cariola and Sunkel (1983) observed that other internal taxes were eliminated during the 1880s. Sicotte *et al.* (2009) linked these changes in taxes to the nitrate boom and explained both impacts. Import rates and internal taxes imposed on one side and nitrate export tax on the other side maximize fiscal revenues. As Gallo (2008) described, the capacity of

¹⁶ About nitrate taxation in Chile see Lüders and Wagner (2003), Palma (1979), Cariola and Sunkel (1983) and Sicotte *et al.* (2009).

¹⁷ Nitrate's mechanization was concentrated on main and bigger offices. Medium and small exploitations relied heavily on labour (Ortega and Pinto 1990).

the state to maximize this revenues changed slightly at the beginning of the 20th century and ended after the World War I, where monopolistic market power of Chilean production ended.

3. Industrial performance during the mining boom

Industrialization has been seen as a way of economic modernization opposite to natural resource dependence, in an export boom context. Since the 1980s, many authors suggested an early industrialization hypothesis in Latin America before the Great Depression, when huge export boom benefited most South American countries (Suzigan 1988; Williamson 2011). This is a key point for effects on economic boom and implications into public policy.¹⁸ In that sense, natural resource expansion could be responsible for industrial backwardness due to the effects of the so-called Dutch disease effect and the impact on the competitiveness of the industrial sector.¹⁹ Chilean bibliography provides opposite views of their existence during the Nitrate boom. On one hand, Jeftanovic (1992) confirmed the existence of a slowdown in agriculture and industry during the beginning of the 20th century due to draining of labour and investment on Saltpetre sector, from a model which considers three sectors (tradable, non-tradable and export). To confirm that, the author only considers the evolution of real exchange rate and existing series of industrial GDP due to the lack of data.²⁰ Following this idea, Llona (1992) pointed out the existence of some degree of de-industrialization on cooper refining during the Nitrate Era, as a way to confirm the existence of Dutch Disease. On the other hand, (Palma 1979; 2000a; 2000b) claimed that the effect of saltpetre trade was not negative to economy and there was no evidence on dropping exchange rates during this period. However, the data used by Palma is considered aggregated, and do not split among tradable and non-tradable goods. He also pointed out the nonexistence of Dutch disease due to the active role played by the state in spending most of the surplus appropriated with their fiscal policy and the expenses of the productive process.²¹ Other work on this topic was focused on the analysis of expansion of copper sector during the 20th century as Pereira *et al.* (2009) states. Later, Ugalde and Landerretche (2011) analyses the first decade of the 21st century and the impact of expansion of copper prices.

In the case of Chile, as far as we know, Nitrate cycle pushed the economy but it was not strong enough to reduce the gap between high and middle-income countries. In that sense, one way to observe the capacity of Chilean economy overcoming mining dependence is analysing what happened with industry. This is why, despite its economic expansion, we have an hypothesis that the country was losing competitiveness in the industry and, due to their forward and backward linkages, the potential boom was reduced during that period.²² We also consider that this bad performance was reinforced during the cooper cycle.

Generally speaking, figures for manufacturing were just 4% during the beginning of the period and the peak (just over 10%) was reached at the end of World War I and during the Great depression. However, even during this period of 'natural protection' due to the crash of foreign trade, the reaction of domestic manufacture was undersized in most South

¹⁸ See (Hirschman 1958) for linkages between industry and economic growth.

¹⁹ A recent review of the theory for Latin America (Gregorio and Rodríguez 2011).

²⁰ The author considers Industrial GDP from (Ballesteros and Davis 1963) which is considered optimistic (Ducuing and Badia-Miró 2013).

²¹ Other authors as Díaz and Wagner (2004) and Lüders and Wagner (2003) reinforce this hypothesis.

²² Llona (1992) points out the de-industrialization in cooper refining during the Nitrate Era as a way to confirm the existence of Dutch Disease in Chile.

American countries (Carreras-Marín *et al.* 2013; Albert 1988). To answer that question, we have to go deeper into the analysis of what happened with manufactured imports and their evolution during all the period. We also have to check industrial performance on the long run following the new estimations provided by Ducoing and Badia-Miró (2013), they observed in detail the level of industrial diversification, its productivity and the capacity of domestic production to substitute imports.

As those authors pointed out and Bulmer-Thomas (2003) summarized, the performance of the industry at the end of the 19th century until the Great Depression is still not solved. If we summarize the main points under debate, Palma (1984) defended that the industrial performance is strong enough to become independent from the evolution of export demand and of imports of inputs and intermediate products. At the same time, the author showed that the share of machinery and intermediate goods increased during the 1920s.²³ Moreover, the percentage represented by local production of consumer goods over total consumption increased considerably. On the other side, Muñoz Gomá (1968) and Kirsch (1977) supported the view that industry and exports were strongly connected until the Great Depression. Muñoz Gomá (1968) justified the small structural change observed because of the strong dependence on consumer goods and consequently, because of the dependence on export performance. It was not until the 1930s when the industrial sector took the lead of economy which was pushed by active state policies and culminated with the foundation of the CORFO in 1939 (Ortega *et al.* 1989). In that sense, Kirsch (1977) exposed that imports contraction caused an industrial bottleneck due to the dependence on combustibles and machinery, already during World War I.²⁴ Ortega and Pinto (1990) in a more pessimistic position, stated that the industry has problems adapting to more processed products and machinery equipment demanded by the mining sector.

New estimations on industrial production (Ducoing and Badia-Miró 2013), showed that the poor performance of the industry was a driver of diversification for Chilean economy. As we have stated, the peak is achieved around the World War I and slightly exceeds 10% (see Table 3). Although the growth of industrial output is greater than the growth of the GDP, we cannot confirm a transformation of the structure of economy led by the industry as a driver of modernization.²⁵ The 11.8 share raised by the industry in 1938 is just 1% more than in 1913, when Palma stated the best period for the industrial sector in Chile began. The higher rate of growth in the period 1929-1938 comparing industry and GDP is a bit misleading, because if we compare this rate with the previous periods, it is not higher than 1880 – 1913 and 1885 – 1913.

<Table 3 – about here>

Figure 3 goes deeper in what happened in the industry during the whole period. Although the analysis in the figure only included the period between the two World Wars, we observe a clear pattern of substitution of non-durable by semi-durable consumer goods. Other subsectors of the industry remained stagnated (durable consumer goods, intermediate goods and capital goods).²⁶ This figure depicts some degree of

²³ Ducoing and Tafunell (2013) shows that the machinery and equipment growth in the 1920's was the recovery from the World War I, more than a sustainable improvement.

²⁴ In spite of this bad performance, Kirsch (1977) accepted the push of some sector as the concrete production due to the stimulus of the infrastructure expansion, sugar or cotton weave.

²⁵ In that sense, this view was consistent with what Carmagnani (1998) raised to explain the failure of the industry as a way to modernize the economy.

²⁶ To build the figures we have considered Ducoing and Badia-Miró (2013) estimations of industrial GDP and we have adopted the shares proposed by Muñoz Gomá (1968). For non-durable consumer goods, we considered food, beverages and tobacco. Textiles, clothes, footwear, paper products and printing were

transformation of the Chilean industry towards a more diversified industrialization and notes this capacity of domestic production to react to the shortages of World War I reinforcing the production of consumer goods industry with low technology requirements (textiles, clothes, footwear and paper and printing). This figures coincide with Palma (1979)'s figures showing a duplication of weight of capital goods production over the whole industry. One question arises, considering that this is expansion enough to state that Chilean industry have started a transformation process towards a more diversified industry? From our point of view, opposite to what Palma defended; the growth is not high enough. Many reasons appeared to support this hypothesis: First, the importance of the industry in Chilean economy is very small, far from what we observe for European standards and even for South American countries. In that sense, Ducoing and Badia-Miró (2013) figures contradict Palma (1979) who observed a strong expansion from the World War I to the Great Depression. This supposed expansion is only a recovery from the shortages of the World War to the previous levels achieved in 1913, followed by an expansion during the beginning of 1920s and stagnation during the second half of this decade.

<Figure 3 – about here>

If we consider what was happening with Chilean foreign trade, the reduction in consumer goods imports observed by Palma (1979; 1984) has to be shaded. The sector aggregation he proposed misled some relevant aspects of what really happened during mining cycles. We have considered the dataset provided by Díaz and Wagner (2004) to analyse performance of imports during Nitrate cycle and the second copper cycle with further detail.²⁷ Our objective is to prove the existence of the structural change announced by Palma, among others, before the ISI period.

As we had expected, Figure 4 showed a decline in the share of consumer goods from 1880 to the beginning of the World War I in parallel with a boom in the share of intermediate goods. From then on to the Great Depression we do not observe any variation of any type of product. This is something different from what Palma observed and goes in the opposite direction of the supposed early industrialization. From the Great Depression to 1950 a strong decline in consumer goods is compensated with an increase in intermediate goods. Although the copper cycle has started, the reason behind this change in import structure is related to the deep impact of the Great Depression, the crush of foreign trade, the beginning of industrialization led by the state and the protectionist turn of economy.²⁸ If we observe in detail what was happening, what really drove the decrease of consumer goods was the evolution of food products, the most important item in the non-durable consumer goods category. Other consumer goods as weaves, considered as

included as semi-durable consumer goods. For durable consumer goods, we considered wood and furniture. For intermediate goods, we considered leather and rubber products, chemical products and non-metallic minerals. Last of all, we considered metallic products as capital goods.

²⁷ Díaz and Wagner (2004) provided data for imports for 15 aggregate sectors during the period of 1882-1900 and Díaz and Wagner (2004) also provided homogenized data for 83 sectors of imports during 1911-1966 as a percentage of total imports (see table 3.1-4).

²⁸ For the period of 1882-1900, for consumption goods we considered food, wine and liqueurs, tobacco (non-durable consumer goods), weaves, dress (semi-durable consumer goods), arts and science goods, arms and other (durable consumer goods). For capital goods, we considered machinery, transports and railways. For intermediate goods, we considered raw materials, mining products, drugs, and other chemical products. For the period of 1911-1950, for non-durable consumer goods we considered food industries, beverages, liquors, and manufactured tobaccos. For semi-durable consumer goods, we considered textile industries. For durable consumer goods, we considered transport products. For Capital goods, we considered machines and tools and for intermediate goods, we considered chemical industries and metallurgic industry.

semi-durable consumer goods, remained stagnated around the 20% of total imports. This showed that this decline in consumer goods are only concentrated in manufactured products with a small level of transformation. This result fits the hypothesis, developed in next section, of an early industrialization in northern regions oriented to the production of food and beverages to supply the expansion of demand. At the same time, due to fact that pushed this industrialization, these were based in an expansion of population and the impact of the home market effect, this industry had a weak basis and disappeared when the mining cycle ended.

<Figure 4 – about here>

Thirdly and last, unlike what we have expected, the share of semi-durable goods increased during the 1920s to levels above of what we seen before World War I. This trend compensated the reduction of the share of intermediate inputs and capital goods at the end of the war. In that sense, imports showed a good performance of those manufactured products, which incorporated some degree of transformation. Therefore, those domestic industries that could compete with this type of goods presumably had a bad performance and the whole industry was not able to advance to a higher level of modernization. To confirm that, we followed what Palma stated on his thesis. We calculated a sort of apparent consumption figures for each industrial sector to compute the share of consumption produced domestically. Unlike Palma (1979), we considered estimations for industrial GDP from Ducoing and Badia-Miró (2013) which clearly showed a different pattern during the 1910s and 1920s. Imports and exports from Díaz and Wagner (2004) and we transformed it into \$US in constant prices of 1995, following data provided by Díaz *et al.* (2007). For sectors figures, we only considered 1914-1935 from Muñoz Gomá (1968) because those are more reliable. Due to lack of export data we decided not to consider it, overestimating domestic production.²⁹

Figure 5 showed stagnation in most of the sectors during the 1920s. This fact contradicts what Palma (1979) stated. In fact, his affirmation is based on lower levels of industrial production before World War I and the strong boom after the end of the war. Our figures confirm that levels of domestic production of industrial consumption during the 1920s were so close to the ones observed before the War. Moreover, this pattern is very similar in all categories. Even for intermediate goods and capital goods. It is not until the late 1930s, when we observe a big change in share of domestic production due to the beginning of industrialization leaded by the state.

<Figure 5 – about here>

All the evidence provided in this section support the idea that Chilean industry was not the leading sector during nitrate cycle, and it was not able to transform the country into a modern economy country. In that sense, expansion of demand in some regions and weak linkages of mining activity to other sectors of economy, specifically in the industry, were not enough to push economy to converge with the high-income countries. In that sense, the decline of nitrate cycle and the emergence of copper cycle could not change this pattern.

²⁹ As Carreras-Marín *et al.* (2013) stated, Chilean industrial exports were very small during the whole period, even during the World War I. Palma (1979) figures showed that even for the highest exporting sector, the non-durable goods (food, beverages, tobacco, textile, and footwear), and this value never reached the 5% of total domestic production.

4. Mining linkages and economic performance

Although nitrate production was far more labour-intensive than capital-intensive, the boom in mining production in provinces of the Northern part of the country attracted workers with relatively higher wages concentrated in few places³⁰, both pushed the demand for consumption goods. As Badia-Miró (2008), Badia-Miró and Yáñez (2015) and Cariola and Sunkel (1983) also confirmed, the first response to the boom in purchasing power of the northern population was the import of low quality manufactured goods, which also drove integration for national market. However, as an example of positive linkage of mining, industrial activities appeared, favoured by the distance of suppliers, both domestic and foreign and the advantage of production closer to the consumer. Apart from production of consumer goods for mine-labourers, there was also a need to handle and commercialize nitrate, which gave rise to secondary activities linked to mining and transport. Mechanization of mills and packaging systems, as well as spreading of railways as means of transport, led to a more upbeat pace of industrial activities in the mining zone.

During the period of economic boom based on nitrate exports, Chilean industrial activity was spatially quite disperse due to the legacy of the mid-1800s. Added to this, the effect of dynamism of nitrate provinces and a renewed strength with the zones of Concepción and Valdivia, in the south, helped to activate their industries. We can state that mineral exports pushed industry of some regions.

The end of nitrate cycle changed this tendency. During this period, a change in economic policies, a change from relative liberalism to determined State intervention³¹, coincided with mining cycle of copper, a spatially disperse activity, which was not capable of generating new geographic focal points of industrial activity, as nitrate mining had done before. Copper mining, being far more capital-intensive than labour-intensive, was founded on more advanced technological bases, but it neither generated new population centre to attract industrial activities for consumption by the workforce, nor did it stimulate the appearance of industrial activities associated with mining activity, apart from metal foundries. Consequently, the geographic dynamic of industrialization was subject to political economy of that time.

Natural resource cycles affected Chilean economy, but without impulse or structural change in economy. The export sector was concentrated in minerals, nitrates and copper, and the effect in the long run was limited. In table 4, we can appreciate an important change in copper production, with predominance during the period of bars, a product with more value added than axis and minerals. However, during the same period (1910-1938) we cannot see a real improvement in manufactured share of GDP. Copper industry was an important sector for economy but it lacked linkages, especially in the demand sector.

<Table 4 – about here>

³⁰ Pinto (1994; 1998). Wage figures of industrial workers were at their highest level during nitrate era and fell later on.

³¹ During the 1940s and 1950s a maximum expansion of industry took place in a context of significantly intense GDP growth. The reorientation of economy towards the domestic market and total immersion in State-directed industrialization in a context of policies, encouraged substitution of a major part of importations, once more, it had a great impact on local economy. During this period, a public organism embodied the State's active stance: '*Corporación de Fomento de la Producción*'. This organism became one main economic agent, not only regarding industry, but it also played a decisive role in development of energy sector, modernization of mining and promotion of agriculture.

To confirm this assumption, we state that the boom of bar production, transforming 50% more tons than axis and 80% than minerals, did not push the rest of the economy nor did it impulse machinery production (Ducoing 2012). At the same time, it had no impact on the demand due to fact that it was an extremely concentrated activity (Badia-Miró and Yáñez 2015).

5. Conclusion

Natural resources played an important role in the Chilean economy, mostly nitrates, and copper has been drove most of booming mining cycles until the end of the 19th century. Nevertheless, its economy was unable to overcome his backwardness and remained as a middle-income country strongly depended in commodities exports. This chapter shed some light to this discussion focusing on the analysis of industrial performance from the end of the 19th century up to 1950 and their linkages with mining cycles. In that sense, we confirm the existence of less dynamism in industrial performance, according with Ducoing and Badia-Miró (2013) figures. We are not stating that there was no industrialization during this period; but that the performance of the mining sector was intensive enough to pull the industry and, as a result, the whole economy. This hypothesis is also confirmed by stagnation of domestic production in most industrial subsectors (both durable and non-durable goods) until the Great Depression.

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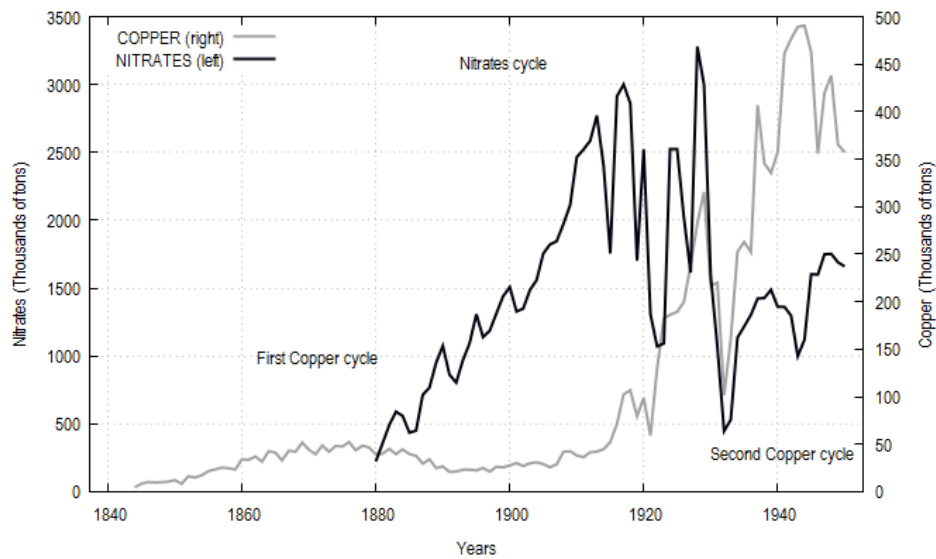
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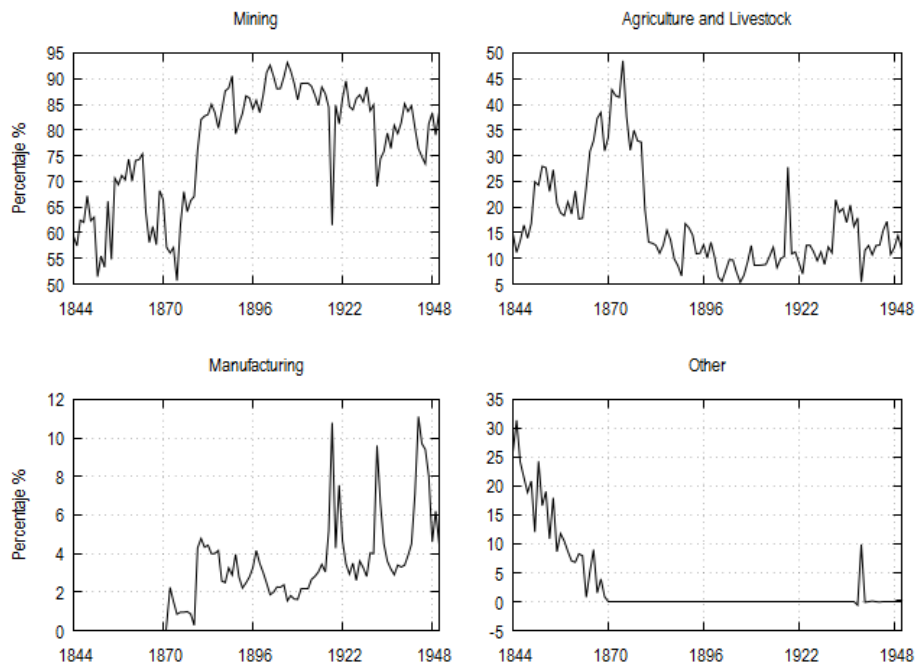
Tables and figures

Figure 1 - Copper and Nitrates cycles. Production (Thousands of tons). 1850 -1950



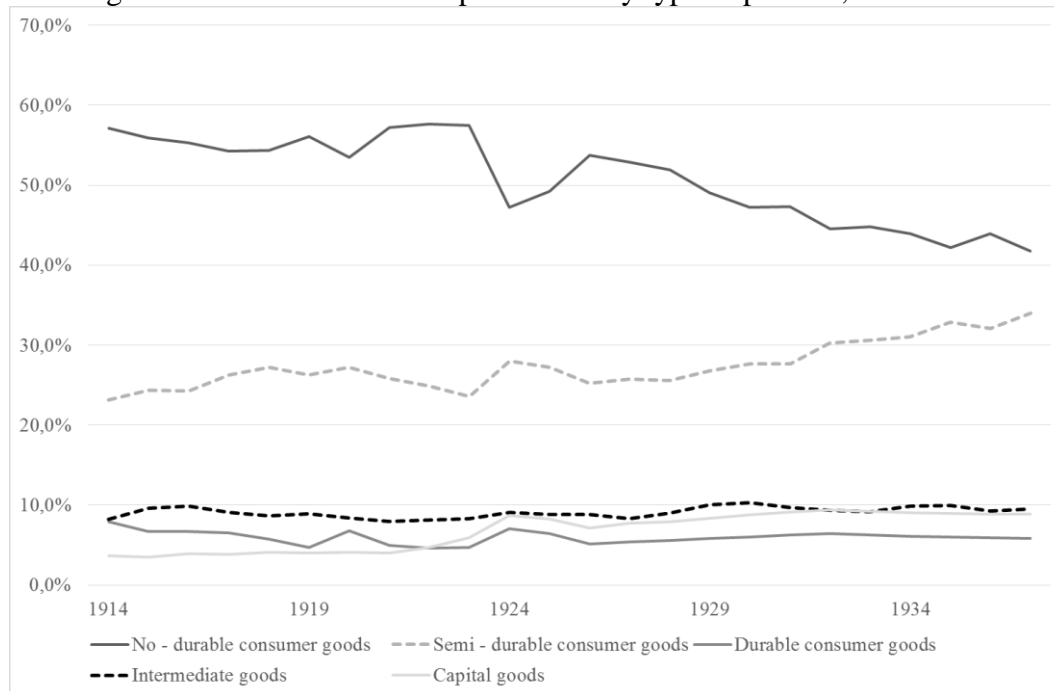
Sources: Statistical Yearbook of Chile. Several years 1844-1950

Figure 2 - Share of Chilean exports by sector, 1844-1950



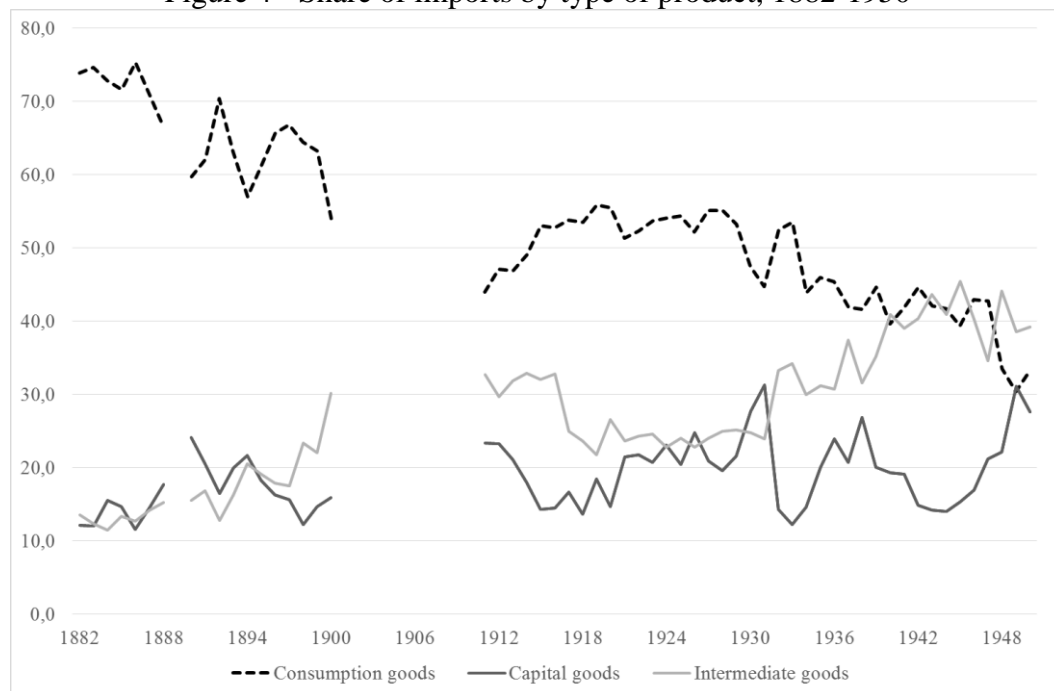
Source: Statistical Yearbook of Chile, several years.

Figure 3 - Share of industrial production by type of product, 1914-1937



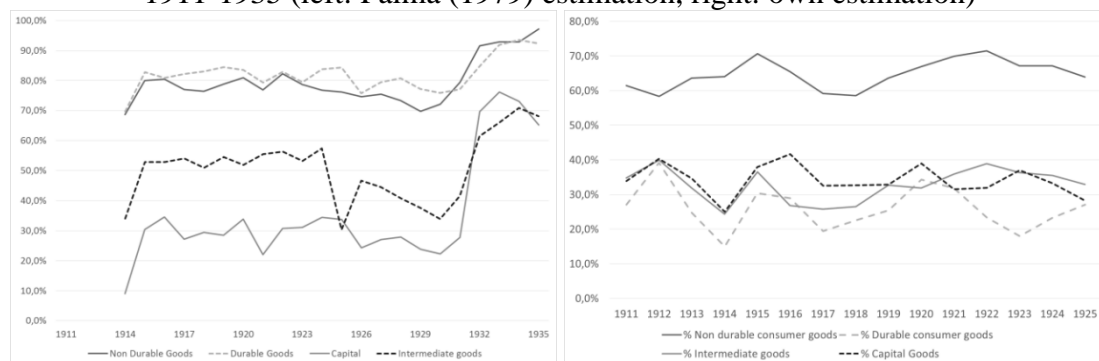
Source: Muñoz Gomá (1968) corrected by the levels of Ducoing and Badia-Miró (2013)

Figure 4 - Share of imports by type of product, 1882-1950



Source: Díaz and Wagner (2004)

Figure 5 - Share of domestic production over total consumption by type of product 1911-1935 (left: Palma (1979) estimation, right: own estimation)



Source: Palma (1979) and an own elaboration based in Muñoz Gomá (1968), Ducoing and Badia-Miró (2013) and Díaz and Wagner (2004)

Table 1 - Copper Production in thousands of tons (Average)

Years	Yield
1870 - 1879	32.457.257
1880 - 1889	32.201.950
1890 - 1899	20.582.527
1900 - 1909	30.558.578
1910 - 1919	62.031.820
1920 - 1929	181.376.087

Source: Statistical Yearbook of Chile, several years and (Sociedad Nacional Minera 1903)

Table 2 - Nitrate production and labour productivity 1880 – 1902

Year	Nitrate production	Workers	Labour productivity	Year	Nitrate production	Workers	Labour productivity
1880	2.239.740	2.848	786,4	1892	8.039.880	13.510	595,1
1881	3.557.180	4.906	725,1	1893	9.686.027	14.756	656,4
1882	4.922.460	7.124	691	1894	10.938.024	18.092	604,6
1883	5.897.200	7.077	833,3	1895	13.077.060	22.485	581,6
1884	5.589.000	5.505	1.015,30	1896	11.389.189	19.345	588,7
1885	4.359.880	4.574	953,2	1897	11.867.302	16.727	709,5
1886	4.510.300	4.534	994,8	1898	13.143.554	15.955	823,8
1887	7.127.000	7.201	989,7	1899	14.403.915	19.914	723,3
1888	7.637.720	9.180	832	1900	15.077.880	19.672	766,5
1889	9.513.720	11.422	832,9	1901	13.286.640	20.264	655,7
1890	10.751.580	13.060	823,2	1902	13.493.000	24.583	548,9
1891	8.619.940	11.657	739,5				

Source: Informe de la Minería de 1903. Sociedad Nacional de Minería, 1905.

Table 3 - Evolution of industry and the GDP in Chile, 1880 – 1938

	1880-1913	1885-1913	1913-1929	1929-1938	(1)
Industrial GDP	3,8%	4,1%	1,7%	2,8%	1923
GDP	3,2%	3,3%	2,2%	0,7%	1923
	1880	1885	1913	1929	1938
Industry as a Share of Total GDP	8,4%	8,7%	10,5%	9,8%	11,8%

Source: (Ducoing and Badia-Miró 2013).

Table 4 - Copper production by kind. Selected years

	Bars			Axis			Minerals			Total	
	Tons	Ore	Fine Copper (tons)	Tons	Ore	Fine Copper (tons)	Tons	Ore	Fine Copper (tons)	Fine Copper (tons)	% raw over total
1899	17.401	100,0%	17.401	2.930	50,0%	1.465	36.109	19,0%	6.850	25.719	26,6%
1913	20.150	98,9%	19.937	18.510	47,2%	8.737	72.537	18,7%	13.586	42.000	32,3%
1929	303.188	99,8%	302.521				121.213	14,9%	18.121	321.000	5,6%
1938	338.294	99,8%	337.516	24	56,5%	13	100.371	13,9%	13.932	352.000	4,0%

Source: Statistical abstracts various years.