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Essays on the world wheat economy (1939-2010)

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PhD Dissertation

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Introduction

This thesis is concerned with the world wheat economy between 1939 and 2010, which may seem somewhat surprising for several reasons. First, the history of wheat is inextricably tied up with the evolution of world agriculture and, as is well-known, the relative importance of agriculture has declined significantly as a consequence of structural change. Second, we are particularly interested in studying the evolution of the international wheat trade, yet it is also well-known that there has been a substantial fall in the share of traditional bulk products, such as wheat, in the international agricultural and food trade over this period (Serrano and Pinilla, 2009). Finally, it is well-documented that, regardless of location, there seems to be a "trading-up" consumption-adjustment pattern as consumers increase their income levels. This means that consumers all over the world tend to substitute high-value animal-protein-rich meat and dairy products for carbohydrate-rich grains such as wheat (Fabiosa, 2011). Thus, it may seem untimely to write a thesis on something that, one may think, has become less important over time (and presumably will become even more insignificant in the future). There are, however, powerful reasons that justify the relevance of a thorough study of the world wheat economy.

The so-called 'king of grains' has a number of features that make its study important in developing a political history of food. It is not by chance that wheat has long been a staple grain in many parts of the world. Of all the grains, only rice has superior nutritive value. Hence, growing wheat for direct human consumption purposes is a very efficient way of producing calories, at least in terms of output per acreage. Despite the previously mentioned 'trading-up' consumption pattern, wheat has never ceased to be a central part of the diet in many countries, nor has it stopped being a crucial aspect of international relations. Almost half the calories consumed globally today derive directly from grain, and of this, about a quarter comes from wheat. In some parts of the world, wheat has long been even more significant than the global averages suggest, and its production and distribution is a central concern of political economy. We know a good deal about this history, up to and including the Second World War, a good example being Malenbaum's comprehensive study covering the period 1885-1939 (Malembaum, 1953). Although much less visible in the post-war years, the scale of wheat production, its efficiency, and its sites of consumption were transformed at historically unprecedented rates. Wheat is grown in an area larger than any other crop, and is a staple in many parts of the world. Due largely to certain of its physical characteristics, wheat is – and has always been –the most-traded grain. Thanks to international trade, wheat is widely consumed in places where its production is virtually

impossible, thus making the functioning of wheat markets unique in their importance for world food security. This helps to explain why agricultural policy – and especially commercial policy – has always paid special attention to 'the king of grains'. Yet, when it comes to the design of national policies, the importance of wheat is not limited to food-security concerns. Due to the predominant role of wheat within total agriculture, wheat policies – both in industrialized and developing countries – have usually been intended to pursue a range of different goals, varying from attaining food security (or self-sufficiency) to solving balance of payment problems or assuring farmer's incomes. Wheat policies have been an extremely delicate matter of dispute both within and between countries, and they are still a major source of controversy in the ongoing and never-ending debate on how to reconcile national development strategies with trade liberalization. Recent developments in food markets, such as price spikes, massive land acquisitions in developing countries, and food riots, have contributed to put wheat back in the public eye. It is our aim to shed light on the history of wheat production, consumption, and trade – paying special attention to national policies and their interactions with the international configuration of trade, so we can better understand the major challenges that the world wheat economy is facing today.

The thesis is composed of this introduction, three independent – although deeply interrelated – chapters, and a final summary section. The first chapter explores the major changes experienced in the world wheat market between 1939 and 2010. It looks at the evolution of wheat imports and exports in various groups of countries, identifies major trends, and offers a detailed explanation for those trends. The construction of a theoretical model serves as a vehicle for structuring the discussion: the wheat trade may be explained by looking at the supply and demand trends within those groups of countries, and particular consideration is given to institutional changes. The outlook for the world wheat economy immediately before the Second World War was decidedly gloomy. Trade and prices plummeted during the 1930s and a large number of interventionist measures were undertaken worldwide in order to deal with the so-called "wheat problem". However, the wheat trade today is almost ten times greater than it was in the immediate postwar years and the signs of market disintegration have disappeared. The aim of this chapter is twofold: first, it analyses the reasons behind the extraordinary expansion of the world wheat trade between 1939 and 2010, and second, it explores the main changes in the di6gstribution of wheat exchanges and offers an explanation of those transformations.

Major patterns of change in wheat production and consumption in different groups of countries are identified, taking into account such institutional variables as national agricultural policies and their impact on wheat prices, the effect of international agreements, the influence of the international context, and the increasing influence of trading companies.

The second chapter is specifically focused on one of the major trends in wheat trade identified in Chapter 1: the increasing concentration of wheat imports in a selected group of developing countries in which wheat consumption prior to World War II was virtually negligible. The growing wheat dependence of low-income countries has often been considered as problematic or even 'non-desirable' – as far as food security and economic development strategies are concerned – and it is for this reason that we opted to follow a 'food regime' approach. Food regime analysis is concerned with interpreting possibilities and conflicts inherent to the twenty-first century food system in historical terms. This chapter summarizes the theoretical discussion of the food regime method, and of the identification of different 'food regime periods' throughout modern history. While it is widely accepted that the so-called 'second food regime' has already ended, there is much discussion on whether, or not, it is possible to talk about a more recent, third food regime. This Chapter traces the evolution of the 'wheat complex' over the 'second food regime' (1947- 1973) and over the next 45 years, and offers an explanation for the evolution of world wheat trade distribution, based on food regime analysis. Certain authors have claimed that the collapse of the WTO Doha round of negotiations may be understood as a 'hangover' from the second food regime. Similarly, this Chapter argues that the increasing wheat dependence of poor and insecure countries over the last 40 years may be considered as a path-dependence outcome of a process initiated during the second food regime.

Chapter 3 is also concerned with identifying the main drivers of the changing patterns in the composition of the world wheat trade. However, rather than analyzing aggregate wheat trade flows, it focuses on the bilateral structure of trade (from 1963 onwards). The estimation of several 'gravity' models serves to test the importance of variables such as distance, cultural proximity, and income growth. In contrast with Chapter 2, this is more focused on the 'economic' determinants of trade, and therefore pays less attention to the institutional framework in which the wheat trade occurs. However, an effort has been made to test the effect of regional trade agreements, and also

that of the inclusion of the wheat trade under the World Trade Organization (WTO) agenda. The results are discussed and interpreted following a cliometric approach that takes into account the major findings of chapters 1 and 2.

This thesis builds on prior research carried out by scholars from many disciplines in multiple places and epochs. The following pages are primarily concerned with wheat, yet they draw heavily on contributions on the evolution of the agricultural sector throughout the 20th Century, on the nature and trends of aggregate international trade, and on the political economy of trade policies. First, de Hevesy (1940) and Malembaum (1953) constitute two essential references in order to understand the functioning of wheat markets over the interwar period. Our conceptualization of the so-called 'wheat problem' is based on their work, and also on the relevant contributions regarding the pre-war agricultural sector made by other scholars, such as Tracy (1964). The wheat problem is framed in a much broader issue, namely the 'farm-adjustment problem' or 'farm-income problem', which authors such as Schultz (1945), Yates (1960) and Heady (1966) have cultivated extensively. In this thesis, the international wheat trade between 1939 and 2010 will be explained by looking at both supply and demand trends at the national level. With regard to the supply side, Federico (2005) has been a valuable source of knowledge in order to understand and situate the progress of the wheat sector within the general trends in world agriculture. For the demand side, Fabiosa (2011) provides us with a major synthesis of the evolution of world food consumption patterns. Chief works on world trade during the 20th Century – such as Serrano and Pinilla (2010) – have allowed us to frame the wheat trade within a broader context. There is also a limited number of works that are specifically focused on the world wheat economy over the second half of the 20th Century. These works have been an important source of inspiration for writing this thesis, and include those of Schmitz and Bwrden (1973), Antle and Smith (1999), and Mitchell and Mielke (2005). Methodologically, some parts of this thesis – Chapter 3 in particular – are indebted to Timbergen (1962), Anderson (1979), and Krugman (1979, 1980), and to those who are responsible for the most recent developments in the gravity equation approach (Anderson and van Wincoop, 2003, 2004; Santos Silva and Tenreyro, 2006). Finally, it is undeniable that the evolution of wheat production, consumption, and trade over the studied period has had much to do with government policies, both at the national and the international level. In this sense, our thesis has been inspired by a large body of literature on commercial policy. Although certain wide-ranging works on the

determinants of commercial policy have not been directly incorporated into this thesis, we have tried to use the 'political economy lens' (Rodrik, 2005) as often as possible when discussing the evolution of trade policies. In this regard, some specific works have been particularly inspiring. First, it is argued that the 1947 signing of the General Agreement on Tariffs and Trade (GATT) – and its peculiar design – had a tremendous impact on the organization of the world agricultural trade after World War II (WWII), and hence on the postwar international restructuring of wheat trade. In this regard, we must acknowledge that the seminal works by Johnson (1987) and Hathaway (1987) have provided the basis for our analysis. Second, we are deeply indebted to those authors who developed the 'food regime' approach. Building from the French Regulation School (Aglietta, 1979) and from world-systems theory (Wallerstein, 1974), the pioneering works of Friedmann (1987) and Friedmann and McMichael (1989) settled the ground for the analysis of wheat markets that is seen in Chapter 2. Another substantial source of inspiration regarding the interpretation of U.S. agricultural policy within the broad food-regime perspective has been Winders (2009). Third, following the crucial work of Krueger, Schiff and Valdés (1988), there is a whole body of literature concerned with the empirical evidence of the political economy of public policies. Within this field of knowledge, the contribution of Anderson, Rausser and Swinnen (2013) has been crucial to understanding the ways in which state policies have distorted agricultural incentives from the 1950s onwards. Finally, there are a number of works specifically focused on international wheat agreements and policies. These contributions have been profoundly informative when tracing major institutional changes in the world wheat market, some examples being Farnsworth (1956), Callear and Blandford (1981), and Ali (1982).

Although no primary data collection has been done in order to construct this thesis – none of the papers make use of any particularly new or unique dataset – a great number of data sources have been used in order to build two different databases. The first database has been extensively utilized in chapters 1 and 2, and provides information on wheat production, consumption, and trade at the national level from 1939 to 2010. A thorough process of data-merging and editing resulted in a panel covering 71 years and 134 countries (roughly 10,000 observations) which contains not only information on wheat supply, demand, and trade, but also a significant number of indicators concerning variables such as wheat end-uses, area harvested, population, and country income. This database was primarily constructed with data from FAO (2016), FAO Production and

Trade Yearbooks (1948-1961) and Institut International d'Agriculture (1947), although data from Mitchell (2013), United Nations (2013) and World Bank (2016) was also incorporated. The second dataset has been used in Chapter 3 and provides information on bilateral wheat trade flows between 1963 and 2010. In this case, the data on bilateral exchanges from UN-COMTRADE (2016) was merged with the CEPII 'gravity set' (Head, Mayer and Ries, 2010) and other data sources, such as de Sousa (2012). This exercise resulted in a non-balanced panel with 111 importers, 61 exporters, and 199,980 observations. Most of our empirical claims and findings are based on the evidence that these two databases contain, although other data sources have also been utilized throughout the thesis, two examples being Anderson and Valenzuela (2008) and Anderson and Nelgen (2012).

It must be acknowledged that this thesis has benefited from a large number of comments and suggestions made by other scholars at diverse academic forums. The first chapter significantly exceeds the standard extension limits that are usually required for publication in specialized academic journals, and it is mainly for this reason that the paper has not yet been submitted to any Economic History publication. However, this does not imply that this work has not received extensive academic feedback from a wide number of specialists. Two very preliminary versions of this chapter were discussed in 2013 at the *10th International Conference: Developments in Economic Theory and Policy* (Bilbao, Spain) and at the *VIII European Historical Economic Society Summer School* (Madrid, Spain). The main idea of this section was also presented to colleagues of the Spanish Economic History Association (AEHE) at the *XI International Congress of the AEHE 2014* (Madrid, Spain). An extended version was discussed in an international conference held in Rome, titled *Gérer la pénurie, gouverner l'abondance: dynamiques du stockage et de l'approvisionnement dans le secteur agroalimentaire, XVIII-XX siécles* (Rome, Italy). Finally, a much more comprehensive version of this work was presented at the *IV Annual SEHA* Meeting 2016 (Madrid, Spain). The second paper has already been accepted for publication in the *Journal of Agrarian Change*. The version presented here corresponds to the final version, which is scheduled to be published by the end of this year. This means that this Chapter has benefited enormously from all the observations and remarks made by the anonymous reviewers of the journal. Two preliminary versions of this paper were also presented at the *Rural History Conference 2015* (Girona, Spain) and at the *VI AEHE Meeting 2016* (Sevilla, Spain). The third Chapter will soon be sent

for consideration to an international journal. Again, a previous version of this paper was presented at *Agricliometrics III 2017* (Cambridge, UK), where it received a substantial number of comments and suggestions that significantly improved its consistency. The current version of this paper will also be discussed at the *UC3M Inter-University PhD Workshop in Economic History* (Madrid, Spain).

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Chapter 1. The world wheat economy, 1939-2010

1. 1 Introduction

Wheat has always been the most-traded staple food. Unlike other commodities such as rice, wheat possesses a number of physical characteristics that facilitate its shipping and storage: it does not break easily and it can be preserved indefinitely as long as it is kept away from humidity and rodents (Maurette, 1922). It is grown in an area larger than any other crop, and has long been a staple in many parts of the world. Growing wheat for direct human consumption is a relatively efficient way of producing calories, at least in terms of output per area harvested. That is probably the reason why historical cases of shifts towards wheat can be found particularly in times of war, when nutritional returns are a high priority. Germany during the First World War (Offer, 1989) and Great Britain during World War II (Collingham, 2011; Egerer, 1965), among others, are good examples. The wheat market is unique in its importance for world food security, and dependence on international grain markets has been the strongest in the case of wheat (Tuomi, 1978). It has also been the major component of food aid and the most important traded food for low income countries (Callear and Blandford, 1981). Due to its key role in international relations in the Cold War period, some authors have claimed that wheat became "one of the foundations of the post-war American empire" (McMahon, 1979, 30). Wheat has also been an essential element in major technological change in agricultural methods and plant breeding (Perkins, 1997), and has been a primary factor in the so-called Green Revolution.

1.1.1 The wheat problem prior to World War II

World wheat markets experienced serious trouble in the thirties. Total wheat trade fell by almost one third between 1925-29 and 1935-38[1] and wheat prices also plummeted during that period. According to Grilli and Yang (1988), wheat prices fell by roughly two thirds between 1925 and 1939, reaching its lowest level in 1932, a collapse in prices that was largely caused by the growth of worldwide supply in excess of demand (Aparicio and Pinilla, 2015; Malembaum, 1953). Wheat production overseas was strongly encouraged by the demand for wheat from the belligerents of the First World War (Marchildon, 2010), and it proved too difficult for overseas countries to reduce their wheat acreage once the European agricultural systems had recovered. The increase in

[1] Estimation based on data from the International Agricultural Statistics of the International Institute of Agriculture; see Aparicio and Pinilla (2015).

world wheat production was not only the result of a large increase in total acreage, but also the consequence of an improvement in yields per hectare, due to technological innovation. Meanwhile, world wheat consumption remained stagnant or even fell slightly due to slow demographic growth in Europe and a tendency towards a greater variety in the diet of the industrialized countries. Eager to dispose of their surplus wheat, exporting countries threw it on the market at almost any price (de Hevesy, 1940: 3) and interventionist measures were widely undertaken in order to protect farmers from low prices.

Widespread protectionism was followed by a spectacular shrinking of the world wheat trade. Plummeting income, balance of payment crises, shortages of payment methods, and the dismemberment of the traditional channels of trade that occurred during the Great Depression help to explain the collapse in world wheat markets. Yet the principal culprit is to be found in the particular features of wheat trade and in the protectionist measures implemented to deal with the so-called "wheat problem" (de Hevesy, 1940). The largest importers (Germany, France, Italy) strengthened their interventionist measures from 1932 onwards, resulting in an increasing degree of self-sufficiency. Free trade advocates, such as Great Britain and Denmark, also resorted to protectionism to achieve higher levels of national wheat production, and exporting countries soon relied on trade-distortive policies in order to give their wheat a competitive edge in world markets. A number of international conferences were held between 1930 and 1933 and the first International Wheat Agreement was signed in 1933, in an attempt to deal with the problem of overproduction. However, none of those arrangements led to any significant improvement in the world wheat situation (Malembaum, 1953: 199). On the international level, the problem was erroneously addressed as one of low prices rather than one of excess production and the countries whose export revenues depended heavily on wheat – Canada, Australia, Argentina – proved extremely reluctant to diminish their wheat production and exports; in fact, they increased their wheat exports to compensate for the falling prices. On the national level, protection schemes encouraged the downward trend of wheat prices: "subsidized farming fosters excess production, excess production necessitates subsidized exports, and subsidized exports must always exert a depressing effect on the world price, which, in its turn, is detrimental to the farming interests" (de Hevesy, 1940, 12).

Importantly, excess wheat supplies in exporting countries coexisted with another implacable reality: the unfulfilled needs of millions of hungry people in many parts of the world. However, a transfer of wheat surpluses "would have involved a basic shift in the pattern of consumption in the underdeveloped areas" (Malembaum, 1953: 213). Malembaum argued that wheat surpluses reflected economic overproduction rather than underconsumption, on the grounds that there was no real demand for wheat from the undernourished areas that the market itself did not fill. Yet it was clear to everyone that there was a fundamental imbalance in wheat markets, and that "it might seem untimely to talk of surpluses when shortages were lasting so long, and paradoxical to call them surpluses when hundreds of people still lacked many of the basic necessities of life" (FAO, 1947: 10)[2]. The view of the Food and Agriculture Organization after the War was that there might be institutional and income barriers preventing people around the world who wanted to buy wheat from getting it (FAO, 1947). The reality of surpluses alongside needs soon became apparent and stood as the cornerstone of the postwar international wheat organization.

1.1.2 Aim and structure

The aim of the paper is to ascertain the main drivers of world wheat trade between 1939 and 2010. We explore the most significant changes in the geographical distribution of wheat production and consumption over the last 70 years, identifying the major economic and institutional forces behind the prolonged expansion of world wheat trade that followed the collapse of the 1930s. For that purpose, the paper is structured as follows. Section 1.2 offers a descriptive analysis of wheat trade flows. This depiction of trade is based on two different ways of aggregating countries: (1) the continental approach, which may be more useful in order to frame trade flows geographically, and (2) the grouping of countries according to Malembaum's categorization for the interwar period (Malembaum, 1953), which may be more convenient in order to illustrate the changes with respect to the pre-war situation. In Section 1.3, we develop a theoretical model that puts together the main variables affecting world wheat trade and briefly discusses the complex interactions between them. Section 1.4 is concerned with the

[2] The Food and Agriculture Organization (FAO) provides a definition of "surplus": "supplies of food and agricultural commodities for which no effective demand exists at current price levels on the basis of payment in the currency of the producing country" (Marchisio and Di Blase, 1991: 26). In this regard, the FAO stated that "surpluses when they emerge are 'local' and 'temporary' in the sense that they cannot readily be sold in a particular place or at a particular time" (FAO, 1947:10).

explanation of the trade flows depicted in Section 1.2. Inspired by the theoretical model, it separately discusses the supply side (1.4.1; trends in area harvested and yields, major technology changes, national agricultural policies…) and the demand side (1.4.2; changes in overall consumer preferences and diets, demography, market promotion…). Section 1.4.3 puts together the supply and the demand side by offering an integrated view of the major institutional developments that have affected wheat trade over the studied period: food aid schemes, international wheat agreements, price behavior and regulations… The concluding section summarizes our major findings.

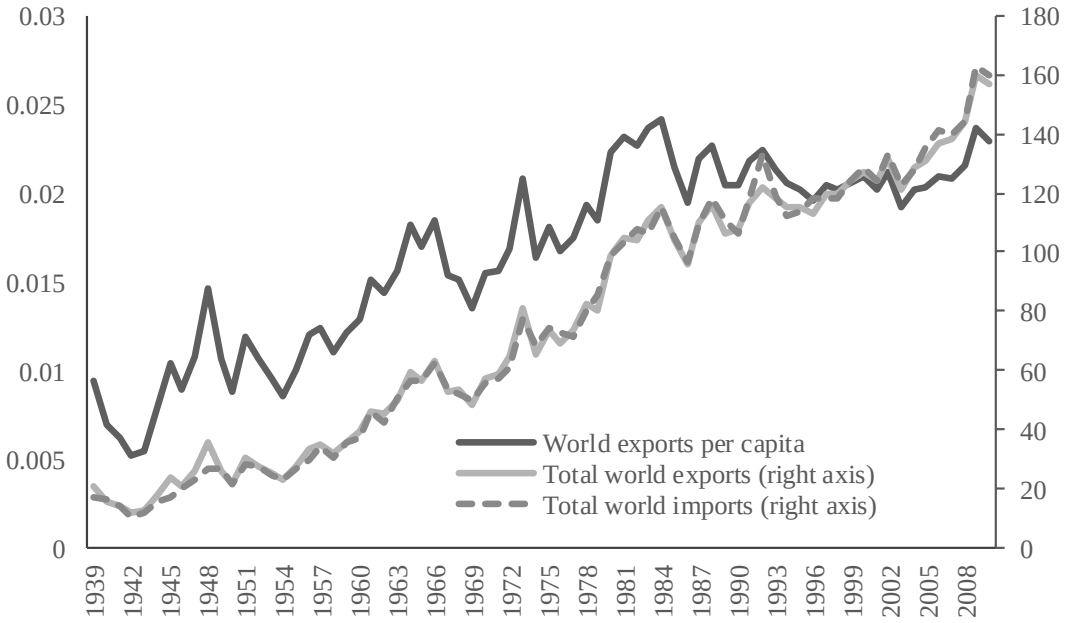
1.2 Wheat trade flows

1.2.1 Total world wheat trade

Total wheat trade has increased tenfold since the end of World War II and, in per capita terms, wheat trade today is roughly 3 times what it was in 1945 (figure 1.1). In addition, wheat exchanges have grown more than wheat production over this period: while wheat trade today accounts for more than 20% of total production[3], wheat exchanges represented approximately 15% of production in the postwar years (figure 1.2). Of course, the spectacular growth of international wheat markets must be put into context, because other agricultural and industrial areas have grown even more significantly. A new international economic order arose after 1945, providing a stable environment in which unprecedented rates of economic growth were attained (Serrano and Pinilla, 2010). Although trade in foodstuffs expanded less rapidly than trade in industrial products, its growth was greater than that of production. According to Serrano and Pinilla (2010), the main reason behind this extraordinary expansion was income growth, while "exchange rate stability and the real price of agricultural products played only a minor role" (Serrano and Pinilla, 2010: 3503). The case of wheat is particularly interesting due to its problematic situation before the War. The expansion of wheat trade over the period studied suggests that a way out of the so-called "wheat problem" was found after the War, and it is the purpose of this paper to shed light on that process.

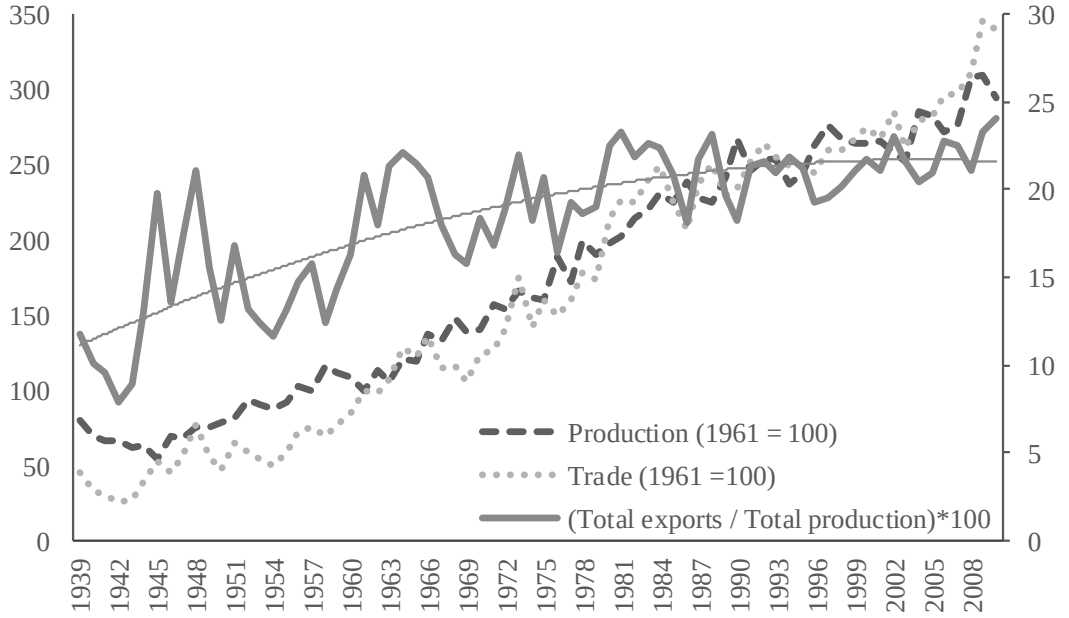
[3] According to FAO (2016), today more than one third of soybeans production (35%) is traded internationally. Other commodities are also much more traded than wheat in relation to its production; for instance, tea (50%) or kiwi (90%). Yet wheat is the most traded staple food, since only 13% of grain production is traded on average. Some examples of cereals are barley (20%), corn (15%) and rice (5%).

Figure 1.1 World wheat trade (tonnes) and world wheat trade per capita (tonnes/population), 1939-2010



Source: author's elaboration from FAO (2016), FAO Production and Trade Yearbooks (1948-61) and Institut International d'Agriculture (1947)

Figure 1.2 World wheat production and trade, 1939-2010 (1961=100)



Source: author's elaboration from FAO (2016), FAO Production and Trade Yearbooks (1948-61) and Institut International d'Agriculture (1947)

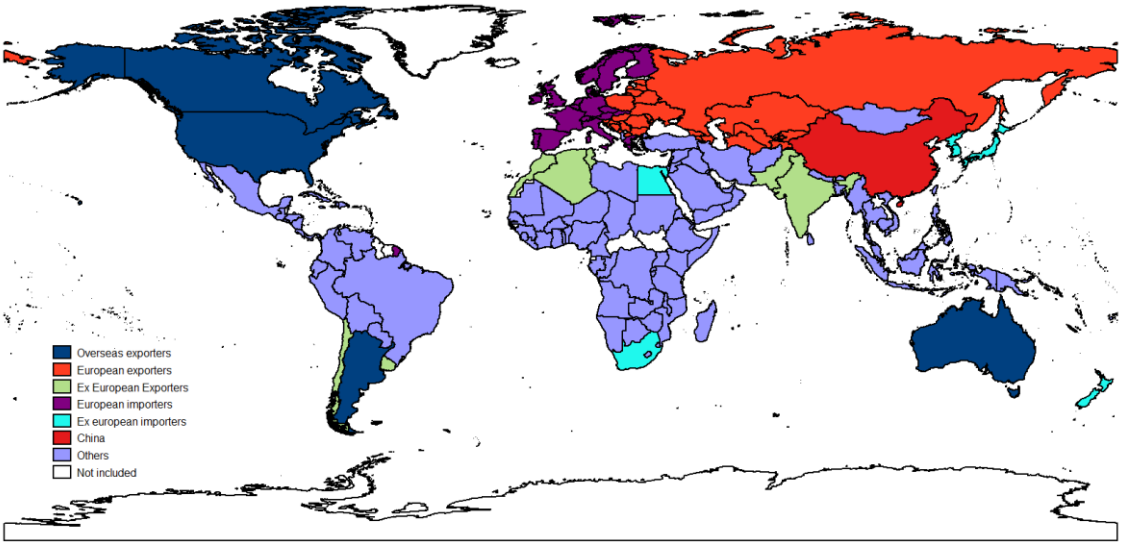
1.2.2 Main spatial trends

Growth in wheat trade has not been distributed equally. There was indeed a more intense growth between 1950 and 1980, and in per capita terms, growth stopped in 1980. The map of wheat exporters and importers has also changed significantly over this period, and new important actors have made their appearance.

1.2.2.1 Classification of countries

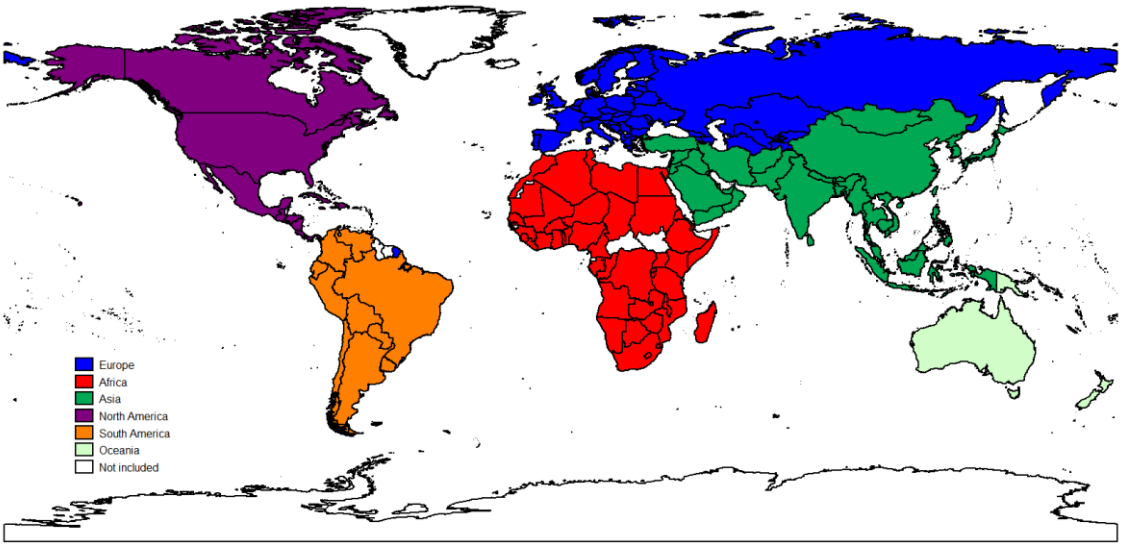
Wheat-producing countries in the interwar period were grouped by Malembaum (1953) according to their usual position in the net balance of international wheat shipments. This author distinguished between the *overseas exporters* (USA, Australia, Argentina, and Canada, accounting for roughly 80 per cent of all net exports of wheat), the *European exporters* (USSR, Bulgaria, Hungary, Romania, Yugoslavia, Poland), the *ex-European exporters* (India, Algeria, Morocco, Tunis, Chile, Uruguay), the *European importers* (British Isles, France, Germany, Italy, Spain, Austria, Belgium, Czechoslovakia, Finland, Denmark, Greece, Ireland, Netherlands, Norway, Sweden and Switzerland, accounting for roughly 70% of all world imports), and the *ex-European importers* (Japan, Korea, South Africa, Egypt, New Zealand). Due to the lack of reliable data, China and Manchuria – by far the more significant countries in the remaining twenty percent – were not included in his analysis. Our study will make use of Malembaum's taxonomy to analyze major trends in world wheat production, consumption and trade after WWII. However, our classification will include China separately – due to its special relevance – and will also include an additional group of 94 countries that were not incorporated in Malembaum's work (see figure 1.3). Applying this categorization to the study of wheat markets in the post-war years will allow us to illustrate major changes with respect to the prewar situation. In addition, we will complement our study with a standard inter-continental analysis (classification of countries by continent may be seen in figure 1.4).

Figure 1.3 Malembaum's classification of countries for the interwar period



Source: author's elaboration from Malembaum (1953)

Figure 1.4 Classification of countries according to continent



Source: author's elaboration

1.2.2.2 Wheat in World War II

The pre-war years were characterized by excess wheat supplies in the major producing countries, but also by unfilled nutritional needs in many areas of the world. In fact, the fundamental imbalance in world wheat markets coexisted with a general concern that, on a global scale, the output of food grains could not keep pace with world population growth. It has been pointed out that many political decisions during the War were inspired by that kind of Malthusian fear (Collingham, 2011). For instance, food

played a crucial role in driving both Germany and Japan into conflict, since both countries were afraid that their agricultural systems would not be able to produce enough food to feed the cities (Collingham, 2011). Yet, it was the War itself that caused 20 million deaths directly attributable to starvation, malnutrition, and its associated diseases.

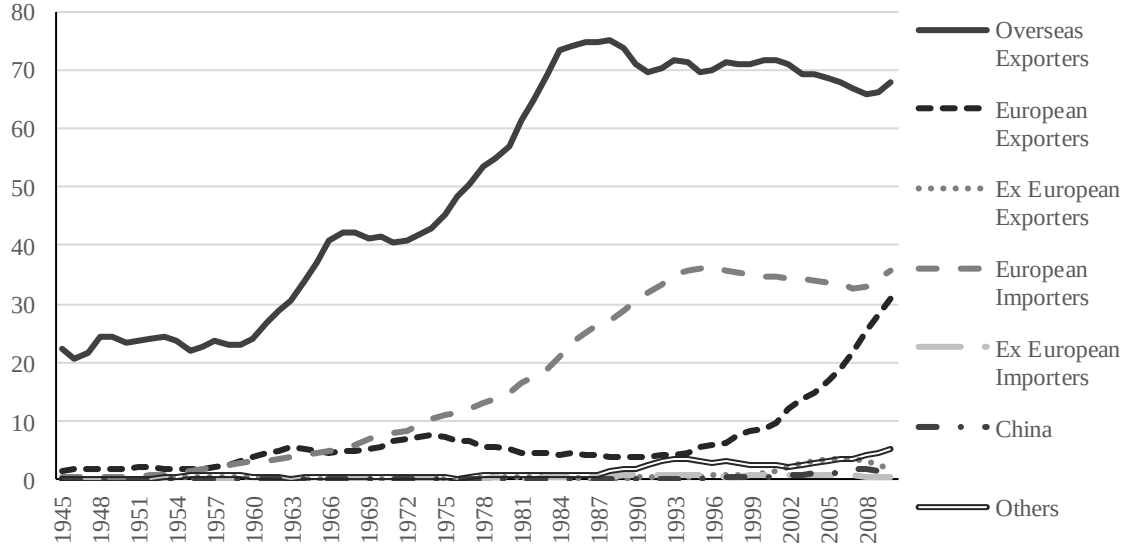
As regards the wheat market, to a certain extent the War contributed to alleviate the problem of surpluses in exporting countries. Global wheat production dropped significantly in the war years because the agricultural systems of chief producing countries such as the USSR were devastated by the military conflict. Moreover, the new activities associated with the War (i.e. fighting in the army or working in the war industries) necessitated higher caloric intakes, and this pushed up global wheat demand. However, the total wheat trade did not rise but dropped significantly over the war period. In terms of tonnage, wheat continued to be the most extensively-traded commodity in the war – as it had been in pre-war years – but warfare threw the global food trade into disarray, and for many countries wheat imports disappeared or were dramatically reduced. European imports of wheat fell by more than half between 1939 and 1944, and Eastern European exports fell in proportion (Brassley, 2012). The Allied Governments "had to switch quickly from the Depression mentality of trying to persuade farmers to grow less in order to reduce food surpluses, to encouraging farmers to cultivate every inch of their land and to grow crops with the highest ratio of nutritional return for the effort expended" (Collingham, 2011: 66). For instance, Britain promoted the growth of wheat as a way of saving shipping space and substituting bulky imports with home production (Edgerton, 2012). France also reduced the amount of wheat it bought from the United States in an attempt to husband its dollar resources. While exceptional countries, such as Spain and Portugal, managed to maintain wheat imports at or above peacetime levels, the level of imports of other crucial European countries, such as Germany and Italy dropped significantly. The traditional Eastern European exporters – Bulgaria, Hungary, Romania – initially managed to increase their wheat exports, "but by 1940 they were falling and from 1942 onwards they were at only one-tenth their pre-war level" (Brassley, 2012, 38). The main problem that the War meant for America was that it caused it to lose a large chunk of its export markets. The United States Department of Agriculture (USDA) warned that they would be burdened with yet more unwanted food unless some way of selling food abroad was found (Collingham, 2011).

1.2.2.3 Trade flows: 1945-2010

In the immediate postwar years, North America alone accounted for roughly 80% of total word wheat exports (figure 1.5). In fact, there were no significant exporters other than the United States, Canada, Australia, and Argentina, which together accounted for more than 90% of total exports. The amount of wheat exported by the group of *Overseas Exporters* grew at historically unprecedented rates over the period 1945-1980 and then leveled off. Although this growth was very impressive, even in per capita terms, the importance of the *Overseas Exporters* in total wheat trade gradually diminished as European exports soared. The upward trend in European wheat exports began in the mid-1950s and continued for the next 60 years. Some countries belonging to the group of the traditional *European Importers* soon became crucial exporters – France being by far the most significant among them – and many former USSR republics also emerged as significant exporters in the 1990s. Figure 1.5 also illustrates other important facts in wheat export trends, such as the increasing per capita exports from Oceania over the whole period.

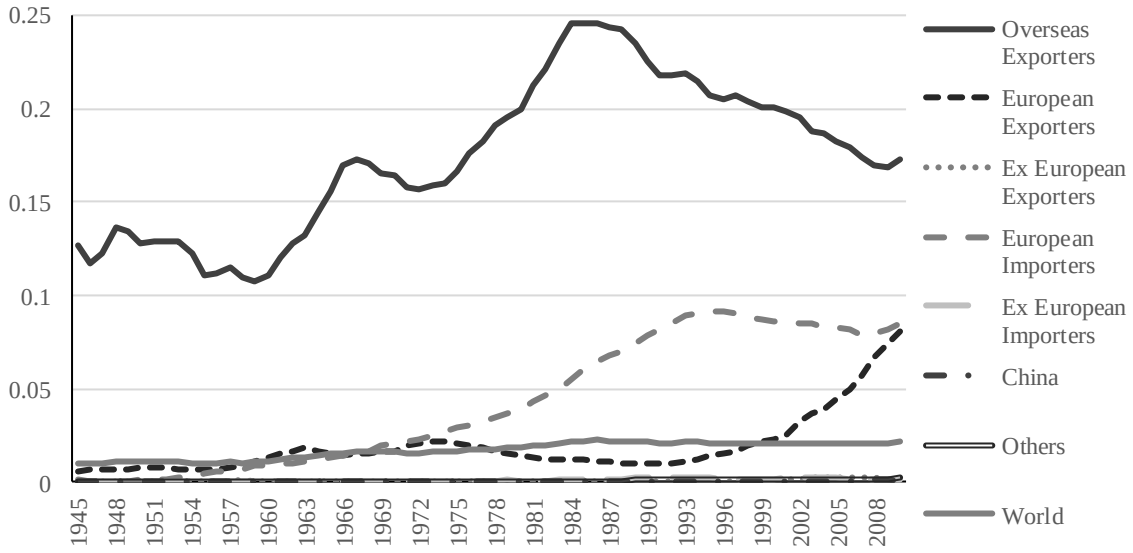
Figure 1.5 Wheat exports by Malembaum's groups and by continent, 1939-2010

1.5 (a) Total wheat exports (tonnes), by Malembaum's groups



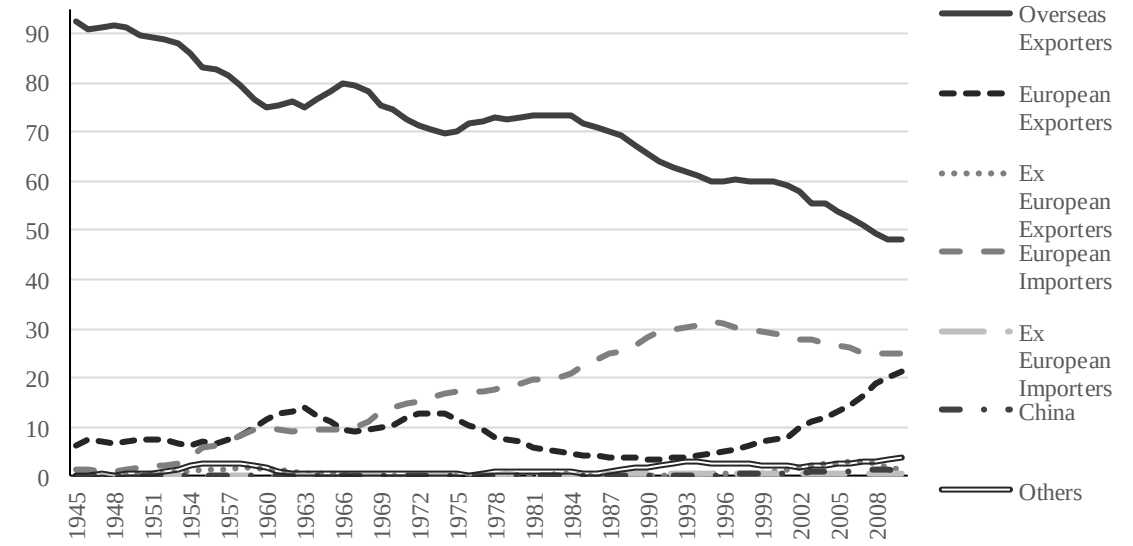
Source: author's elaboration from FAO (2016), FAO Production and Trade Yearbooks (1948-1961), Institut International d'Agriculture (1947), World Bank (2016), United Nations (2013) and Mitchell (2013)

1.5 (b) Wheat exports per capita (tonnes/population), by Malembaum's groups



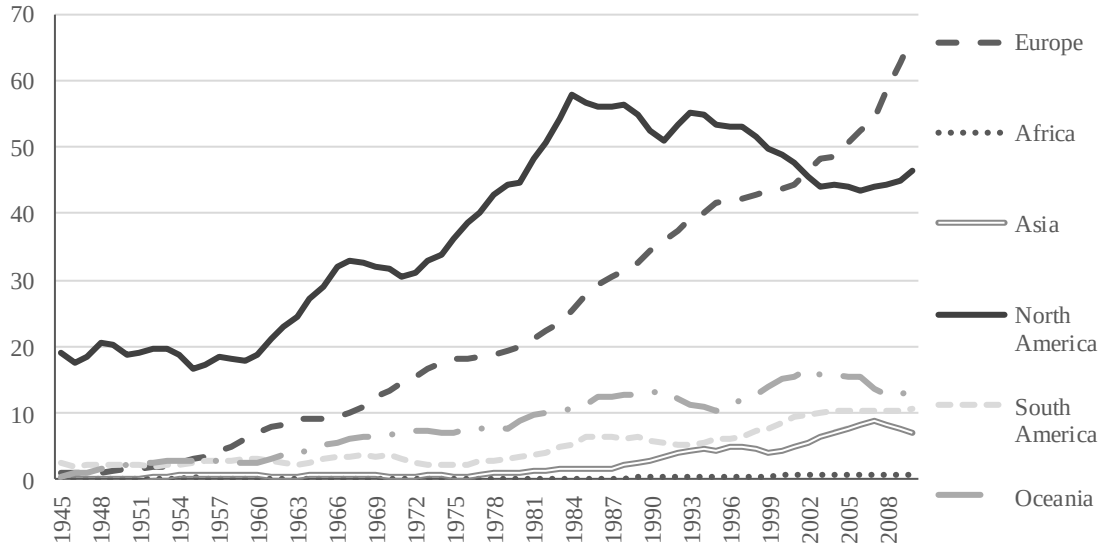
Source: author's elaboration from FAO (2016), FAO Production and Trade Yearbooks (1948-1961), Institut International d'Agriculture (1947), World Bank (2016), United Nations (2013) and Mitchell (2013)

1.5 (c) Wheat export shares (% of total exports), by Malembaum's groups



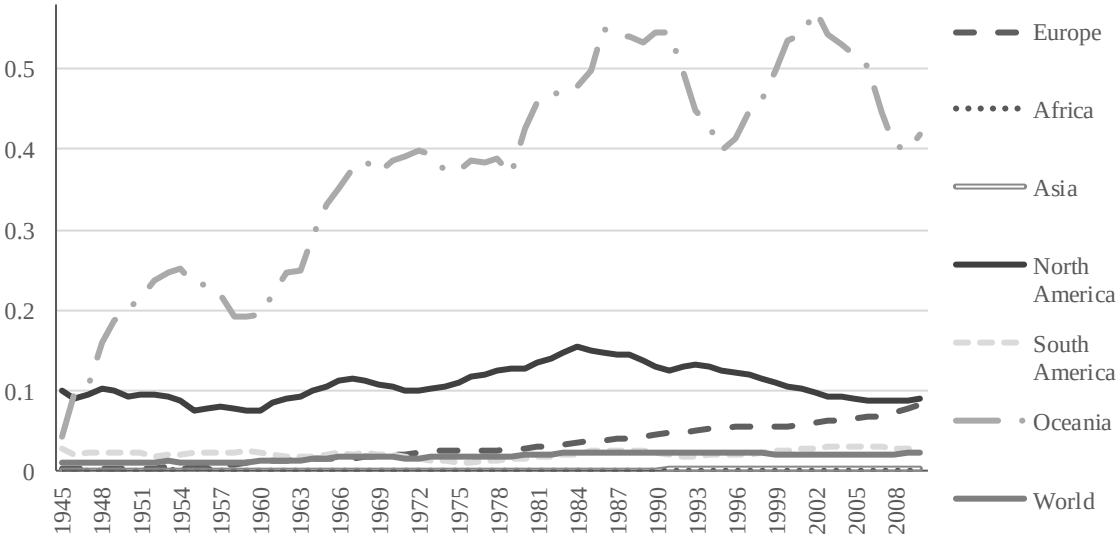
Source: author's elaboration from FAO (2016), FAO Production and Trade Yearbooks (1948-1961), Institut International d'Agriculture (1947), World Bank (2016), United Nations (2013) and Mitchell (2013)

1.5 (d) Total wheat exports (tonnes), by continent



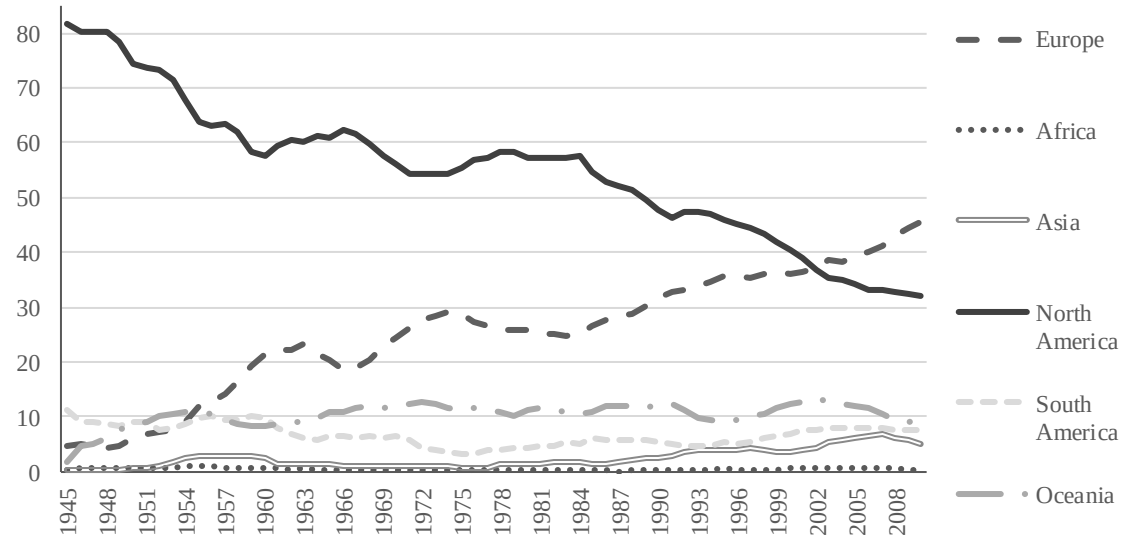
Source: author's elaboration from FAO (2016), FAO Production and Trade Yearbooks (1948-1961), Institut International d'Agriculture (1947), World Bank (2016), United Nations (2013) and Mitchell (2013)

1.5 (e) Wheat exports per capita (tonnes/population), by continent



Source: author's elaboration from FAO (2016), FAO Production and Trade Yearbooks (1948-1961), Institut International d'Agriculture (1947), World Bank (2016), United Nations (2013) and Mitchell (2013)

1.5 (f) Wheat export shares (% of total exports), by continent



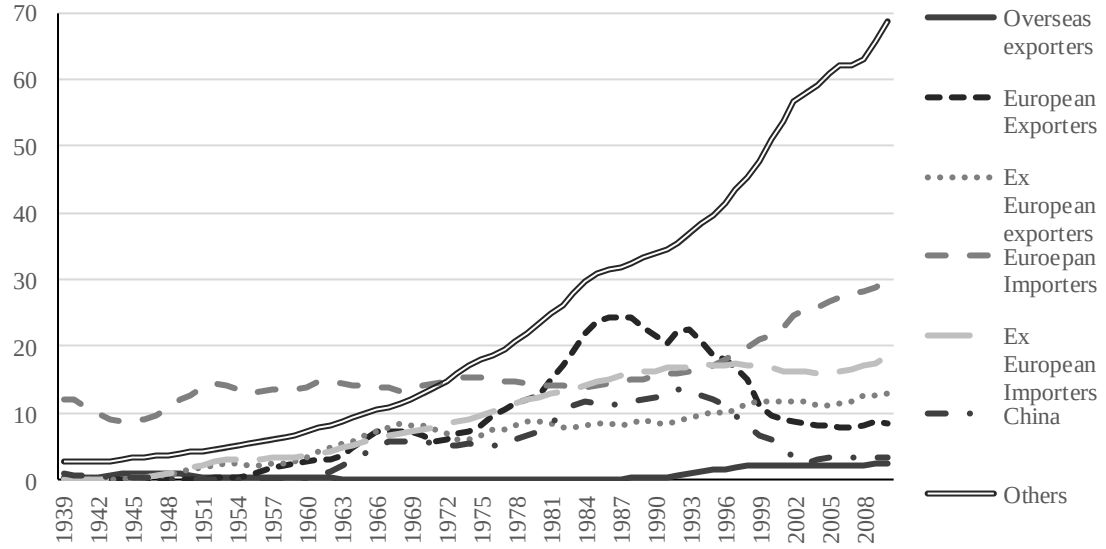
Source: author's elaboration from FAO (2016), FAO Production and Trade Yearbooks (1948-1961),Institut International d'Agriculture (1947), World Bank (2016), United Nations (2013) and Mitchell (2013)

With regard to wheat imports (figure 1.6), Europe accounted for more than 70 % of them in the aftermath of the War. On average, the volume of European imports followed an upward trend over the period 1945-2010 and it grew even more than the European population. Yet, it is possible to distinguish different trends among European territories: while some countries belonging to the *European Importers* group, such as France, Germany, and the United Kingdom, have managed to diminish wheat imports (or even to become significant net exporters), other countries, such as Italy and Spain are now major importers. As the main representative of the *European Exporters* group, the USSR also became a net importer from the mid-1970s to the mid-1990s. Yet, despite the overall growing volume of European wheat imports, its share in total world imports fell significantly throughout the whole period. The data show the emergence of a vast new market for wheat exports after World War II in developing countries. Asian countries began to import significant amounts of wheat in the immediate postwar years and by the 1960s its volume of imports had become as important as that of their European counterparts. African countries began to import wheat in large amounts later, but their imports now are roughly 20 times greater than they were in the 1960s and more than 30 times greater than in the immediate postwar years. In per capita terms, South American and African wheat imports have come to be almost as important as those of Europe. If we consider Malembaum's classification, the group of countries not included in his work –

mostly African or Asian countries, which had no relevance at all in prewar wheat markets – have come to be the recipients of roughly half of total world wheat exports.

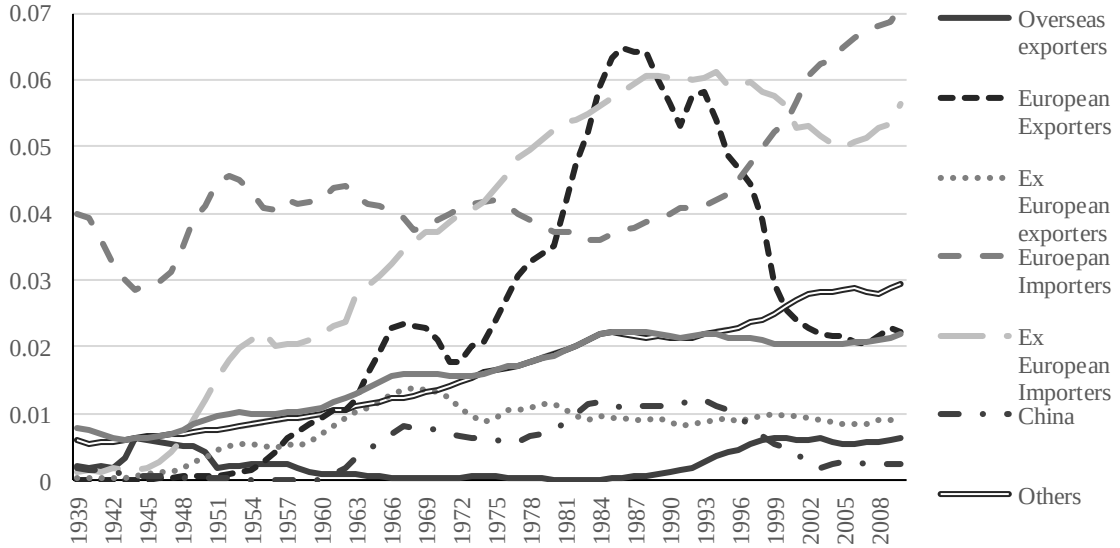
Figure 1.6. Wheat imports by Malembaum's groups and by continent, 1939-2010

1.6 (a) Total wheat imports (tonnes), by Malembaum's groups



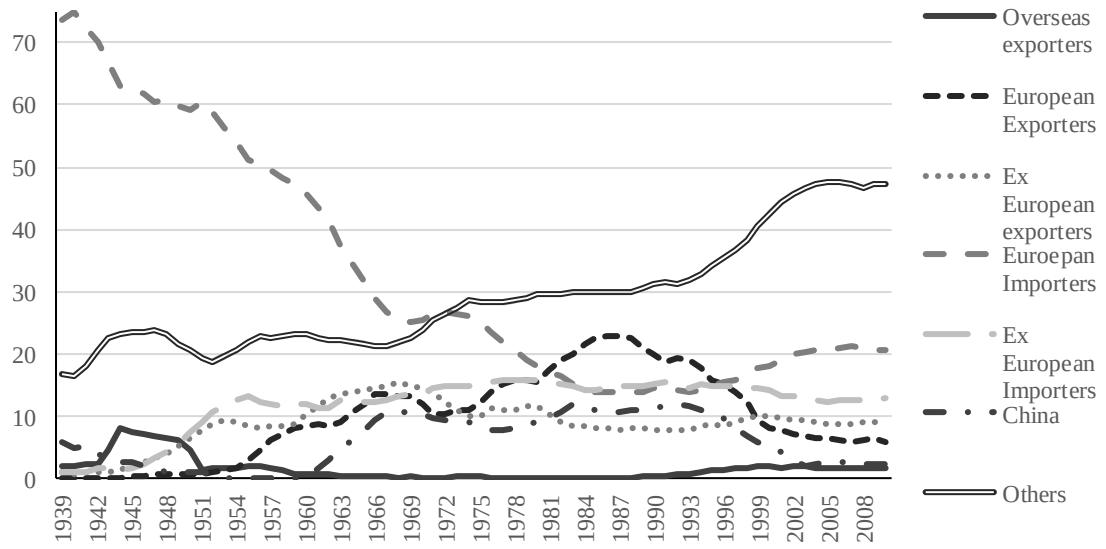
Source: author's elaboration from FAO (2016), FAO Production and Trade Yearbooks (1948-1961), Institut International d'Agriculture (1947), World Bank (2016), United Nations (2013) and Mitchell (2013)

1.6 (b) Wheat imports per capita (tonnes/population), by Malembaum's groups



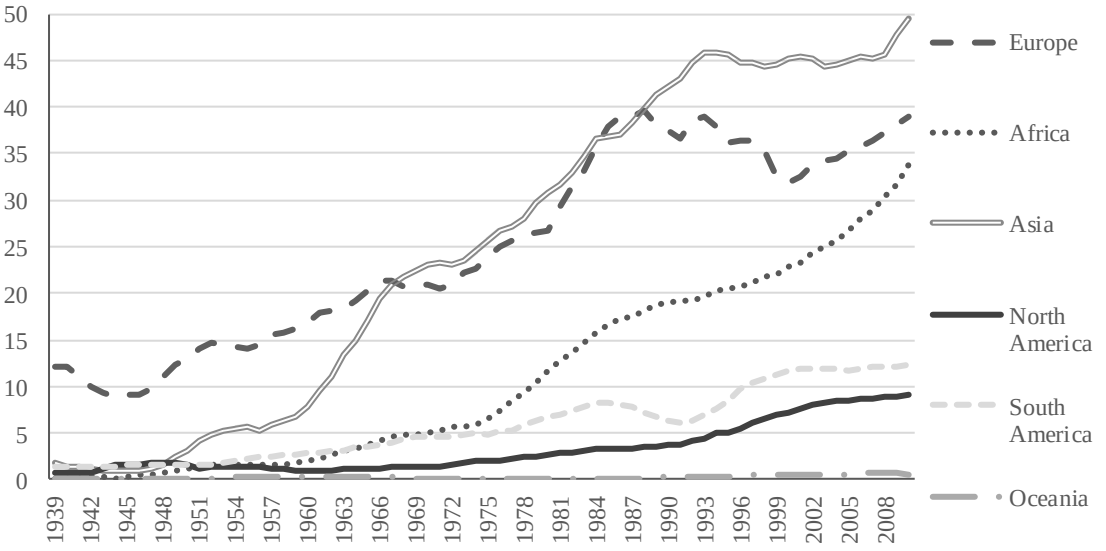
Source: author's elaboration from FAO (2016), FAO Production and Trade Yearbooks (1948-1961), Institut International d'Agriculture (1947), World Bank (2016), United Nations (2013) and Mitchell (2013)

1.6 (c) Wheat import shares (% of total exports), by Malembaum's groups



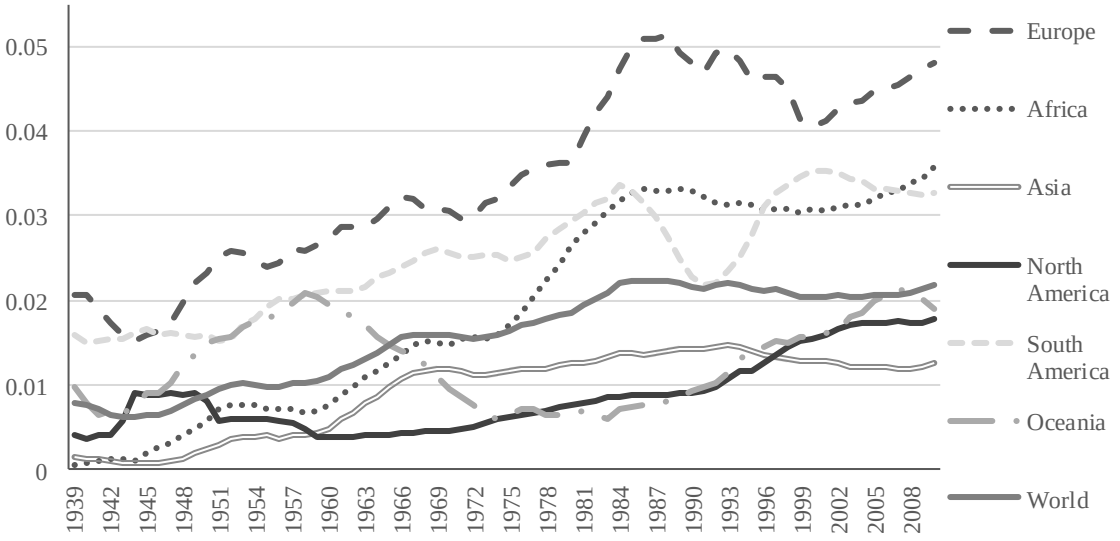
Source: author's elaboration from FAO (2016), FAO Production and Trade Yearbooks (1948-1961), Institut International d'Agriculture (1947), World Bank (2016), United Nations (2013) and Mitchell (2013)

1.6 (d) Total wheat imports (tonnes), by continent



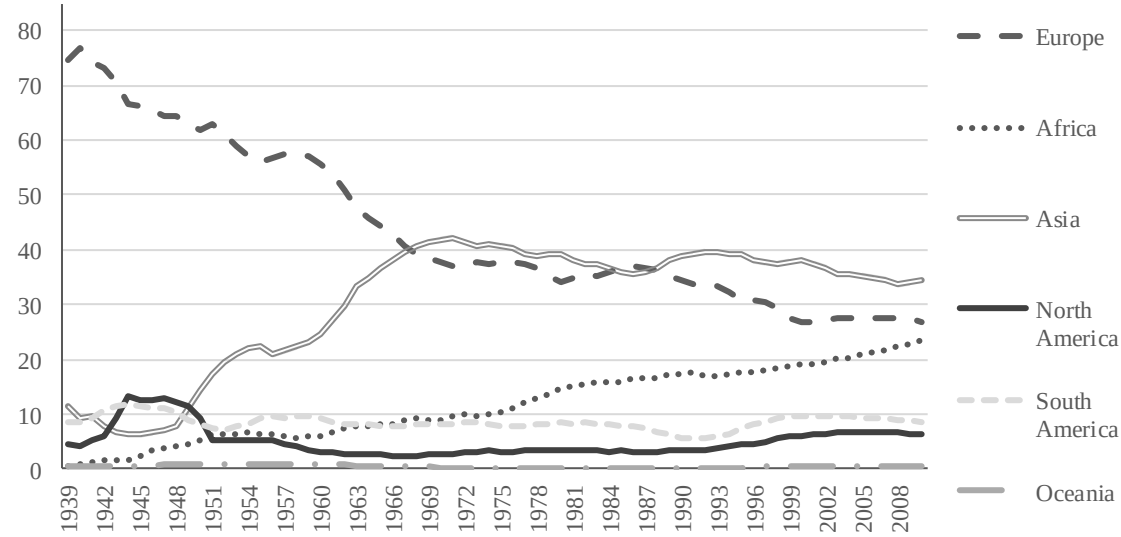
Source: author's elaboration from FAO (2016), FAO Production and Trade Yearbooks (1948-1961), Institut International d'Agriculture (1947), World Bank (2016), United Nations (2013) and Mitchell (2013)

1.6 (e) Wheat imports per capita (tonnes/population), by continent



Source: author's elaboration from FAO (2016), FAO Production and Trade Yearbooks (1948-1961), Institut International d'Agriculture (1947), World Bank (2016), United Nations (2013) and Mitchell (2013)

1.6 (f) Wheat import shares (% of total exports), by continent



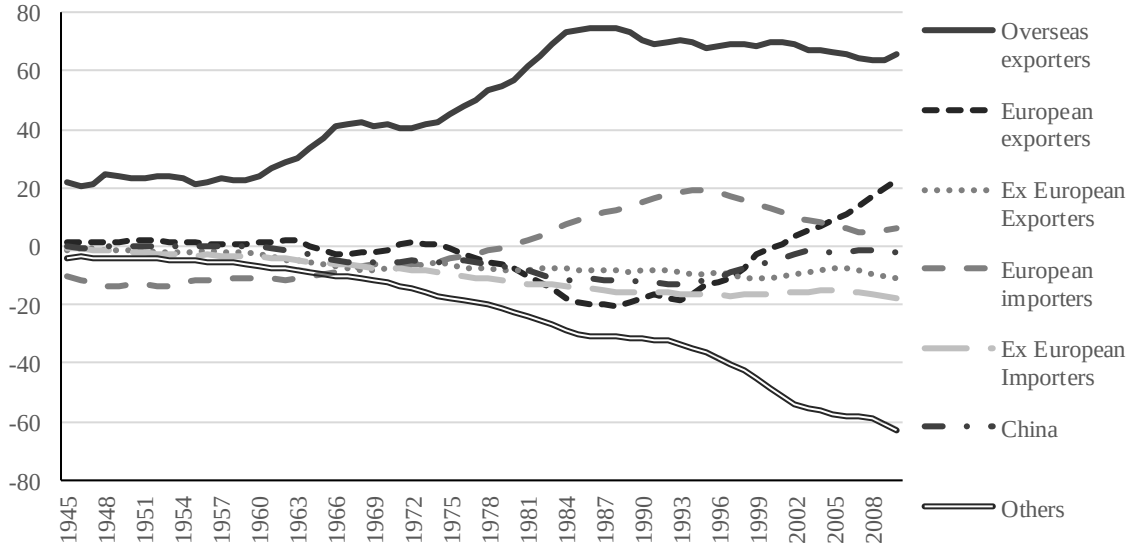
Source: author's elaboration from FAO (2016), FAO Production and Trade Yearbooks (1948-1961), Institut International d'Agriculture (1947), World Bank (2016), United Nations (2013) and Mitchell (2013)

Figure 1.7 puts together the evolution of wheat imports and exports by illustrating trends in net exports between 1945 and 2010. It confirms the fact that world wheat trade over the last 65 years has not only grown significantly, but has also changed dramatically. While the countries belonging to the overseas exporters group have kept their position as major wheat exporters throughout the whole period, other significant exporters have made an appearance. Importantly, the group of traditional European importers managed to

gradually reduce their notable dependence on international wheat markets and not only ceased to be a crucial importing group in the 1970s, but became a significant export force in the 1980s. France has always been by far the most prominent exporter among this group of countries, but even the United Kingdom – the most significant importing country in the 19th Century – consolidated its position as a net exporter of wheat in the 1980s. The traditional European Exporters – most noticeably certain countries belonging to the former USSR– also regained the status of net exporters in the 1990s, after decades of importing large amounts of wheat. With regard to the import side, a huge market for wheat has emerged in developing countries. The group of countries not considered by Malembaum – because of their lack of importance in international wheat markets before WWII – have come to be the most significant importing group. While their overall per-capita imports have always been less important than those of the traditional Ex-European importers (Egypt, Japan, South Africa…), the rapid population growth experienced in these countries has allowed them to absorb an increasing amount of wheat coming from the wealthier exporting countries. Overall, the clearest trend over the studied period is that more and more wheat has gone from Europe to Africa and Asia.

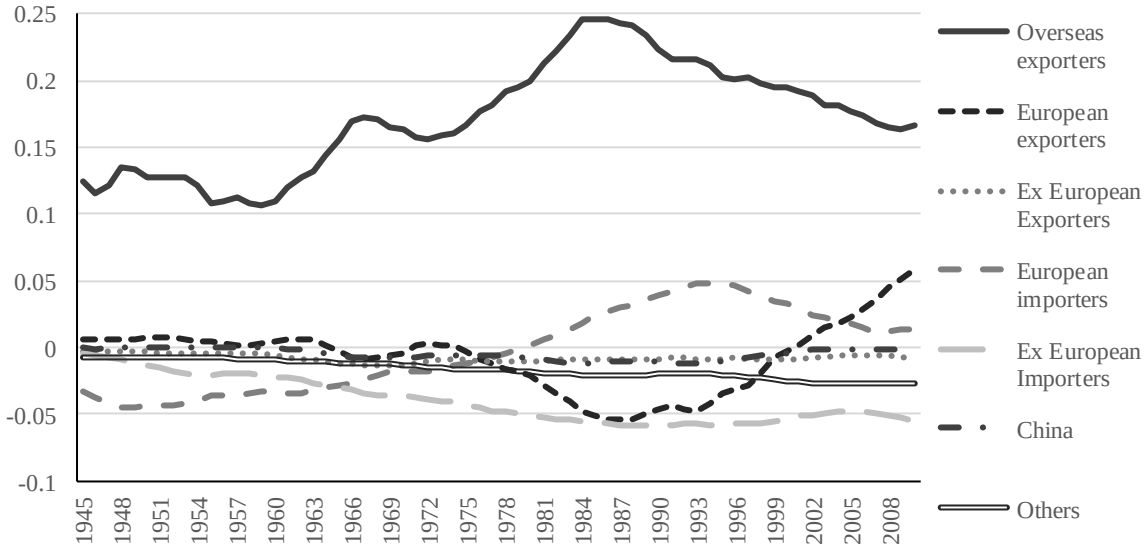
Figure 1.7 Net exports of wheat by Malembaum's groups and by continent, 1939-2010

1.7 (a) Net exports (tonnes), by Malembaum's groups



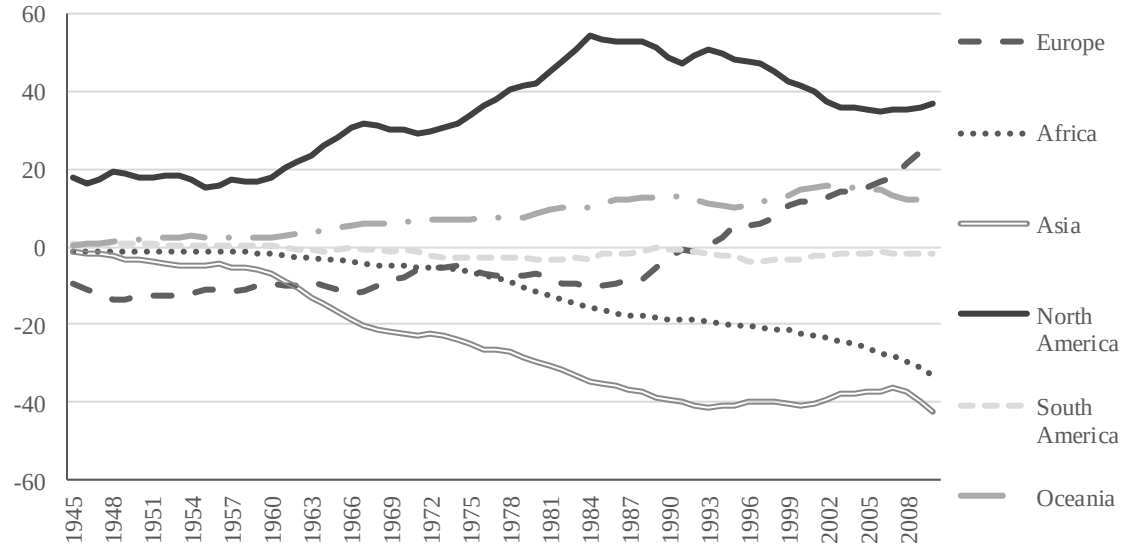
Source: author's elaboration from FAO (2016), FAO Production and Trade Yearbooks (1948-1961), Institut International d'Agriculture (1947), World Bank (2016), United Nations (2013) and Mitchell (2013)

1.7 (b) Per capita net exports (tonnes / population), by Malembaum's groups



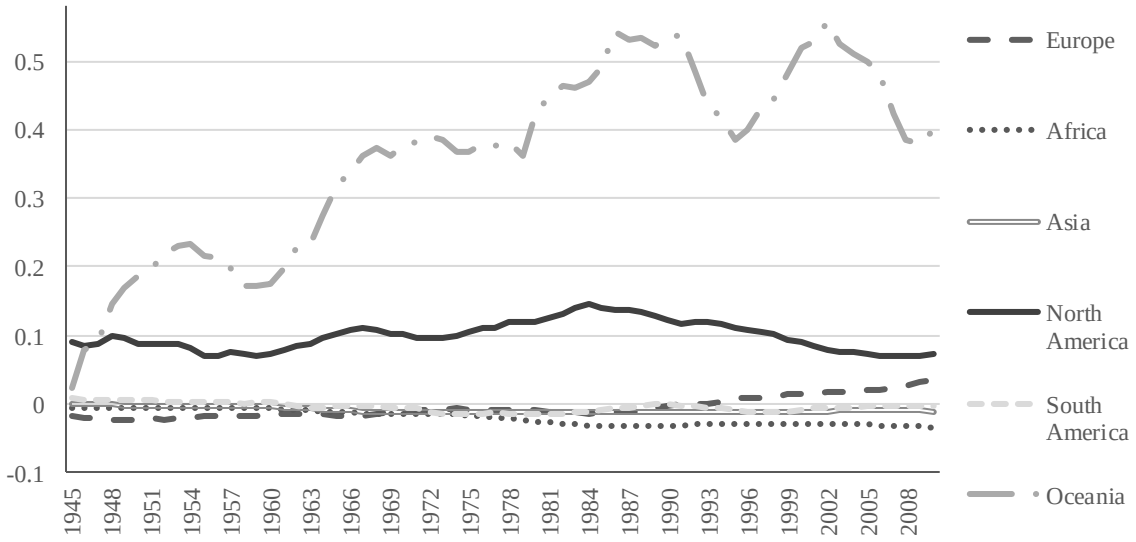
Source: author's elaboration from FAO (2016), FAO Production and Trade Yearbooks (1948-1961), Institut International d'Agriculture (1947), World Bank (2016), United Nations (2013) and Mitchell (2013)

1.7 (c) Net exports (tonnes), by continent



Source: author's elaboration from FAO (2016), FAO Production and Trade Yearbooks (1948-1961), Institut International d'Agriculture (1947), World Bank (2016), United Nations (2013) and Mitchell (2013)

1.7 (d) Per capita net exports (tonnes / population), by continent



Source: author's elaboration from FAO (2016), FAO Production and Trade Yearbooks (1948-1961), Institut International d'Agriculture (1947), World Bank (2016), United Nations (2013) and Mitchell (2013)

It is important to note that, due to the special features of wheat – for instance its key role in food security, its importance in national development plans, and its significance in terms of nutrition and basic population welfare – changes in the volume and in the direction of world wheat trade have been at the core of many political and theoretical controversies. First, there is the notion that governments (on occasion) have been tempted to seek a coercive advantage by manipulating – or threatening to manipulate – the volume and timing of their wheat exports (Paarlberg, 2010: 78). In his seminal work on the world wheat economy, W. Malembaum suggested that the United States should use its wheat surpluses as a "positive tool of foreign economic policy" (Malembaum, 1953, 231)[4]. His work was published in the same year that P.L 480 (or the Food for Peace Act) was approved in the United States: a law that – as we shall see – would restructure the international wheat trade through the mechanism of food aid (Friedmann, 1990). Some authors have claimed that "to some Americans, the possibility of agricultural power suggested extravagant opportunities" (Rothschild, 1974: 287). For instance, Earl Butz, U.S. Secretary of State for Agriculture under Nixon and Ford, observed that "hungry men listen only to those who have a piece of bread. Food is a tool. It is a weapon in the US

[4] This idea was criticized by MacGibbon (1954) in the same year that Malembaum's book was published. Referring to Malembaum's words about using wheat surpluses as a "tool of foreign economic policy" (Malembaum, 1953, 231), MacGibbon said that "however well managed, it is doubtful whether this form of economic imperialism would prove an effective method of making friends and influencing people" (MacGibbon, 1954, 176).

negotiating kit" (Patel, 2008: 92). There have been indeed many attempts to exercise this kind of 'food power'. Subsidized food shipments to Chile "were stopped after the Marxist Salvador Allende was elected president in 1970, and it was one of the first forms of aid to resume after he was overthrown on September 11, 1973" (Morgan, 1979: 258). Wheat exports were also considered as a means of exerting pressure on the OPEC countries through a 'counter embargo' (Rothschild, 1974: 287). Several embargos were also placed on U.S. wheat sales to the USSR, the last one being approved by the Carter administration in response to the Soviet invasion of Afghanistan[5] (Tarrant, 1981; O'Connor, 1982; Friedmann, 1993). Yet, probably the main source of controversies and intellectual debates has not been the idea that wheat exports could be used as a foreign policy weapon, but the awareness that wheat policy in industrialized/exporting countries may have conditioned the design and execution of agricultural policy in developing/importing countries (Harle, 1978; Friedmann, 1982). In fact, there is an ongoing discussion of the extent and consequences of this phenomenon (Gilmore, 1982; Byerlee, 1987; Bernstein et. al, 1990; Bovard, 1998; Chang, 2002; Rupiya, 2004; McMichael, 2012). It is for all those reasons that the history of the wheat trade over the last 70 years should not be understood merely as a study of international trade in a single commodity. Because of its particular and very special characteristics, studying the wheat trade requires taking an in-depth look into the specific historical and political processes of the main exporting and importing nations, and it also involves revisiting some of the main historical discussions of the process of economic and agricultural development.

1.3 Theoretical framework

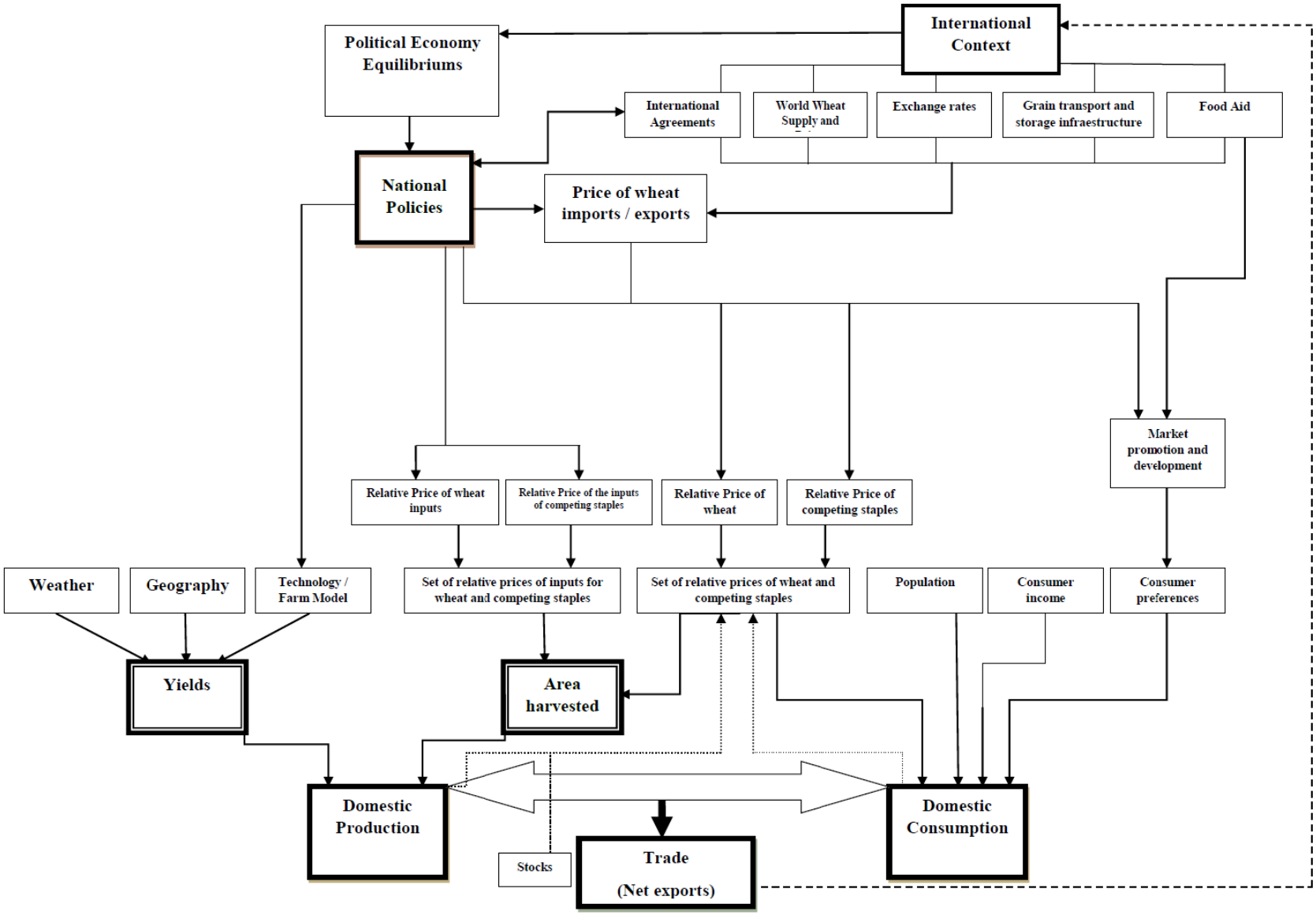
The aim of this paper is to identify and discuss the fundamental reasons behind the extraordinary growth of wheat trade over the last 70 years, and to analyze the variables affecting its distribution. A theoretical model is suggested and summarized in figure 1.8. The model aims to be a schematic simplification of an extraordinarily complex reality

[5] However, using wheat as a weapon has not been such a widespread practice among big exporters. In fact, most attempts to manipulate exports/aid in search of a coercive leverage have proven ineffective, and several reasons have been pointed out in order to explain such ineffectiveness. For instance, contrarily to commodities such as petroleum, "food is not a scarce resource available only in a few places in a fixed supply; food is a renewable resource that most countries can and do produce for themselves or can begin to produce" (Paarlberg, 2010: 89). Moreover, governments have come to depend on the big grain companies for information and facilities, and it has proved extremely difficult for governments to manipulate trade as a tool of foreign policy if the outcomes are expected to damage those companies' interests (Morgan, 1979).

and for that reason it does not include every potential explanatory variable of the wheat trade, nor all possible relationships between the incorporated variables. It will allow us to put together the main factors affecting wheat production and consumption in both importing and exporting countries, and thus to construct a global explanation of the major wheat trade flows over the second half of the 20th Century.

The model attempts to bring together multiple fields of discussion: the effect of national policies on prices or preferences, the role of technology and geography, the impact of the international context... With regard to the demand side, the model is inspired by that proposed by Byerlee for wheat imports in low-income countries (Byerlee, 1987). However, our model integrates the supply side with the demand side and offers a framework that is valid for both exporting and importing countries. In our theoretical model, net exports in one country are broadly considered as the difference between wheat production and wheat consumption in that country. It follows that trade occurs when production in a given country is not enough to cover its domestic consumption *and* when there are other countries in which production exceeds their current consumption requirements. In the following sections, it is our aim to explain why some countries produce more wheat than they consume – considering both production and consumption as endogenous variables – and why other countries resort to the market to consume more wheat than they produce. In order to explain the evolution of the wheat trade over the last 70 years, this paper will discuss the supply side and the demand side separately. We will first analyze the supply side: major trends in wheat production by continent or by Malembaum's groups of countries, taking into account trends in yields and area harvested, the effect of national policies, and the international context. The next section (1.4.2) will deal with the demand side and will analyze major trends in consumption and in the main variables that affect consumption. The final section (1.4.3) will put together both sides, incorporating into the discussion the institutional factors that make trade possible by connecting necessities in some countries with surpluses in others.

Figure 1.8 Major determinants of wheat production, consumption and trade



Source: author's elaboration

1.4 Discussion

1.4.1 The supply side

Wheat possesses a combination of genes that allows it to grow and mature in a wide range of temperature and moisture settings (Hanson et. al., 1982). Since wheat can be stored for years, under proper conditions, without deterioration, it is well suited both for its transportation and for its use as a buffer against food shortages (Mitchell and Mielke, 2005; Maurette, 1922). Today, wheat is grown in more than 120 countries, and is produced "using technologies ranging from fully mechanized production and harvesting on large tracts to manual planting and harvesting on small plots" (Mitchell and Mielke, 2005: 196). Of course, wheat is not simply just wheat (Smith, 2000) and hundreds of different varieties of wheat are produced around the world based on characteristics of the local climate (Ghoshray, 2006). Plant breeding programs differ significantly from one producing region to another, and environmental factors, such as temperature, rainfall, topography, and soil determine wheat characteristics such as protein content and kernel size (Ghoshray, 2006). Importantly, some of those characteristics may limit the viability of wheat for various end uses. This helps to explain the presence of a significant degree of intra-industrial trade in international wheat markets.

Following Smith (2000), wheat quality attributes may be divided into three general categories: (1) *intrinsic characteristics* such as hardness, kernel size, color, ash content, disease resistance, and protein quality and quantity; (2) *physical condition*, including test weight, moisture, purity and damaged kernels, and (3) *wholesomeness*, including insect damage, pesticide residues, and noxious weed seeds. Wheat is commonly classified according to some of its *intrinsic characteristics*, which generally are not easy to identify by simple visual inspection. For instance, a commonly-used basis for classifying wheat is according to hardness –a milling characteristic– or according to strength, which is a baking characteristic (Kent and Evers, 1994). Hard varieties tend to be higher in protein and are mainly used in bread flour, whereas softer varieties are usually milled into flour for cookies or cakes, due to their lower protein content (Wheat Flour Institute, 1981). The growing season is also commonly used to classify wheat (Inglett, 1974). All these general groupings have resulted in the establishment of seven basic classes of wheat: Hard Red Spring, Hard Red Winter, Soft Red Winter, Soft White,

Durum, Unclassed, and Mixed[6] (Uri and Douglas Beach, 1997). Many of these wheat classes are further divided into subclasses, according to some of the intrinsic characteristics of wheat. For instance, durum wheat – the hardest – is divided into three subclasses: hard amber durum wheat, amber durum wheat, and durum wheat (Smith, 2000).

The producer's decision of choosing one particular variety of wheat above the alternatives has to do with the expected yields and prices for each variety and the potential for unpredictable variations in those yields and prices (Smith, 2000: 6). While variations in prices among classes of wheat derive from differences in *intrinsic characteristics*, such as kernel hardness or protein quantity[7], the expected yields are mostly dependent on the suitability of the variety to the climate and soil features of the area. Therefore, although there is a certain degree of substitutability between varieties[8], some of them are always more suitable to certain regions than others. In fact, each of the major exporters have tended to specialize in producing and exporting one type of wheat. For instance, Canada specializes in Hard Red Spring while Argentina is "the main competitor of the US Hard Winter wheat" (Shalaby and Hassler, 1988: 25). This has been important in the history of the wheat trade, since higher quality wheat –for instance, the Canadian Western Red Spring Wheat– normally commands a premium on the world market (Larue, 1991). However, in spite of the heterogeneous nature of wheat, historical statistics on wheat production and trade are usually only available in an aggregated form. This is why, for the purpose of our study, wheat will be considered as a homogeneous product.

World wheat production in 2010 was roughly 4 times greater than it was in 1939 (see figure 1.9). This may be considered a somewhat surprising outcome, for two reasons. First, because the outstanding growth in total wheat production has gone hand in hand with an increasingly clear realization that wheat markets are characterized by a persistent tendency towards overproduction. As stated above, the collapse of wheat markets in the interwar period was mainly due to excess wheat supplies. Overproduction was corrected

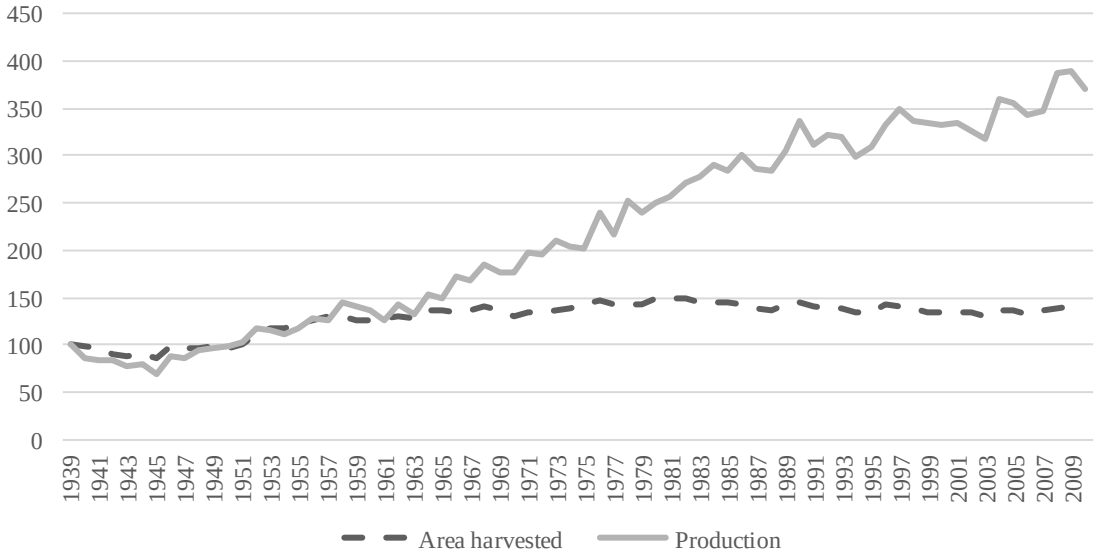
[6] Mixed wheat consists of less than 90 percent of one class of wheat and more than 10 percent of another class of wheat. Unclassed wheat includes any varieties that cannot be classified under other criteria (Smith, 2000).

[7] On the other hand, differences in *nonintrinsic characteristics* such as cleanliness and the presence of pesticide residues usually determine variations in prices among different grades of wheat *within classes* (Smith, 2000).

[8] There is substitution between varieties and "blending of different varieties to produce flour with specific characteristics" (Mitchell and Mielke, 2005: 196).

during the war years, but the main producing nations were beset with the problem of surpluses soon after the war. Wheat production grew so much over the following 40 years that it was claimed that "for the time being, Malthusian prophecies of food scarcities are wrong, at least from the perspective of the North American wheat farmer without whom Malthus might have been right. The question today is the same as it was in the time of the mercantilists: what can we do to sell more goods abroad?" (Dennis, 1987, 3). Thus, as we shall see, global wheat production has grown significantly, even when it represented a crucial problem for producers in the main exporting countries, and despite policies often being aimed at limiting output.

Figure 1.9 Total (world) wheat production and area harvested (1939 =100)



Source: author's elaboration from FAO (2016), FAO Production and Trade Yearbooks (1948-1961) and Institut International d'Agriculture (1947)

The second reason why the growth of wheat production may be surprising is because the global amount of land devoted to growing wheat has not expanded much over the studied period (moreover, it began a downward trend in the 1980s). Production of wheat tended to be highly correlated with acreage in the period before World War II. In fact, it can be said that the general movement of the world wheat output was almost exclusively caused by changes in the acreage sown. According to Malembaum's data and calculations, the coefficient of correlation of world production and world acreage for the period 1885/86 – 1938/39 was 0.983 (Malembaum, 1953: 25). This is no longer the case from the mid-1960s onwards. Our estimates of the coefficient of correlation are 0.741 for the period 1939-2010 and only 0.208 for the period 1961-2010. This was indeed a key

change in the history of wheat production, since the quantity of land devoted to growing wheat ceased to be the chief determinant of total wheat output after the widespread adoption of new production techniques and inputs in the 1960s and 1970s. This outstanding break with the past may be better observed in figure 1.9, and had much to do with the availability of new wheat breeds suitable for moist growing areas, such as found in Brazil, India, and Mexico (Whitman, 1989). The new high-yielding semi-dwarf varieties – developed by the Centro Internacional de Mejoramiento de Maíz y Trigo (CIMMYT)[9] in Mexico and adapted to local conditions – were quickly adopted in developing countries and allowed for an extraordinary increase in yields (Dalrymple, 1974). As is known, these varieties require large quantities of fertilizers, pesticides, herbicides, and fungicides to grow at all (Whitman, 1989).

According to Malembaum's data the USSR accounted for roughly one fourth of the total world wheat area in the interwar period (1919-1939). Our own calculations – also based on Malembaum's statistics – show that the Soviet Union was closely followed by the United States (22%), India (10%), Canada (7%), Argentina (6%), France (4%), and Australia (4%). Since production and area were highly correlated at that time, wheat production shares were very similar to those of area: USSR (20%), United States (19%), India (8%), Canada (8%), France (7%), Argentina (5%), Italy (5%), and Australia (3%). The Overseas exporters group accounted for roughly 36% of world wheat production, followed by the European exporters (28%), the European importers (24%), the Ex-European exporters (10%), and the Ex-European importers (2%). Malembaum estimated that the countries not included in his study due to lack of data – most notably China and Manchuria – represented approximately 20 per cent of the world wheat output (Malembaum, 1953). Therefore, we must be extremely cautious when comparing postwar trends in wheat production to the previously-mentioned shares in the interwar period. Fortunately, our series for the period 1939-2010 takes into account every significant producing nation (including China), and allows us to illustrate that the significant growth

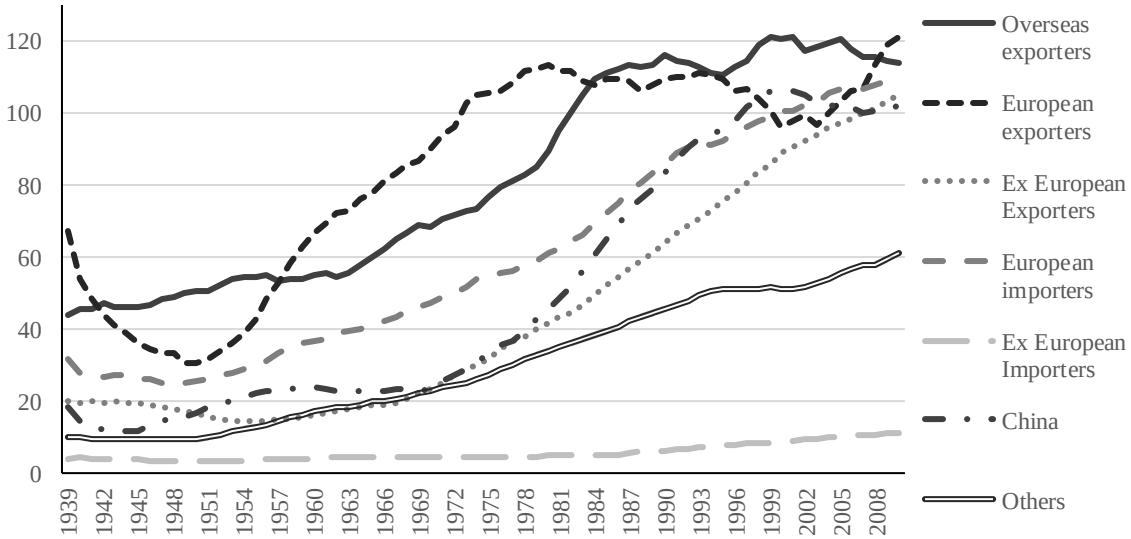
[9] The international wheat genetic improvement system in the 1960s and 1970s was decidedly collaborative and depended on international testing by the CIMMYT and national agricultural research systems (NARS) worldwide (Maredia and Byerlee, 1999). The CIMMYT did not release varieties directly to farmers; NARS tested CIMMYT germplasm for direct release or incorporated it into their own research to develop final varieties (Byerlee and Moya, 1993). Over the period 1966-88, higher yields in CIMMYT wheats were increasingly due to improved nitrogen-use efficiency, tolerance to heat, tolerance to drought, and superior leaf rust resistance (Heisey et.al. 2003). These authors asserted that the international wheat genetic improvement system linking CIMMYT with the NARS proved to be "an outstanding success in delivering improved wheat varieties and tangible economic benefits throughout the wheat-growing developing world" (Heisey et.al., 2003, 65).

of world wheat production over the last 70 years has been far from being evenly distributed among countries.

Figure 1.10 shows production trends by continent, and by Malembaum's groups of countries over the period 1939-2010. The most remarkable facts are: **(1)** the spectacular growth of wheat production in Asian countries between 1960 and 2000 (most notably in China); **(2)** the increasing wheat production in the group of traditional European importers over the whole period; **(3)** the erratic trends in the USSR and the European exporters group (a large increase between the end of World War II and the mid-1970s, a downward trend over the next twenty years, and a significant recovery over the last fifteen years); **(4)** the diminishing share of North American wheat production; and **(5)** the increasing wheat production per capita in the traditional European Importers between 1950 - 2010 and the diminishing per capita production in North America since the mid-1980s. Following our theoretical model, total wheat production in a country is dependent on the quantity of land devoted to growing wheat and on land productivity, and both are dependent on many other variables). Therefore, we will first analyze the main trends in area and yields, and then we will discuss the overall reasons behind the aforementioned changes in wheat production.

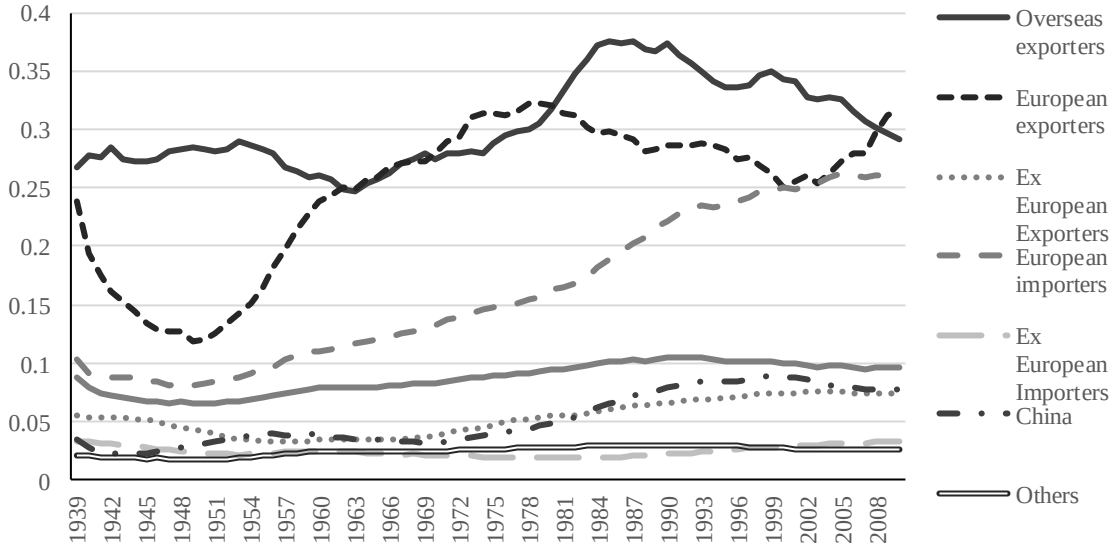
Figure 1.10 Wheat production by Malembaum's groups and by continent, 1930-2010

1.10 (a) Total wheat production (tonnes), by Malembaum's groups



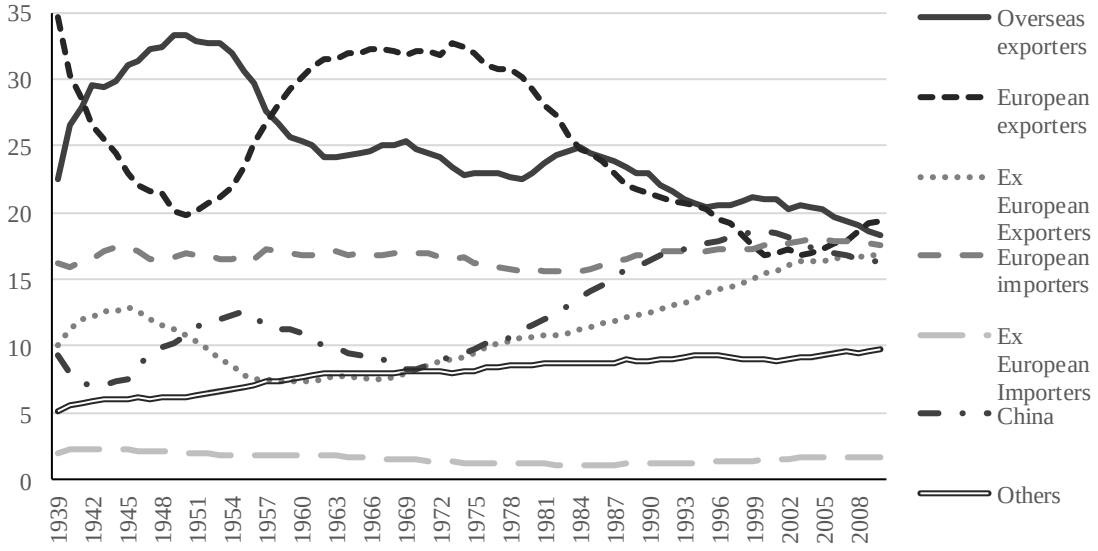
Source: author's elaboration from FAO (2016), FAO Production and Trade Yearbooks (1948-1961), Institut International d'Agriculture (1947), World Bank (2016), United Nations (2013) and Mitchell (2013)

1.10 (b) Per capita wheat production (tonnes / population), by Malembaum's groups



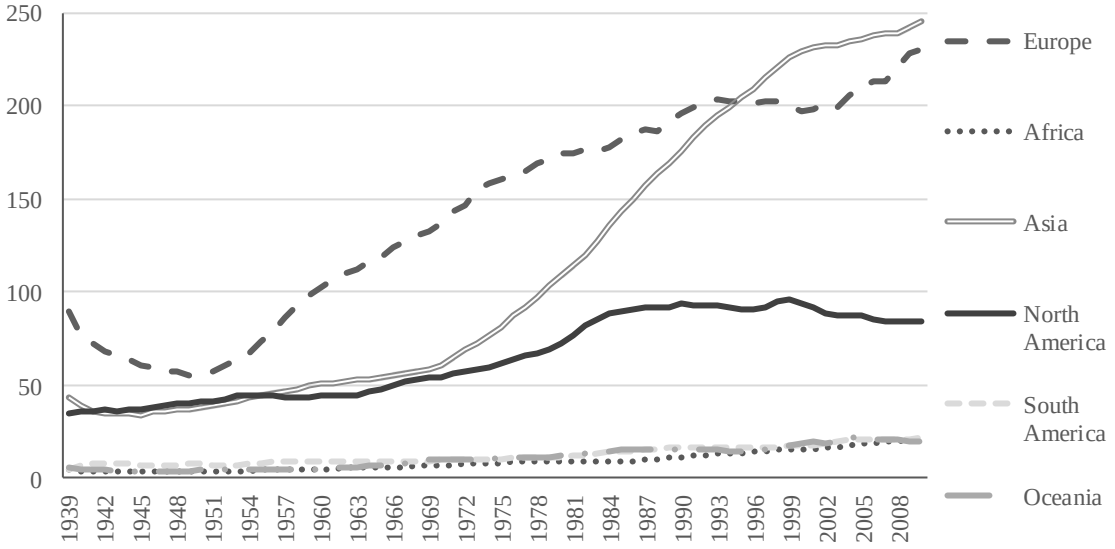
Source: author's elaboration from FAO (2016), FAO Production and Trade Yearbooks (1948-1961), Institut International d'Agriculture (1947), World Bank (2016), United Nations (2013) and Mitchell (2013)

1.10 (c) Wheat production shares (% of world production), by Malembaum's groups



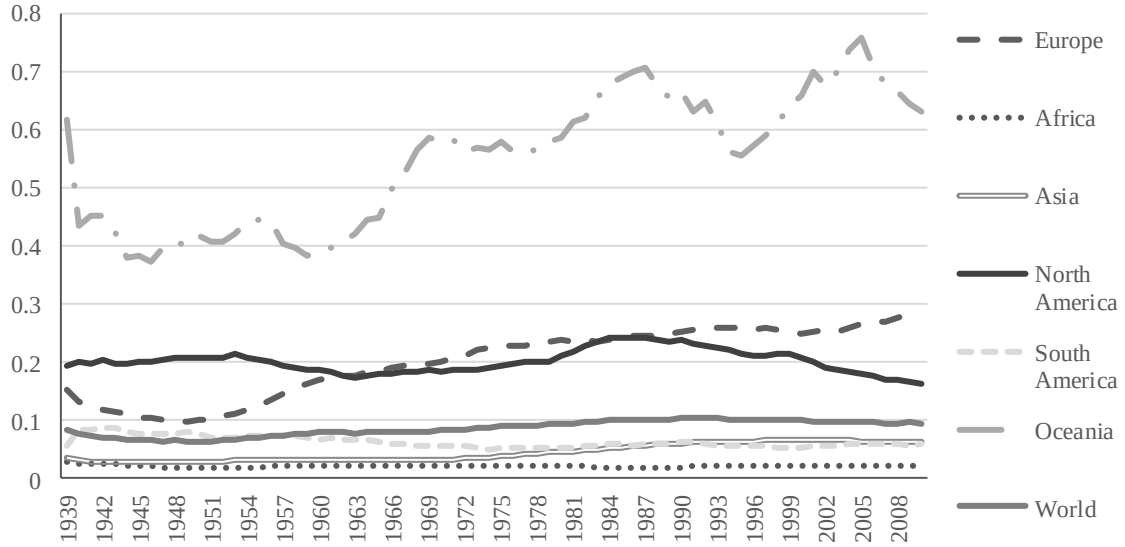
Source: author's elaboration from FAO (2016), FAO Production and Trade Yearbooks (1948-1961), Institut International d'Agriculture (1947), World Bank (2016), United Nations (2013) and Mitchell (2013)

1.10 (d) Total wheat production (tonnes), by continent



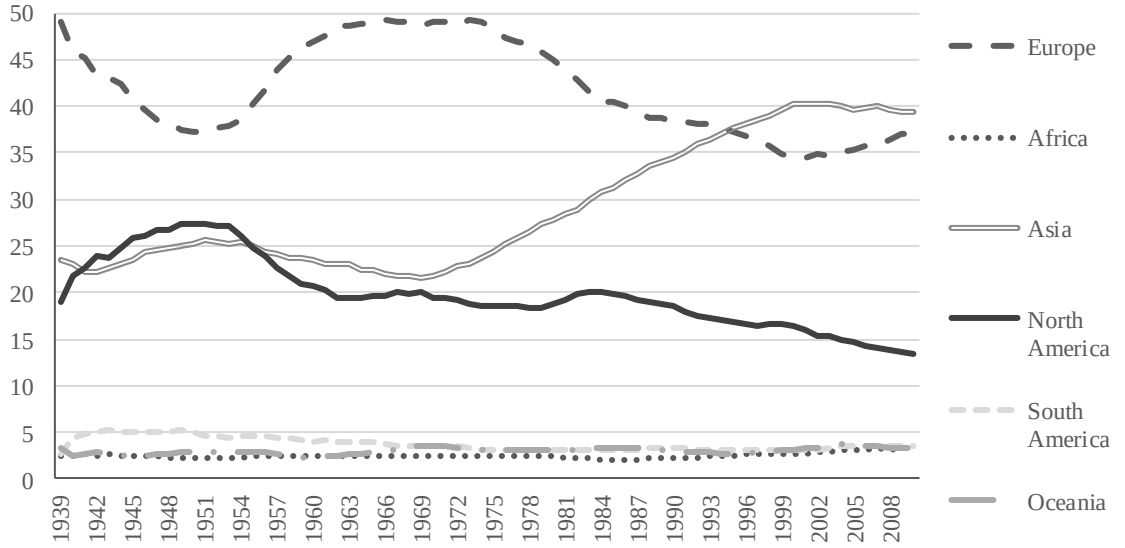
Source: author's elaboration from FAO (2016), FAO Production and Trade Yearbooks (1948-1961), Institut International d'Agriculture (1947), World Bank (2016), United Nations (2013) and Mitchell (2013)

1.10 (e) Per capita wheat production (tonnes / population), by continent



Source: author's elaboration from FAO (2016), FAO Production and Trade Yearbooks (1948-1961), Institut International d'Agriculture (1947), World Bank (2016), United Nations (2013) and Mitchell (2013)

1.10 (f) Wheat production shares (% of world production), by continent



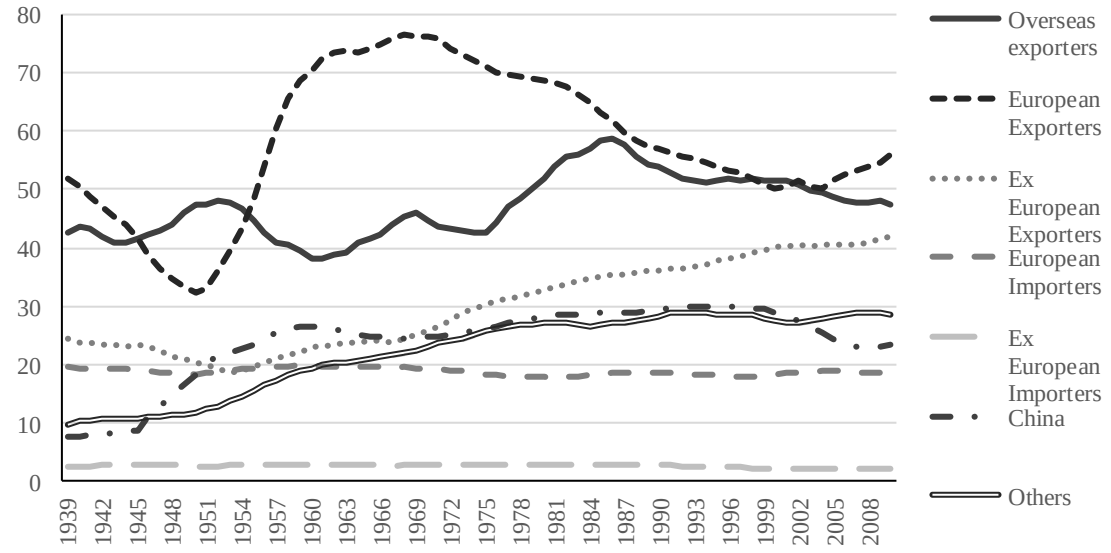
Source: author's elaboration from FAO (2016), FAO Production and Trade Yearbooks (1948-1961), Institut International d'Agriculture (1947), World Bank (2016), United Nations (2013) and Mitchell (2013)

Figure 1.11 shows major changes in the area trends and figure 1.12 illustrates the evolution of yields, again by continent and by Malembaum's groups of countries. Total (world) area devoted to growing wheat rose significantly from the end of WWII to 1980, and then began a downward trend. In per-capita terms, however, there has been a declining trend for all groups throughout the whole period (of course, due to the extraordinary population growth that has characterized the second half of the 20th Century). At least two significant exceptions to this general trend can be found. First, the extraordinary surge in wheat area experienced in the USSR over the 25 years following the end of the War. Second, the also impressive expansion of wheat area in China between 1945 and 1960. Figure 1.11 illustrates other significant facts, such as the massive destruction that WWII meant for Soviet countries. This very large decline in wheat cultivation was unparalleled in modern history and had tremendous social implications (Collingham, 2011). Regarding the long-term evolution of wheat area by Malembaum's groups, there has been a gradual and significant increase in the group of 'others' over the whole period, and also a substantial rise in the Ex-European exporters from the 1950s onwards. More and more land has been put under cultivation in Asia, first in China and later in other Asian countries, such as India and Pakistan. In addition, although the increase in absolute terms is not very significant, African land devoted to wheat production has increased twofold since 1945. On the other hand, the decrease in world wheat area beginning in the 1980s is related to the falling trend initiated in North America

in that decade (in both Canada and the United States) and with the decreasing trend prevailing in the group of traditional European exporters (which had started more than a decade before).

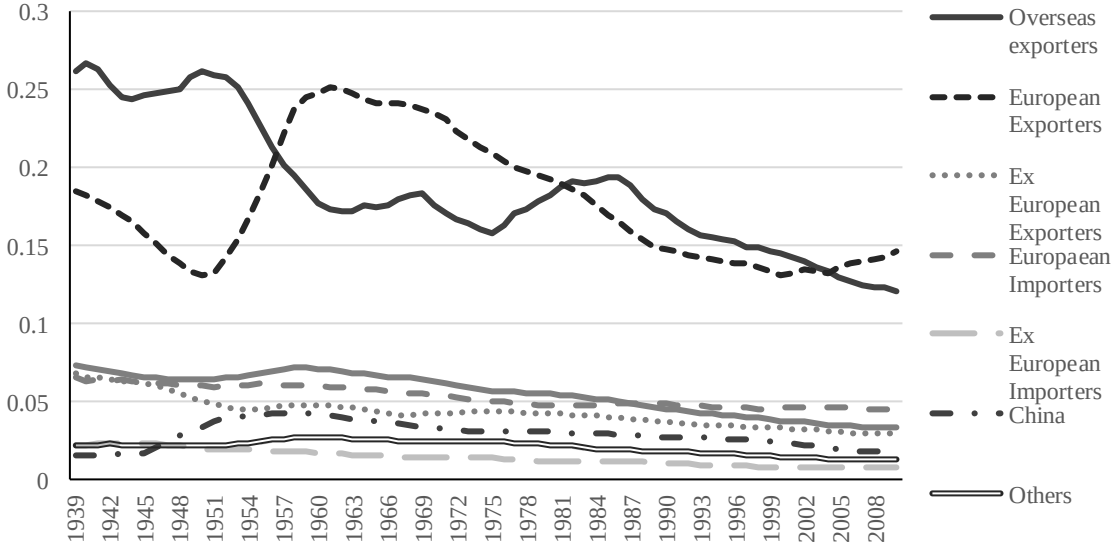
Figure 1.11 Wheat area by continent and Malembaum's groups, 1939-2010

1.11 (a) Total wheat area (ha), by Malembaum's groups



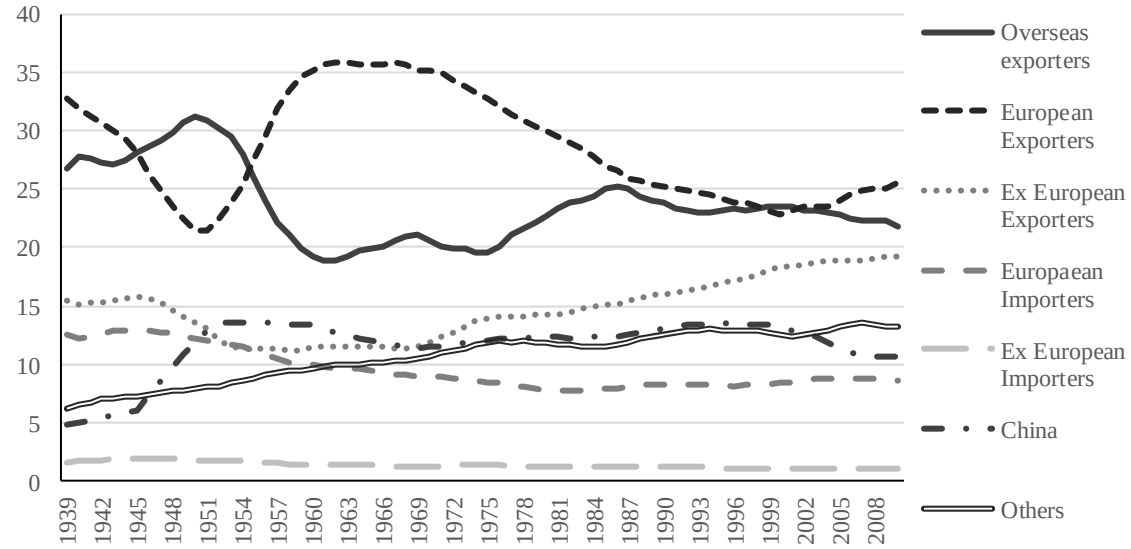
Source: author's elaboration from FAO (2016), FAO Production and Trade Yearbooks (1948-1961), Institut International d'Agriculture (1947), World Bank (2016), United Nations (2013) and Mitchell (2013)

1.11 (b) Wheat area per capita (ha / population), by Malembaum's groups



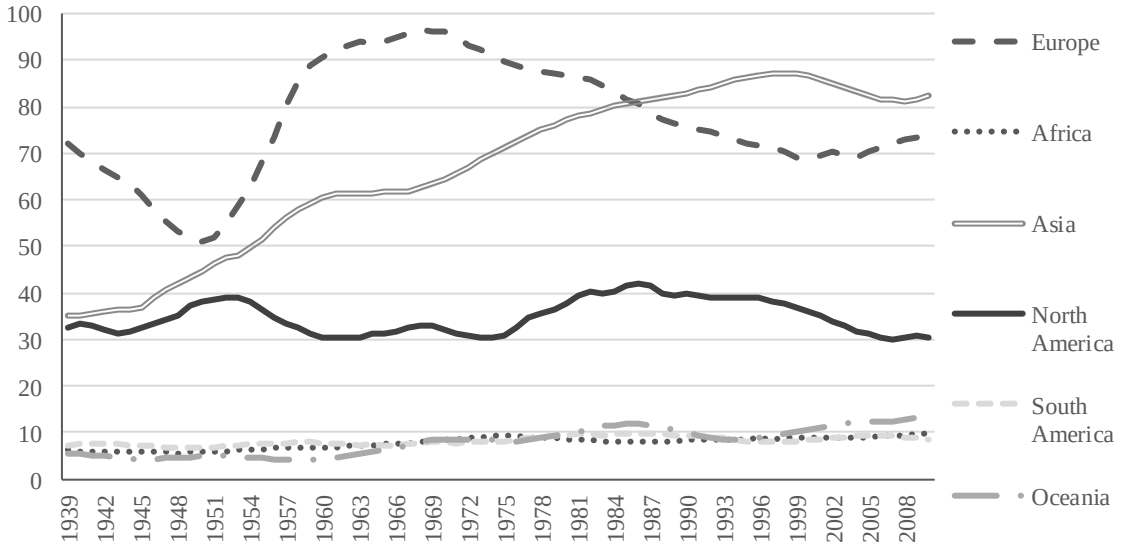
Source: author's elaboration from FAO (2016), FAO Production and Trade Yearbooks (1948-1961), Institut International d'Agriculture (1947), World Bank (2016), United Nations (2013) and Mitchell (2013)

1.11 (c) Wheat area shares (% of world area), by Malembaum's groups



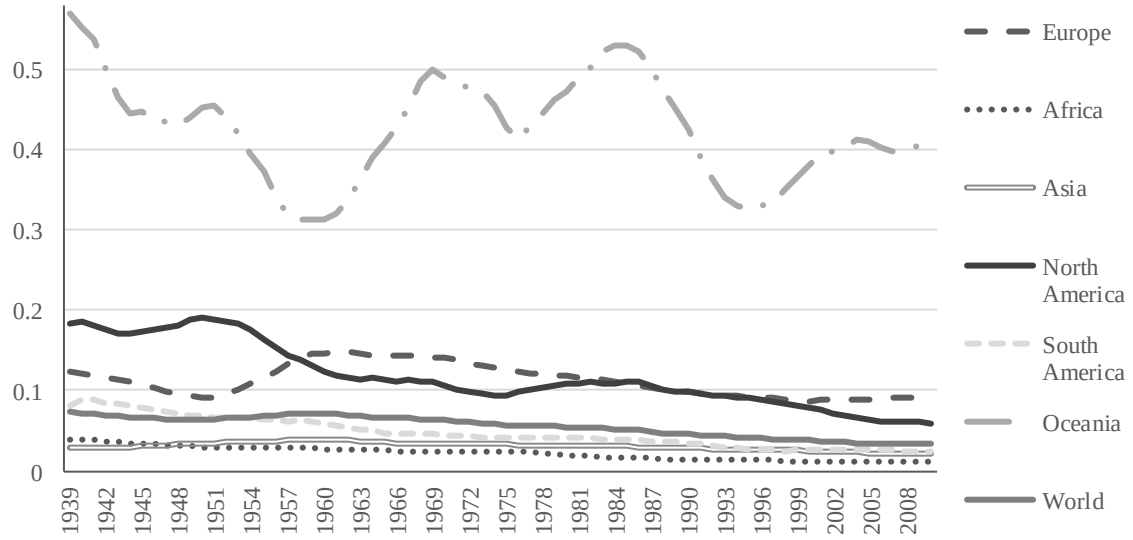
Source: author's elaboration from FAO (2016), FAO Production and Trade Yearbooks (1948-1961), Institut International d'Agriculture (1947), World Bank (2016), United Nations (2013) and Mitchell (2013)

1.11 (d) Total wheat area (ha), by continent



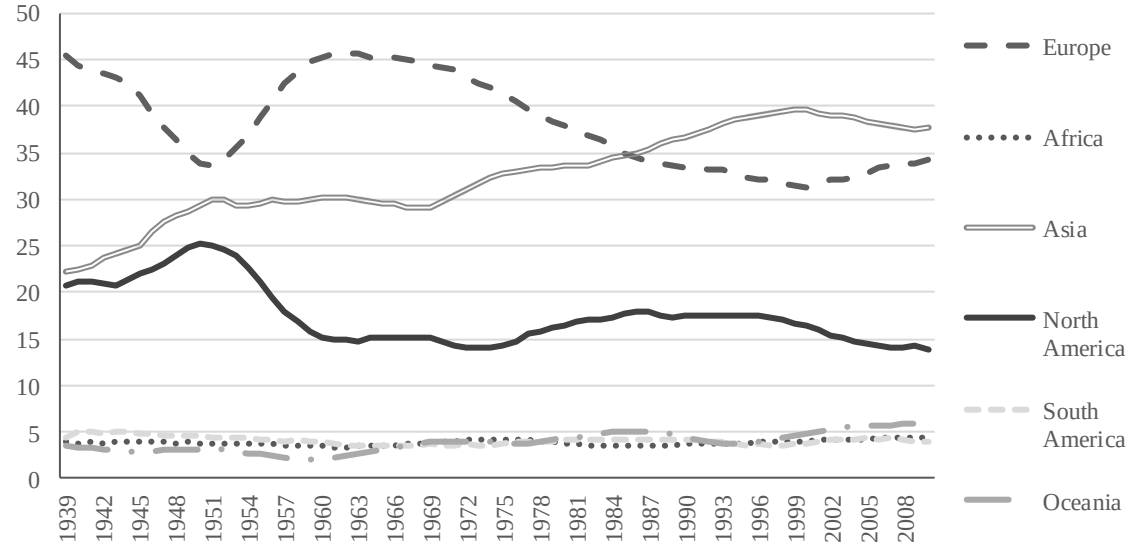
Source: author's elaboration from FAO (2016), FAO Production and Trade Yearbooks (1948-1961), Institut International d'Agriculture (1947), World Bank (2016), United Nations (2013) and Mitchell (2013)

1.11 (e) Wheat area per capita (ha / population), by continent



Source: author's elaboration from FAO (2016), FAO Production and Trade Yearbooks (1948-1961), Institut International d'Agriculture (1947), World Bank (2016), United Nations (2013) and Mitchell (2013)

1.11 (f) Wheat area shares (% of world area), by continent

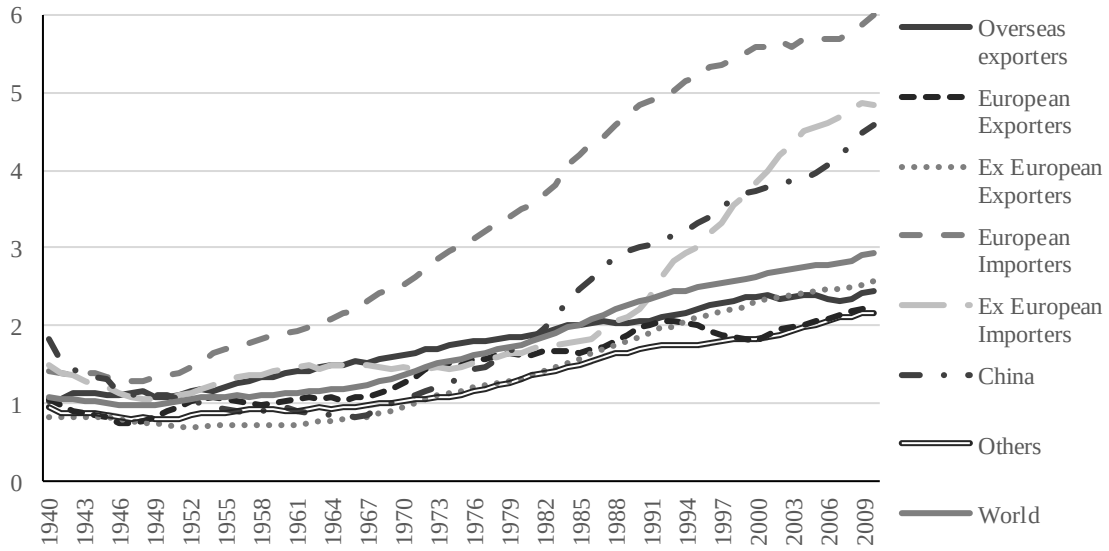


Source: author's elaboration from FAO (2016), FAO Production and Trade Yearbooks (1948-1961), Institut International d'Agriculture (1947), World Bank (2016), United Nations (2013) and Mitchell (2013)

With regard to wheat yields (figure 1.12), the overall increase in virtually all regions may hide the fact that some countries have benefited much more than others. In fact, there has been a widening gap – at least in absolute terms – between the most productive regions and the least. The most impressive improvement has occurred in the traditional European importers group. These countries experienced an extraordinary revolution in yields soon after the War, and the pace of improvement further accelerated over the second half of the 20th Century. The Green Revolution arrived in China, India, and other Asian countries later than in Europe, yet the improvement in wheat yields was also very impressive. On the other hand, yield enhancement was much more modest, and slower, in Africa, and particularly in the group of countries not considered by Malembaum. The improvement in yields has also been slow in some traditional exporting countries, such as Australia, which have always been characterized by more extensive cultivation methods.

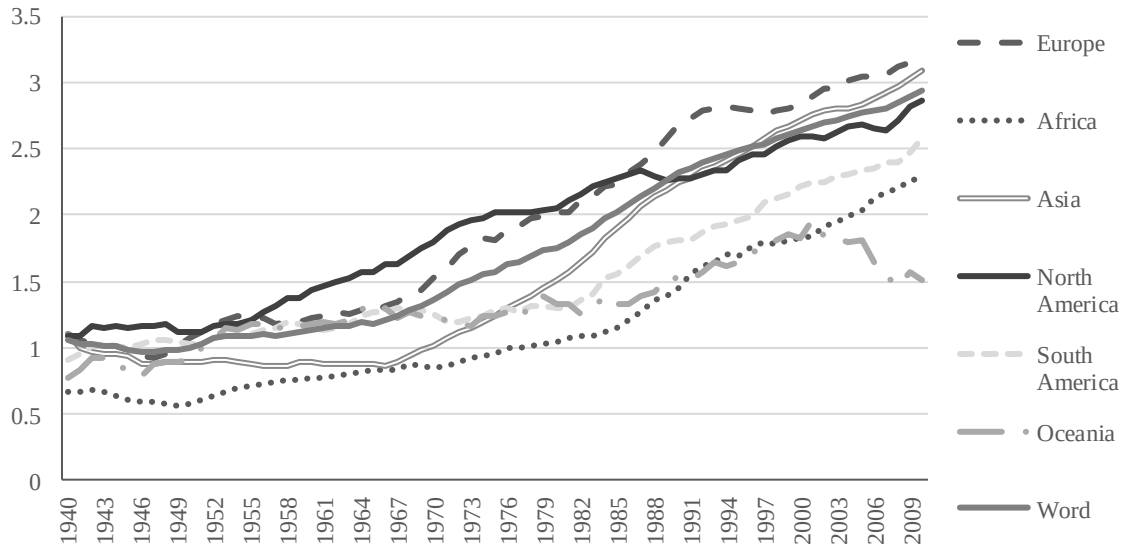
Figure 1.12 Wheat yields by Malembaum's groups and by continent, 1939-2010

1.12 (a) Wheat yields (tonnes / ha), by Malembaum's groups



Source: author's elaboration from FAO (2016), FAO Production and Trade Yearbooks (1948-1961), Institut International d'Agriculture (1947)

1.12 (b) Wheat yields (tonnes / ha), by continent



Source: author's elaboration from FAO (2016), FAO Production and Trade Yearbooks (1948-1961), Institut International d'Agriculture (1947)

Our theoretical model (figure 1.8) predicts that wheat production in a given country is determined by area harvested and yields, which in turn are dependent on many other variables. Now that the main trends in area and yields have been examined, we may offer a more robust explanation of the previously-mentioned changes in production. First, we have seen that **(1)** the spectacular growth of wheat production in Asian countries between1960-2000 (most notably in China) may be attributable to both an increase in area and an improvement in yields. Both developments had much to do with the agricultural policies set in motion by Asian governments. In general, domestic policies in Asia have been aimed at self-sufficiency and self-reliance over the second half of the 20th Century (Mitchell and Mielke, 2005). In China, it has been pointed out, the growth of agricultural production since the 1950s has been "one of the main accomplishments of the nation's development policies" (Rozelle and Huang, 1998). The wheat sector was indeed China's most tightly-regulated commodity over the pre-reform period (1950-1978). Producer quotas were established (Mitchell and Mielke, 2005) and irrigated area began a significant expansion thanks to publicly-financed large-scale surface projects (Stone, 1993). Rust-resistant semi-dwarf varieties were imported from the international agricultural research system in the late 1960s, and Chinese breeders incorporated these traits into their own varieties. All these factors allowed wheat yield performance to surpass all other major staples (Rozelle and Huang, 1998). Many things changed over the early reform period (1978-84) and late reform period (1985-95), since China began a

transition from a socialist system to one where an increasing proportion of its goods, including food, would be allocated by market forces (Sicular, 1991; Rozelle et al. 1996). Decollectivisation policies began in the late 1970s and the system of producer quotas for wheat was replaced by the Household Responsibility System: local leaders "began contracting production quotas with small work units and family farms instead of large collectives" (Mitchell and Mielke, 2005, 209). Provincial authorities were in charge of stimulating production, stabilizing prices, making provisions for satisfactory grain stocks, and ensuring wheat supplies for urban areas since the establishment of the Governor's Grain-Bag Responsibility System in 1995, (Mitchell and Mielke, 2005). Although these institutional innovations led to large increases in wheat production, it is not clear to what extent institutional reform has been the main driver of production[10]. Some authors claim that reforms were responsible for most of the growth in the early reform period (McMillan et. al, 1989; Lin, 1992). Other authors assert that technological change has been the engine of China's wheat economy (Stone, 1988; Rozelle and Huang, 2000). Considering the whole period, it seems that growth in the stock of research capital has been a major determinant of the significant improvements in wheat production (Fan and Pardey, 1995; Huang and Rozelle, 1997). The impact of decollectivisation, price trends, and environmental factors pales against the influence of public investment in research and irrigation (Rozelle and Huang, 2000). This is a characteristic common to other Asian countries. India has followed a policy of self-sufficiency since independence, and the public sector has systematically provided "agricultural inputs, such as fertilizer, power and water for irrigation at subsidized prices" (Mitchell and Mielke, 2005, 211). The successful adoption of the new high-yielding varieties that came with the Green Revolution was complemented with a system of minimum support prices to acquire wheat from farmers (Mitchell and Mielke, 2005). In spite of the liberalization process that began in the 1980s and accelerated since 1991, the Indian government has always preferred domestic buffer stocks over external trade in order to stabilize prices (Srinivasan and Jha, 2001). Government intervention has also been the norm in other Asian countries, such as Pakistan, where wheat producers have usually perceived support prices for their wheat (Faruqee et. al., 1996). In general, increased wheat production in the most populous Asian countries has been seen as part of an overall national food security strategy of reducing

[10] Importantly, institutional reforms led to lower labour utilization in China's wheat production. Chemical fertilizers have been widely used to substitute for falling labour inputs (Ye and Rozelle, 1984; Rozelle and Huang 2000).

dependence on food imports, and that is the main reason why government intervention has been widespread and aimed towards increasing production.

With regard to **(2)** the growing wheat production in the group of traditional European importers between 1945 and 2010, figure 1.11 shows that it had nothing to do with the evolution of the area, since the total amount of land devoted to growing wheat in these countries hardly changed throughout the whole period. On the contrary, the surge in wheat production can be understood only by looking at the very large increase in yields experienced in these countries. Of course, there are many factors that help to explain this improvement in land productivity. As figure 1.10 illustrates, by the end of the Second World War, wheat production in Western Europe had fallen below the pre-war level. The situation was critical in Western Germany – since it had been separated from the grain-producing eastern regions – and agriculture in the other European countries had also suffered from shortages of labour, machinery, and fertilizers (Tracy, 1964). In 1945, the main concern in these countries was to increase agricultural production as rapidly as possible (González Esteban et. al., 2016) and most governments maintained the tight regulation that had characterized the wheat sector during the War years. Since the major aims were to achieve – whenever possible – self-sufficiency and also to raise farmer's income (Federico, 2005), policy schemes always involved some kind of price support for wheat growers. The Marshall Plan, administered through the Organization for European Economic Cooperation (OEEC), also contributed significantly to the rapid recovery of wheat production from 1948 onwards (Tracy, 1964). Probably the most interesting fact is that no traditional European importer removed price supports for wheat once food security had been achieved. Production subsidies were consolidated with the establishment of the Common Agricultural Policy (CAP) in 1962, even when food shortages were no longer a problem. This had, indeed, a profound impact on wheat yields over the following decades. The key change was the surge in capital investment in farm machinery, technologies, and structure (Whitman, 1989). The European Community farm sector received a large share of the new gross fixed-capital formation, and it was used for equipment, irrigation, and land drainage (Whitman, 1989). Wheat growers adopted intensive production techniques and modern agronomic practices, and wheat production per hectare was maximized, thanks to the combination of labour-saving machinery and the massive utilization of fertilizers and pesticides. This process was encouraged by an

increased availability of financial resources – more flexible loans[11] – and by the high assured prices offered to farmers. In addition, there was a strong financial compromise with education and farmer training, and also with the research and development of new wheat strains (Whitman, 1989). As will be discussed in section 1.4.3, the main consequence of the resulting improvement in yields – and the consequent surge in wheat production – was that some traditional European importers began to be troubled with the problem of wheat surpluses. In fact, attention turned away from the problem of self-sufficiency to one of budgetary costs and surplus disposal over the 1970s and 1980s. The CAP began to shift from a heavily state-managed functioning towards a more market-directed approach, and wheat intervention prices were severely reduced in the CAP reform of 1992 (Rayner et. al., 1999). This reform – commonly known as the MacSharry reform – also required land "set-asides", and involved compensation to farmers for the price cuts through subsidies per hectare (Thompson and Gohout, 2000). These changes were considered so significant to warrant the name the 'new CAP' (Swinbank, 1997). Yet all those changes were implemented within the existing CAP structure of variable levies and export restitutions, and the European wheat sector continued to be isolated from the world economy (Thompson and Gohout, 2000). In fact, although further reforms were implemented in 2000 and 2003, total support was not cut significantly, and wheat production continued to increase (Mitchell and Mielke, 2005).

Regarding the **(3)** erratic trends of wheat production in the European exporters (most noticeably in the USSR), it must be said that Soviet agriculture suffered the most from World War II devastation. The ownership of land as private property had been abolished before the War, and peasants had been forced to work for the collective farms in what has been described as a 'slave system' (Collingham, 2011, 220). The USSR entered the war with its agricultural sector in a marked state of disrepair, and by the end of 1941 it had lost most of its fertile agricultural regions. The War put the whole system of food distribution in disarray, and the steep decline in food supplies (the case of wheat is plotted in figure 1.10) was responsible for roughly three million deaths by starvation (Collingham, 2011). In fact, all but the most privileged Soviets were affected by malnutrition and hunger, something that Stalin would not acknowledge when the War was over. The Soviet authorities attempted to raise wheat production over the following

[11] For instance, the French Government provided large subsidies to the *Credit Agricole* cooperative to provide low-interest loans to farmers. The German Government also gave significant subsidies to commercial banks and the loan-cooperatives for the same purpose (Whitman, 1989).

years, and they did so by expanding it on to 40 million hectares of new land in the semi-arid steppe region (Whitman, 1989). This campaign –known as the Virgin Lands Campaign – was part of Nikita Khrushchev's plan to boost agricultural production, and it was implemented during the 1950s and early 1960s (Burkitbayeva and Kerr, 2013). Wheat production growth was extraordinary over those years (1950-1970s), but it had little to do with the evolution of yields. Production had been pushed on to marginal land, and yields there were highly variable, because minor changes in precipitation could cause large variations in output (Whitman, 1989). Since the new areas were not really suitable for grain production, overall wheat yields remained stagnant over those years. In addition, much of Soviet agriculture had been collectivized, greatly distorting peasant incentives and dampening productivity growth. It has been claimed that there was a systemic failure of agricultural production in the whole country (Johnson and Brooks, 1983). The situation further deteriorated following the collapse of the USSR. Wheat production fell significantly over the 1990s, partly because the cropped area continued the downward trend that had begun in the 1970s, and mostly because wheat yields dropped due to the general disruption to agriculture, the drop in input use – especially fertilizers – and several years of bad weather (Liefert et. al, 2010). After this decline, wheat production in countries such as Russia, Ukraine, and Kazakhstan began to rise again, and it did so mainly because of an increase in yields. The new large corporate farms – which were basically the former state and collective farms of the Soviet period – conserved the old Soviet system of internal management and work incentives for several years after the dismemberment of the USSR (Wehrheim et. al., 2000). During the 2000s, however, "a growing number of farms have been adapting successfully to their market environment" (Liefert et. al., 2010, 68). The regional decline corrected the Soviet policy of pushing grain on to marginal land, and the switching in the Russian grain area from spring to higher-yielding winter wheat – together with the increased use of fertilizer – allowed for further increases in wheat yields and production.

The remaining stylized facts in the history of wheat production between 1939-2010 are **(4)** the falling share of North American wheat production, and **(5)** the increasing wheat production *per capita* in the traditional European importers *vs* the diminishing *per capita* production in North America since the mid-1980s. All these facts are, of course, closely interrelated. The main reasons behind the increasing wheat production per capita in the group of traditional European importers have been summarized before, and the

falling share of North American wheat production has much to do with it (and also with the rapid growth of wheat production in China and other Asian countries). At the end of WWII, North America alone accounted for almost 30% of total world wheat production. Yet in 2010 this share was barely 15%. In absolute terms, production followed an upward trend from the end of the War until the mid-1980s. This growth was mostly due to the improvement in wheat yields, and it was particularly strong between 1960 and 1985 (mainly because wheat acreage also expanded over those years). However, the advances in land productivity were not even close to those experienced by the European importers or by certain Asian countries, such as China (figure 1.12). Moreover, absolute wheat production in North America began to decline in the early 1980s due to successive reductions in the area harvested. This was a consequence of the major reforms undertaken by the United States and Canada during the 1980s. In the United States, the introduction of the Conservation Reserve Program removed roughly 10 million acres of wheat land from production, which was about 15 percent of the wheat area (Hoffman et.al., 1995). The 2002 farm bill continued the wheat-land diversion program (Mitchell and Mielke, 2005). The wheat area in Canada also began to decline in the 1980s, since the country basically abandoned direct price supports to wheat, in favor of general income support to farmers (Gardner, 1999). In fact, policy instruments in the United States and Canada have changed remarkably over time (Cochrane and Runge, 1992) yet "the principle of the almost sixty-year-old policy has not changed, namely to provide income support to farmers by supporting agricultural producer prices above international levels" (von Witzke and Hausner, 1993, 3). This principle has indeed determined North American agricultural commercial policy over the last 70 years (González et. al. 2016; Hathaway, 1987; Johnson, 1987) and wheat production has always been deeply affected by the choice of agricultural policy instruments. However, as will be discussed in section 1.4.3, wheat production trends in North America (and particularly its diminishing share in total world production) have also had much to do with the evolution of the agricultural trade policies of the European Union.

1.4.2 The demand side

The importance of wheat is not simply because of bread. Hard Red Winter wheat is generally utilized in bread production, but it is also widely used to make noodles, sweet goods, and all-purpose flour (Smith, 2000). Soft Red Winter wheat is commonly used for

cakes, flat breads, pastries, and crackers. Semolina flour, the basic input from which pasta products are made, is obtained from Durum wheat (Smith, 2000). In fact, wheat is the elementary ingredient for many Mediterranean dishes, such as pizza and pasta, it is a staple in many parts of the world, and it provides roughly one-fifth of the world's calorie supplies (Mitchell and Mielke, 2005). Moreover, wheat uses are not confined to producing food for human consumption: wheat is widely used for animal feed in certain countries, it can be used as biofuel, and it can be utilized as a food additive (starches, gluten, and so on). Of course, wheat consumption is not equally distributed among different end-uses in all countries. For instance, only 8 countries used wheat as biofuel in 2012, and each of those showed very different rates of use (Canals and Amante, 2015)[12]. As will be discussed later, the rate of use of wheat as animal feed has also varied greatly over time and across regions, and it has come to be truly important in some developed countries (despite wheat being disadvantaged as a feed grain because it costs more to produce than maize but provides less feed energy (Whitman, 1989)). Since wheat has many different end-uses, it has been pointed out that its demand is a derived demand (Stigler, 1966). The desire for wheat is not based on any intrinsic want for the wheat itself, but rather on the need to use the flour resulting from the milling of the wheat to produce differentiated products such as pastries, bread, and rolls (Uri and Douglas Beach, 1997). This means that "the demand for wheat is determined in the final markets by the demand and supply for wheat derivative products being sold" (Uri and Douglas Beach, 1997, 360).

As mentioned in the previous section, different classes of wheat have different end uses and are not always considered as close substitutes (Antle and Smith, 1999; Larue, 1991; Wilson, 1989)[13]. Yet, wheat has usually been regarded as a homogeneous product for the purpose of discussing demand trends. This is entirely understandable, since direct human consumption represents by far the largest part of wheat demand[14] (and basic demand for food possesses distinctive characteristics). In particular, the income-elasticity of demand for food has been a major concern throughout history. By the end of the 19th

[12] Although France used more tons of wheat for biofuel production than any other European country, its use corresponded to only 5% of total wheat consumption. The highest rate of wheat use as biofuel was in Sweden (23%). Overall, "49% of the wheat consumption in Europe was used for human/industrial purposes, 42 % was used for animal feeding, 3% was used as biofuel and 6% was used as seeds and for other industrial purposes" (Canals and Amante, 2015, 421). For more information on the historical evolution of wheat end-use by continent and by groups of countries, see figures 1.A.3 and 1.A.4 (in the appendix).

[13] In particular, the baking characteristic is directly related to end use (Ghoshray, 2006)

[14] According to FAO (2016), human consumption of wheat accounted for roughly 70% of total wheat utilization over the period 1960-2010. The remaining 30% consisted of non-food uses such as seed, feed, and waste.

Century, the Prussian statistician Ernst Engel had already noticed that, the richer the people, the lower the share of food in total family spending (Scholiers, 2014). Since food has to be obtained in *all* situations, it was also noticed that food demand was highly inelastic with respect to price: changes in price affected total demand only slightly (Lehfeldt, 1914). The awareness of this peculiarity of food demand – i.e. its low income-elasticity and low price-elasticity[15] – led to growing concerns about trends in food prices over the first decades of the 20th Century[16]. The fact that there was a clear physiological maximum in per capita wheat demand was certainly taken into account by the authors who aimed to explain wheat overproduction in the 1930s. It was feared that wheat income-elasticity of demand could be negative at certain levels of income: as people would earn more, they would purchase fewer wheat products because they would shift to more expensive sources of calories. These limits to the growth of wheat demand in industrialized countries were soon perceived as an obstacle to overcome the so-called 'wheat problem' in exporting countries. There was indeed the view that:

> *the inelasticity of the demand curve for human consumption of wheat means that the possibilities for increasing human consumption by decreasing price were limited indeed. Moreover, one major objective in expanding human consumption, thus increasing demand, was specifically to raise prices. It is clear, therefore, that only basic improvements in living standards and forward strides in the development of less developed areas could bring about such an increased demand for wheat*
>
> (Malembaum, 1953, 196)

Thus, after WWII it was clear to some authors and policymakers in the United States that supply-management policies would not be enough to tackle the 'wheat problem': an increased world demand for wheat was also strongly desirable. As illustrated in the theoretical model (figure 1.8), world wheat demand chiefly depends on three variables: the percentage of population that consumes wheat, the amount of wheat consumed *per capita*, and population growth. Considering this, and given the previously-

[15] Income and price-elasticities of wheat demand have been extensively studied throughout the 20th Century. The low income-elasticity of the majority of foodstuffs is demonstrated in Yates (1960), Yu et. al. (2002) and Cranfield (2003). With regard to price-elasticity, Malembaum noticed that the inelasticity of wheat demand may have been overstated, probably due to the fact that expenditures on wheat are usually maintained for a while when prices rise (Malembaum, 1953). It has also been pointed out that price-elasticity tends to be higher at lower levels of income (McMahon, 2013) and that general computations of price-elasticity usually impede seeing a more elastic demand for wheat as feed (Malembaum, 1953).

[16] This notion has been at the core of many political and theoretical controversies throughout the 20th Century. Raúl Prebisch – an influential economist born in one of the largest wheat exporting countries, Argentina – realized that the terms of trade had only deteriorated in underdeveloped, commodity-exporting countries (Prebisch, 1952). This would become the cornerstone of Latin-American structuralism.

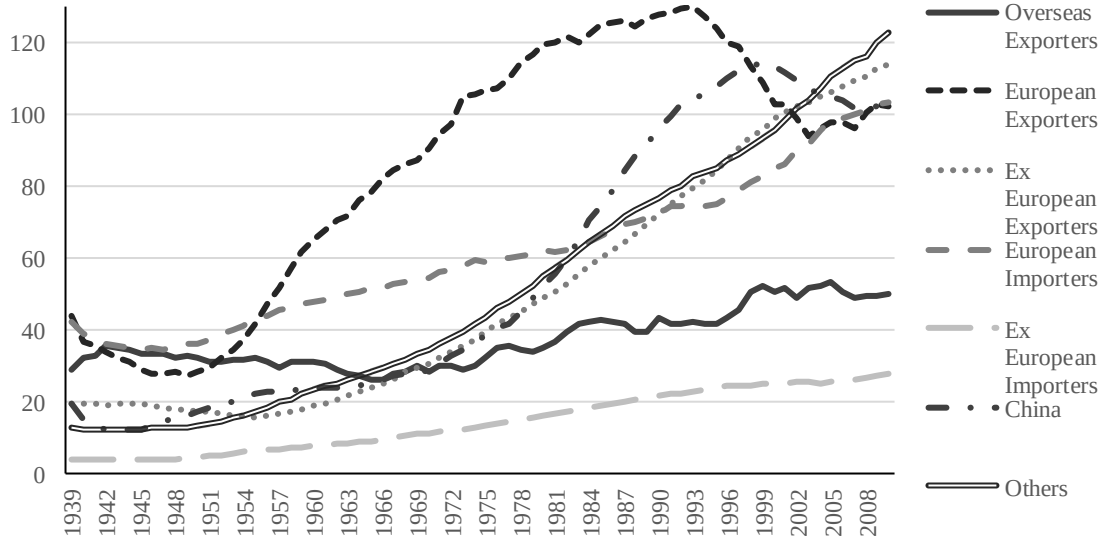
mentioned peculiarities of wheat demand in industrialized countries, it was clear to policymakers in wheat-exporting countries that the most promising possibilities of increased demand were to be found in developing countries.

World wheat consumption today is roughly four times what it was in the immediate postwar years. At the beginning of the War, Europe accounted for more than 50% of total world consumption and Asian citizens consumed roughly half of the remaining 50%. While North American consumption was also important in relative terms – particularly in the immediate post-war years – African demand for wheat was insignificant when compared to that of their European and North American counterparts (both in absolute and in *per capita* terms). The group of countries not considered by Malembaum consumed less than 10% of world wheat production. Yet this situation would change dramatically in the following 70 years. Figure 1.13 illustrates the evolution of wheat consumption[17] by continents and by Malembaum's groups of countries. The most interesting facts are **(1)** the growing wheat consumption in the group of 'others', which has much to do with **(2)** the spectacular growth of wheat consumption in Asia **(3)** the increasing wheat demand in the group of European exporters between 1950 and 1990 and the dramatic fall in the 1990s (mostly in the countries belonging to the former USSR) **(4)** the growing consumption *per capita* in the group of European importers and **(5)** other facts, such as the declining *per capita* trend in North America between WWII and the 1970s, and the stagnation of wheat consumption *per capita* in South America throughout the whole period.

[17] Wheat consumption trends by groups of countries have been plotted by constructing series of apparent consumption by country and aggregating countries into categories (i.e. continents and Malembaum's groups of countries). Apparent consumption has been constructed as wheat production *plus* wheat imports *minus* wheat exports [production + imports – exports]. This means that changes in inventories have not been taken into account for the purpose of estimating consumption. Stock variation may have been important in certain countries and for some years, but unfortunately, data on beginning and ending stocks is often unavailable and, when available, tends to be particularly vague. The ambiguity about the actual stock situation has been discussed in some recent works. For instance, Carter et.al. (1999) pointed out that, while USDA's estimation of ending stocks in China in 1997 was 400 million tones (USDA, 1998), the estimation made by the FAO was only 54 million tones (FAO, 1997). Importantly, "the 350 million tons difference between these two figures exceeds FAO's estimate that total world cereal grain stocks were 280 million tonnes" (Carter et. al., 1999, 78). Therefore, apparent consumption series plotted in figure 1.13 must be regarded only as a rough long-term approximation of the actual wheat consumption values.

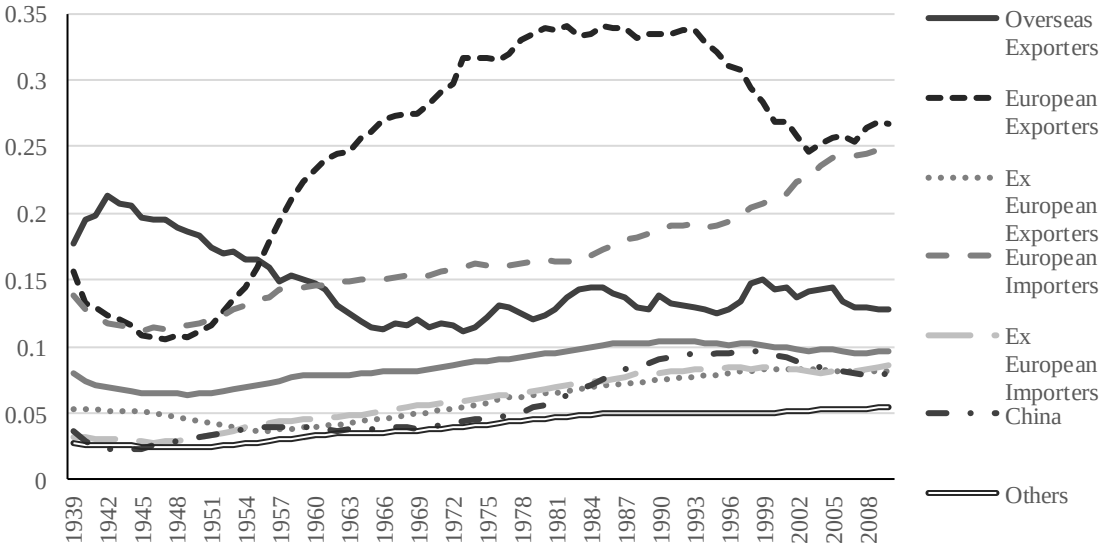
Figure 1.13 Wheat consumption by Malembaum's groups and by continent, 1939-2010

1.13 (a) Total apparent wheat consumption (tonnes), by Malembaum's groups



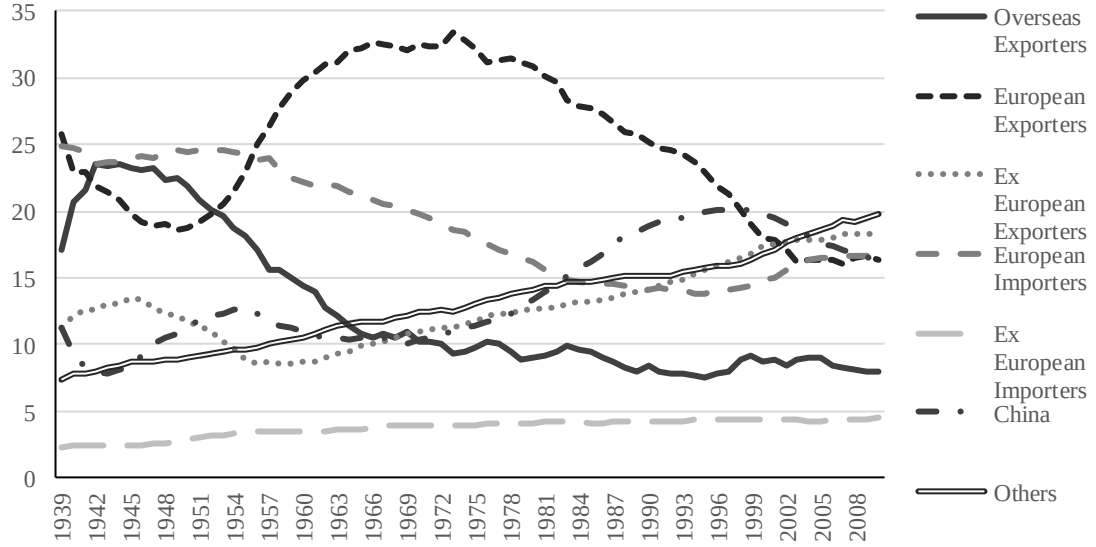
Source: author's elaboration from FAO (2016), FAO Production and Trade Yearbooks (1948-1961), Institut International d'Agriculture (1947), World Bank (2016), United Nations (2013) and Mitchell (2013)

1.13 (b) Apparent wheat consumption *per capita* (tonnes / population), by Malembaum's groups



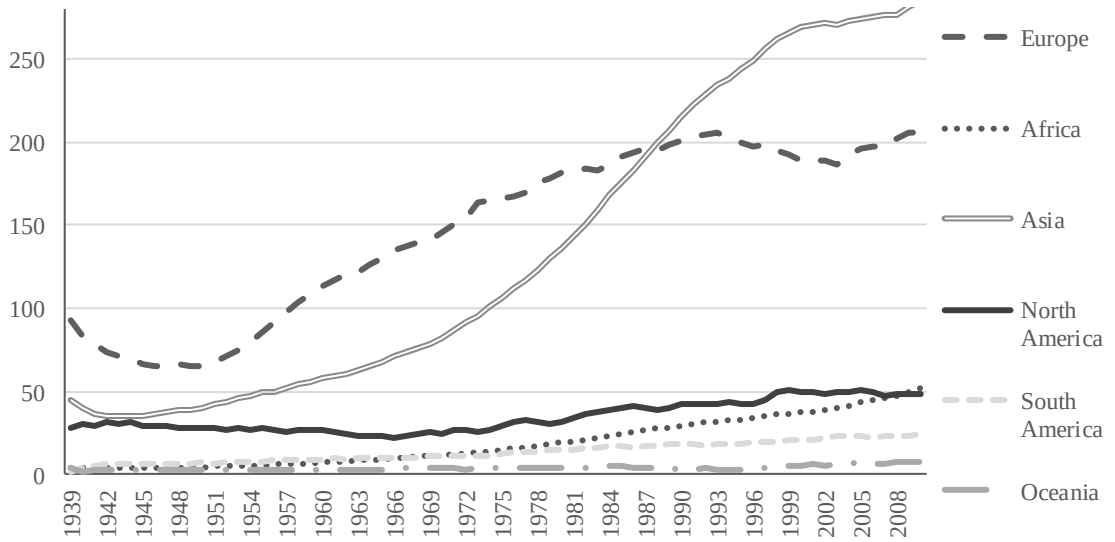
Source: author's elaboration from FAO (2016), FAO Production and Trade Yearbooks (1948-1961), Institut International d'Agriculture (1947), World Bank (2015), United Nations (2013) and Mitchell (2013)

1.13 (c) Wheat consumption shares (% of world consumption), by Malembaum's groups



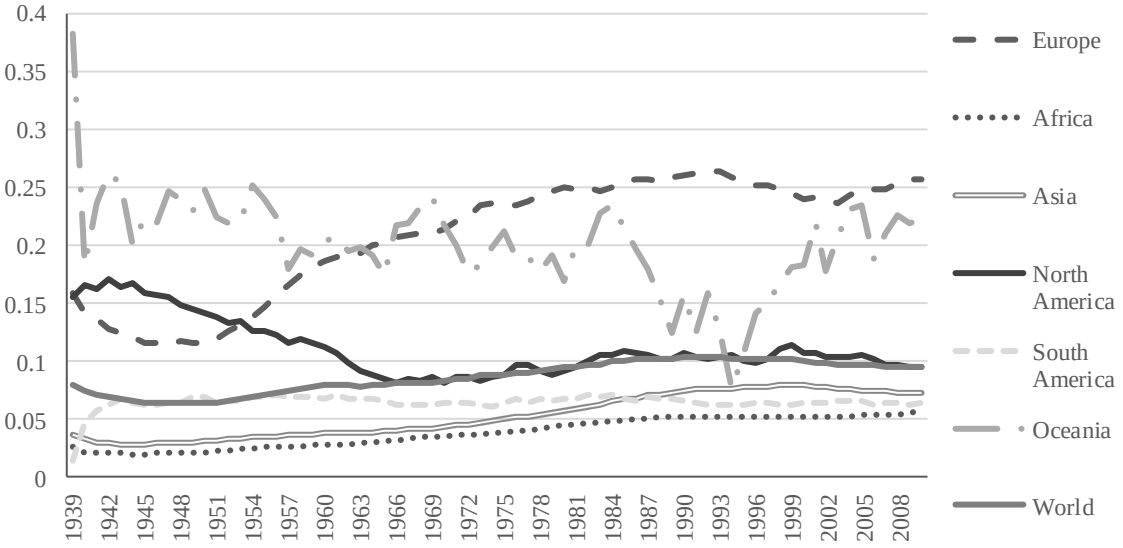
Source: author's elaboration from FAO (2016), FAO Production and Trade Yearbooks (1948-1961), Institut International d'Agriculture (1947), World Bank (2016), United Nations (2013) and Mitchell (2013)

1.13 (d) Total apparent consumption (tonnes), by continent



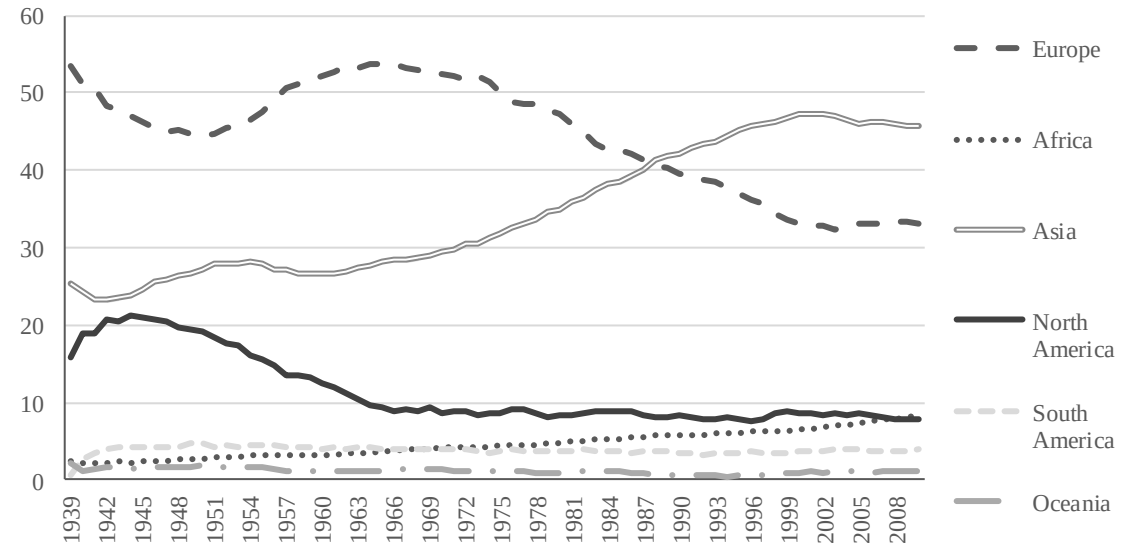
Source: author's elaboration from FAO (2016), FAO Production and Trade Yearbooks (1948-1961), Institut International d'Agriculture (1947), World Bank (2016), United Nations (2013) and Mitchell (2013)

1.13 (e) Apparent wheat consumption *per capita* (tonnes / population), by continent



Source: author's elaboration from FAO (2016), FAO Production and Trade Yearbooks (1948-1961), Institut International d'Agriculture (1947), World Bank (2016), United Nations (2013) and Mitchell (2013)

1.13 (f) Wheat consumption shares (% of total consumption), by continent



Source: author's elaboration from FAO (2016), FAO Production and Trade Yearbooks (1948-1961), Institut International d'Agriculture (1947), World Bank (2016), United Nations (2013) and Mitchell (2013)

The **(1)** growth in wheat consumption experienced in the group of 'others' is the key to understanding the evolution of wheat trade flows over the last 70 years. Although there are several exceptions – most notably Turkey, Iran and Iraq – overall wheat consumption in this group of countries was virtually negligible in the 1940s. Today, these countries account for more than 20% of total world consumption. Among the many factors that explain this evolution, one is of crucial importance: population growth. Almost all countries belonging to this group are located in Africa, South/Central America,

and South Asia, and most of them fall into the categories of low or lower-middle income according to the World Bank classification (World Bank, 2016). Importantly, population growth in this group of countries has been the strongest among all Malembaum's groups (even stronger than in China, India and other Ex European exporters). However, while it is obvious that the rising population has contributed significantly to push up demand, population growth alone cannot explain the increasing wheat consumption in these areas, nor does income growth answer. The other crucial factor is, of course, the transformation of markets and diets that occurred in these countries over the studied period. Overall, people living in these countries today consume twice as much wheat than they did in the postwar years. Average consumption per capita in the group of 'others' is still much lower than the world average, yet it should be noted that many of these countries began from a position close to zero consumption in the 1940s. Consumption patterns are heterogeneous across and within countries belonging to this group, but most of them share certain characteristics. Following our theoretical model, domestic wheat consumption in a country is directly determined by population, consumer income, the set of relative prices of wheat and competing staples, and consumer preferences. It has already been mentioned that population growth has been remarkable in these countries. Some studies also point to rising incomes as a key driver of growing wheat consumption in developing countries (Mason et. al. 2012). Yet the discussion of the main drivers of consumer preferences is inherently complex: preferences are dependent on culture, income, and relative prices, but also on policies and market promotion. With regard to international policies, a crucial feature of international wheat markets over the second half of the 20th Century has been wheat aid being shipped to developing countries (Schultz, 1960; Maxwell and Singer, 1979; Friedmann, 1992). In fact, many of the countries belonging to the group of 'others' have been the recipients of vast amounts of wheat aid – wheat at reduced prices – proceeding from the main exporting nations. The United States began to ship subsidized wheat to a great number of developing countries as soon as 1949 (Morgan, 1979, 116), but it was not until 1954 when P.L. 480 – commonly known as the Food for Peace Act – was approved and wheat aid was institutionalized on a global scale (Vellianitis-Fidas and Mansar Manfredi, 1977; Vengroff and Mei Tsai, 1982). Although the program was said to pursue humanitarian goals, its main motivation was indeed getting rid of the growing wheat surpluses (Eggleston, 1987; Bovard, 1998). Subsidized exports became thus the third pillar of supply-management policy in the United States, the other two pillars being price supports and production controls (Winders, 2009). Between 1956 and 1960, the

United States' help came to be more than a third of total world wheat trade (Friedmann, 1992) and when other exporting nations, such as France, began to be troubled with the problem of wheat surpluses, they set in motion similar dumping programs (Spoerer, 2010). The importance of wheat aid gradually diminished from the 1980s onwards (Mason et.al., 2012,), yet for many years, international wheat aid schemes distorted relative prices in recipient countries in a manner that encouraged wheat consumption. Food aid "exposed consumers to wheat and encouraged the development of a preference for wheat over locally-produced staples", particularly in Sub-Saharan Africa (Mason et. al., 2012, 5; Morris and Byerlee, 1993; Byerlee, 1987). Of course, changing eating habits required market-promotion programs that were carried out by the USDA and other national and international agencies (Morgan, 1979), and usually included milling and baking assistance (Collingham, 2011). Although there is a "lack of verifiable research in the area of export development and promotion in the international wheat trade" (Lauweryssen et. al., 1989, 13), all available studies have concluded that the returns to investment in wheat-export market development activities have been impressive (US Wheat Associates, 1986; Williams, 1985; Pointon, 1978).

Wheat aid was intended as a solution to the farm problem in industrialized countries, and that is the reason why it has been asserted that the transformation of diets in developing countries occurred "as a result of first-world agricultural policies" (Fairbairn, 2018, 7). However, many other factors help to explain the shift towards wheat consumption in the group of 'others'. Malembaum noted that there has been a historical 'preference for wheat' and that wheat could be referred to as "the only true bread grain" on the grounds that most consumers of cereals (except rice-eaters) have preferred it and have generally been willing to pay more for it than for other breads of equal nutritive value (Malembaum, 1953, 67)[18]. The convenience and reduced preparation time associated with wheat products relative to rice and maize has also been cited as a driver of the transition towards wheat in many developing countries (Senauer et.al., 1986; Byerlee, 1987; Morris and Byerlee, 1993; Kennedy and Reardon, 1994; Boughton and Reardon, 1997; Mason et.al., 2012). The development process is commonly associated with a rising opportunity cost of time, so households seek ways of reducing cooking time

[18] Malembaum also noted that no such preference exists for wheat as a feed, even when it becomes available at lower prices (Malembaum, 1963, 68). Since wheat with high protein content is usually associated with certain digestive troubles, wheat used as feed tends to be of lower quality (lower protein content) than that used for direct human consumption (Kent and Evers, 1994).

through foods such as bread and other wheat products. Since women are generally responsible for meal preparation in most developing countries, the growing participation of women in the labor force may also have fostered the shift towards wheat products (Mason et. al., 2012). In addition, bread had been the staple diet of the colonial masters in many African countries, such as Zaire and, for that reason, it has been claimed that bread consumption identified with progress and modernity for the masses in some of these countries (Morgan, 1979). Finally, it has often been pointed out that wheat consumption is systemically higher in urban than in rural areas (Delgado and Readon, 1991; Morris and Byerlee, 1993; Pingali, 2004; Fabiosa, 2006), so rapid urbanization in the group of 'others' may have also encouraged demand for wheat products.

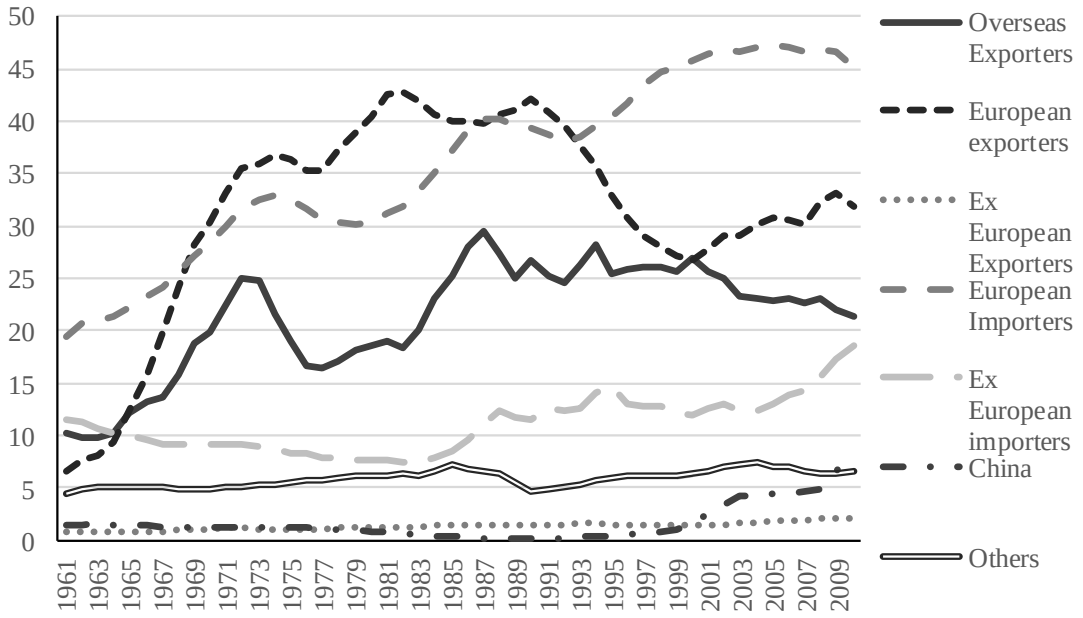
Since many of the countries belonging to the group of 'others' are located in South Asia, the **(2)** spectacular growth of wheat consumption in Asia can also be explained by most of the aforementioned reasons. However, wheat consumption trends in certain Asian countries deserve a closer look. In particular, demand patterns in China exhibit distinctive characteristics. First, rural households have always consumed more wheat than their counterparts in urban regions (Rozelle, 1998). In fact, China "is the only country in East and Southeast Asia that has a large wheat-consuming rural population" (Rozelle, 1998, 1). Thus, in contrast to other Asian or African countries, rural-urban migration's impact on total wheat consumption may have been different than in most other countries. Second, wheat consumption in China grew at historically unprecedented rates between 1970 and 1990, but then began a downward trend (see figure 1.13). This process has had much to do with income growth and increased food availability. While in the early years of the reform (1978-1984) rising incomes led to increased demand for wheat products (Rozelle, 1998), by the 1990s the attained levels of income meant that consumption of wheat would rise only marginally with further increments in income (Garnaut and Ma, 1992; Carter and Zhong, 1991). Since the 1990s, China's rural population began to substitute meat, fruit, and vegetables for wheat, in a similar process to that of other rapidly-developing countries in Asia (Carter and Zhong, 1999; Rozelle, 1998).

With regard to **(3)** the increasing wheat demand in the group of European exporters between 1950 and 1990 and the dramatic fall in the 1990s, special attention must be paid to wheat end-uses. Wheat used as feed has always been virtually non-existent in the group of 'others' and in developing countries in general (Asia, Africa and South America). However, when it comes to the European countries – and particularly to

the countries belonging to the former USSR – the picture is very different. As shown in figure 1.13, wheat consumption in the USSR rose dramatically between the 1950s and the 1980s, and plummeted in the 1990s. Figure 1.14 suggests that this trend had much to do with the increased utilization of wheat as feed over the Soviet period and its considerable fall during transition. In the former Soviet Union, wheat production "had been heavily subsidized to keep bread prices low and increase livestock production by providing feedstock to the then rather inefficient livestock industries" (Götz et.al., 2013, 216). Wheat used as feed came to be more than 40% of total domestic supply when the Brezhnev government decided to further expand livestock and milk production in the 1970s. The USSR government succeeded in raising meat production between 1970 and 1990 by over 60%, at the expense of becoming a large wheat importer over that same period (Liefert and Swinnen, 2002). However, the transition from centrally-planned to market economies that began in the early 1990s reversed the expansion of the livestock sector. Integration in world markets revealed that the countries belonging to the former USSR were not cost-competitive in livestock production (Liefert, 2002) and the huge government support of the livestock sector was largely eliminated. Therefore, the dramatic fall in wheat consumption that occurred in the 1990s was closely linked to the expansion of meat imports (Liefert et. al., 2010).

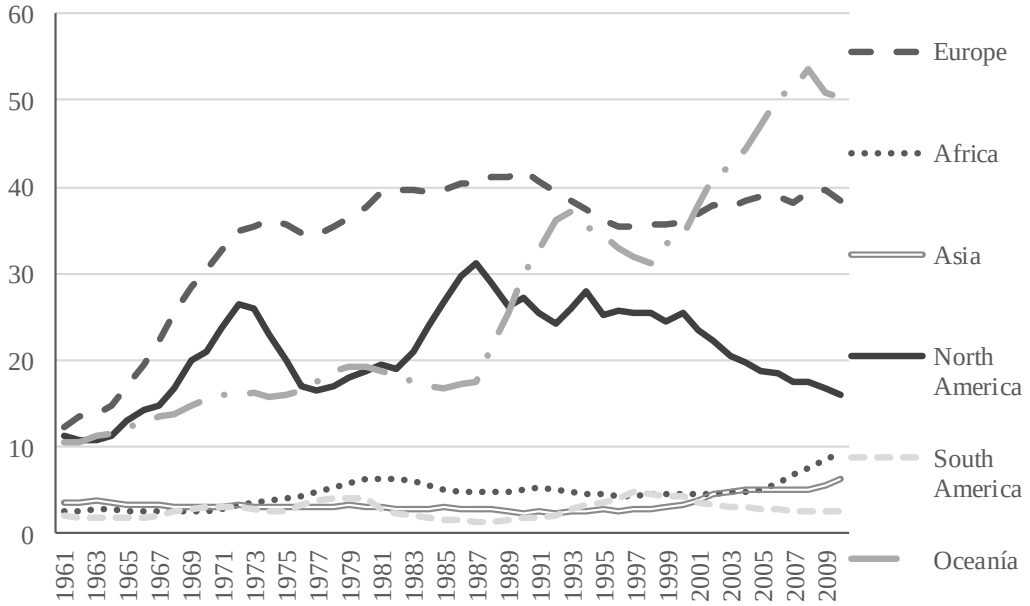
Figure 1.14 Wheat utilization: [Feed / domestic supply]*100, by continent and by Malembaum's groups, 1939-2010

1.14 (a) Wheat feed as a percentage of total wheat utilization, by Malembaum's groups



Source: author's elaboration from FAO (2016)

1.14 (b) Wheat feed as a percentage of total wheat utilization, by continent



Source: author's elaboration from FAO (2016)

The **(4)** growing per-capita wheat consumption in the group of European importers, throughout the whole period, also had much to do with the changing end-uses of wheat, and with an increasing utilization of wheat as feed, in particular. In his seminal work of 1953, Malembaum concluded that there was little room for increased wheat

consumption per capita in high-income countries, such as the European importers (Malembaum, 1953). His contention was based on the observed income-elasticity of demand: at high income levels, the elasticity of demand with respect to income is negative. However, he acknowledged that wheat utilization per capita could rise due to the shift towards meat products and the subsequent increased utilization of wheat as feed. This is exactly what happened with the European importers over the 70-year period studied. While wheat utilization *per capita* in 2010 was roughly 1.6 times higher than in the 1960s, wheat used as feed went from about 20 % in the 1960s to almost half of total wheat utilization in the 2000s. Of course, increased utilization of wheat as feedstock was closely related to the specific protections that wheat was granted under the CAP. In fact, the growing wheat consumption in the European importers contrasts with consumption trends in other high-income countries, and in particular with **(5)** the declining *per capita* trend in North America between WWII and the 1970s, and its stagnation over the following 40 years. Falling wheat consumption *per capita* in the United States and Canada may be described as a 'trading-up' consumption adjustment: income growth made household preferences for better food products more affordable and resulted in "changes in food baskets represented by a shift from the consumption of carbohydrate-rich staple grains to high-value, protein-rich meat and dairy products" (Fabiosa, 2012, 599). In addition, demand for wheat as feed was much lower than in Europe throughout the whole period. Since wheat is disadvantaged as a feed grain, its effective demand depends greatly on the relative prices of competing alternatives, such as maize and soybeans. The lower demand for wheat as feed in North America has been, therefore, strongly related to the relative abundance of corn and soybeans in the United States. On the contrary, Europe's soil and climate are unsuitable for growing soybeans (Morgan, 1979), and the relative abundance of wheat over alternative feed grains in countries such as France have pushed up demand for wheat as feed.

1.4.3 Trade explanation

1.4.3.1 International wheat markets overview and price trends

Government intervention in wheat markets is a worldwide phenomenon, because the multiple objectives of economic policy can be pursued through wheat policies. Given the considerable weight of the wheat sector within the agricultural systems of most developed countries, and considering the growing importance of wheat in the basic diet

of developing countries, this should come as no surprise. Of course, the objectives of government intervention in exporting countries have been very different from those of importing countries. The choice of instruments and the configuration of international wheat trade have also varied greatly over time.

It is not possible to talk about industrialized countries' agricultural policies in the postwar years, and over the 1950s, without mentioning the so-called *farm-adjustment problem* or *farm-income problem* (Schultz, 1945; Heady, 1966; Johnson, 1987). In fact, the 'wheat problem' of the 1930s was only an early and certainly virulent manifestation of a much wider problem, namely the task of adapting basic agricultural supplies to demand, while ensuring the farmers a 'fair income' (Tracy, 1964). The approval of the Agricultural Adjustment Act (AAA) by president Franklin D. Roosevelt in 1933 was intended to raise the purchasing power of wheat and other basic foodstuffs while tackling the problem of overproduction, and it has often been said that this marked the beginning of the end for *laissez faire* in world agriculture (Libecap, 1998; González Esteban et.al., 2016). The Second World War alleviated the problem of agricultural overproduction for a while, but wheat surpluses in the United States reappeared soon after the end of the conflict. In Europe, the wartime years were characterized by growing concerns about the availability of food supplies, and strong state intervention in agriculture was maintained in the postwar years with the aim of achieving self-sufficiency (Federico, 2005, 198). However, no European government liberalized its domestic agricultural markets once food shortages disappeared, thus revealing that one of the main drivers of agricultural policy had been tackling the farm-income problem (Tracy, 1964). Wheat policies in exporting countries have certainly been conditioned by this issue throughout the 20th Century, though the design and execution of those policies may have also served other interests, such as increasing export earnings and guaranteeing price stability (Kostecki, 1982). Most OECD wheat exporters, such as the United States and the European Union (EU), have consistently supported domestic wheat production through the institution of price support policies (Mitchell and Mielke, 2005). For instance, a U.S. Department of Agriculture study (USDA, 1987) found that "producer subsidies were used in all wheat exporting countries with the exception of Argentina" (Shalaby et.al., 1988, 25). These policies were relatively successful in bolstering farmer's income, but failed in the objective of reducing wheat surpluses. In fact, price supports stimulated production by artificially raising the prices received by farmers, thus aggravating the problem of

surpluses (Tracy, 1964). Of course, the international wheat trade became increasingly distorted as a result. First, price support schemes were required by the implementation of import and tariff barriers, because the cheaper foreign wheat in the domestic market would otherwise erode domestic prices (Hathaway, 1987). It has often been claimed that the General Agreement on Tariffs and Trade (GATT), signed in 1947, allowed protectionism in agriculture because it was specifically designed to permit the functioning of the agricultural support programs then in existence in industrialized countries, and particularly in the United States (González Esteban et.al., 2016; Rausser, 1995; Hathaway, 1987). Second, export subsidies were soon required in exporting countries in order to get rid of the accumulating wheat surpluses. Wheat export subsidies have been widely used to reduce stocks, raise farm income, increase foreign exchange holdings, and maintain or increase market shares (Shalaby, 1988). They have generally taken two forms: (1) reduced export prices paid by foreign purchasers –including wheat aid recipients – and (2) export credit guarantees/insurance[19] (Shalaby, 1988). Export subsidies for wheat have been a "perennially important issue in international agricultural trade" (Wilson et.al., 1999, 1): they have harmed competing exporters by forcing them to accept lower prices for their wheat (Mitchell and Mielke, 2005), and they have been expensive both for governments and taxpayers (O'Connor, 1982). In addition, since surplus disposal schemes have been reduced over periods of relative wheat shortages, export subsidies have contributed to global price volatility (Mitchel and Mielke, 2005). The importance of the North American aid diminished when international wheat prices skyrocketed in the 1970s, but wheat surpluses soon reappeared and aid schemes gave way to a fierce battle over subsidized commercial sales between the main exporting countries (Friedmann, 1992). Given the overall harmful effects of these practices, it has been claimed that "for wheat, negotiated reductions in export subsidies were perhaps the most important outcome of the Uruguay Round of Agreements Act", when high-income countries agreed to reduce the value of their wheat export subsidies by 36 per cent by 2000 (Wilson et. al., 1999, 3).

The policies of wheat importing countries have varied greatly. One reason for this is that they have depended on many factors, such as income levels, population growth, political stability, political economy equilibriums within the country, the international

[19] It has been pointed out that "extension of credit guarantees provides for lending at interest rates less than those for commercial lending, thus providing an implicit interest subsidy over the length of the loan" (Wilson et.al., 1999: 9). The implicit interest subsidy can be considerable.

credit situation, and foreign exchange restrictions (Shalaby et. al., 1988, 25). In general, wheat-importing countries have always been concerned about the lack of assured access to wheat export markets over periods of shortages and high prices. There have been, however, different approaches to tackle the problem of food security. On the one hand, **(a)** many countries, particularly in Asia, have long intervened strongly in grain markets (Tyagi, 1990; Alderman and Garcia, 2003; Rahman et. al., 2005; Chabot and Dorosh, 2007). Government intervention has taken many forms: subsidies, price guarantees, trade restrictions, credit facilities, domestic purchases, and sales of wheat stocks… (Islam and Thomas, 1996; Timmer et. al., 1983; Timmer, 1989). While in centrally-planned economies, those instruments served rigid long-term goals, in market economies they were usually the result of more decentralized decisions (Dennis, 1973). In any case, it has been said that part of the rationale for these interventionist policies has been "a deep mistrust of private traders and private markets, deemed to work against the best interests of consumers and producers" (Chabot and Dorosh, 2007, 335). For instance, wheat production has been significantly subsidized in importing countries such as Japan (Lee et.al., 1994; Jabara, 1981), Pakistan (Dorosh and Salam, 2006), India (Srinivasan and Jha, 2001), and China (Rozelle and Huang, 2000; Crook, 1996). Of course, domestic wheat markets in those countries required substantial protectionist measures that isolated them from international markets. On the other hand **(b),** there was a large group of developing countries whose governments followed industry-driven development strategies and adopted policies with an anti-agricultural bias (Anderson et.al.,2013; Krueger et.al. 1988; GATT, 1958). Most South American and African countries welcomed subsidized foreign wheat while discouraging local wheat production (for instance, many of these countries implemented anti-agricultural biased policies, such as export taxes). The key idea, inspired in the law of comparative advantage proposed by David Ricardo (1817), was to maintain a low level of urban wages by virtue of low food prices, and thereby "to maintain a high level of profits of factory owners for reinvestments and to enhance economic growth" (Son, 1986, 2). Yet somehow, surprisingly, many of these governments also put the emphasis on increased food production and self-sufficiency –which was clearly at odds with the anti-agricultural bias – so ambiguous policy settings often arose in those countries (FAO, 2000). The overall trend in most wheat importing countries – and particularly in those whose governments supported heavily its local wheat sector over the 1950s, 1960s, and 1970s – has been one of deregulation and liberalization from the 1980s onwards (Dorosh and Salam, 2006; Srinivasan and Jha, 2001; Rozelle and Huang, 2000).

In addition, the anti-agricultural bias in most African and South American countries began to lose importance in the 1980s, so it may seem that there has been a convergence process in the policies of wheat importing countries[20] (Anderson et.al., 2013). There have been, however, significant exceptions to those overall trends. For instance, certain high-income countries such as Japan – which is one of the largest wheat-importing countries – have not reduced import controls or meaningfully reduced producer support so far (Mitchell and Mielke, 2005). India and other significant developing countries began to cautiously liberalize wheat trade in the 1980s and 1990s, but have now expressed opposition to further reform under the WTO, "arguing that developing countries have not gained from the Uruguay Round and that the URAA deals only with issues of importance to developed countries" (Young, 2000, 19). It can surely be said that wheat policies in importing countries have been the subject of severe controversy throughout the last 70 years. In fact, the history of wheat policies in deficit countries could easily be taken as an example of the very different perspectives that have coexisted on the purpose of ensuring adequate availability of food and household food security in importing countries (González Esteban, 2014). Moreover, considerably less agreement has existed on how the food security aim can be balanced with other goals, such as maintaining farm income or achieving economic development (O'Connor, 1982).

The wheat market is often taken as an example of a competitive system in Economics textbooks (Samuelson et.al., 1995; Mankiw, 1998; Krugman, 2006). This is understandable, mainly because the domestic market for wheat usually fits well within the theoretical construction of a structure with many individual producers who cannot affect prices by increasing or decreasing their output. The consideration of wheat markets as an example of perfect competition has been questioned on the grounds that wheat is not a homogeneous product (Lame, 1991) and also by virtue of the presence of 'informational uncertainties' (Dahl et.al., 2003). Nevertheless, since Economics textbooks are usually concerned with theoretical – rather than empirical – elucidations, it may be considered that the wheat market constitutes a good example of real-world perfect competition, particularly with regard to the supply side. Yet, it is somehow ironic that, when it comes to the demand side, the market for wheat has historically been one of the most concentrated. While there are millions of final consumers of wheat products,

[20] Nominal rates of assitance to wheat, by Malembaum's groups, have been plotted in figure 1.A.2 (see the appendix).

considerably fewer purchasers of unprocessed wheat (or wheat flour) exist. In fact, although a certain 'resemblance of competition' has existed in some producing countries, the predominant market structure for wheat throughout the 20th Century has been one of monopsony (Morgan, 1979). With the notable exception of the United States, all the major wheat exporters have had government-controlled wheat boards, whose purpose is to buy all wheat from producers, and this has been the case for most of the past 70 years. With regard to the United States, it has been claimed that "in spite of the rhetoric of a free market, five giant international grain companies dominate the U.S. grain market and, consequently, in a very real sense, the world's grain trade" (O'Connor, 1982, 234). Since there has been an enduring active participation of governmental and quasi-governmental institutions that possess market power in the global wheat trade, it is quite clear that "the world wheat market exhibits properties that violate many of the assumptions applied in traditional trade models" (Roeber, 2002, 1; Carter el.al., 1990).

State trading enterprises (STEs) have certainly been a crucial aspect of the world wheat trade over the last 70 years. According to the WTO (1995), STEs are "governmental and non-governmental enterprises, including marketing boards, which have been granted exclusive or special rights or privileges, including statutory or constitutional powers, in the exercise of which they influence through their purchases or sales the level or direction of imports and exports" (McCorriston, 2007, 25). There are, therefore, two types of STE: exporting and importing. Rather than ownership, the key distinguishing characteristics of an STE are its exclusive rights to sell/purchase and its objective, which is not necessarily maximization of profits (McCorriston, 2007). While wheat exporting STEs are typically designed to maximize the revenues of their wheat suppliers, importing STEs have usually been conceived to restrict wheat imports while trying to maximize consumer surplus (Maeda et.al., 2001). The Canadian Wheat Board (CWB) and the Australian Wheat Board (AWB) may have been the most significant wheat-exporting STEs, whereas some noteworthy examples of wheat-importing STEs include the Food Corporation of India (FCI), the China National Cereals, Oils and Foodstuffs (COFCO), the Marketing Department for National Wheat (CITRIN) in Brazil, and the General Authority for Supply Commodities (GASC) in Egypt (Young and Abbott, 1998). Both importing and exporting STEs came to be extremely important after WWII, and a special clause was included in the GATT to permit countries the utilization of these institutions (Abott and Young, 1999). It has been estimated that more than 90% of the

world wheat trade involved a government agency on one or other side of the transaction during the 1980s (Shalaby, 1988, 25). Of course, STEs' objectives have been pursued through discrimination between domestic prices and import/export prices – which is equivalent to the application of tariffs/export subsidies – and this has greatly affected the wheat trade. It has often been said that these agencies have been 'unfair' traders in international markets (Koo and Krause, 1994; McCorriston and Maclaren, 2007), so that they became a most controversial issue in the new WTO (Lavoie, 2003). As a result, although state trading is still practiced by many governments, the private sector is now responsible for a growing share of wheat imports in countries such as Pakistan, Indonesia, the Philippines, Algeria, Turkey, Morocco, Egypt, Brazil, and Mexico (Mitchell and Mielke, 2005, 202).

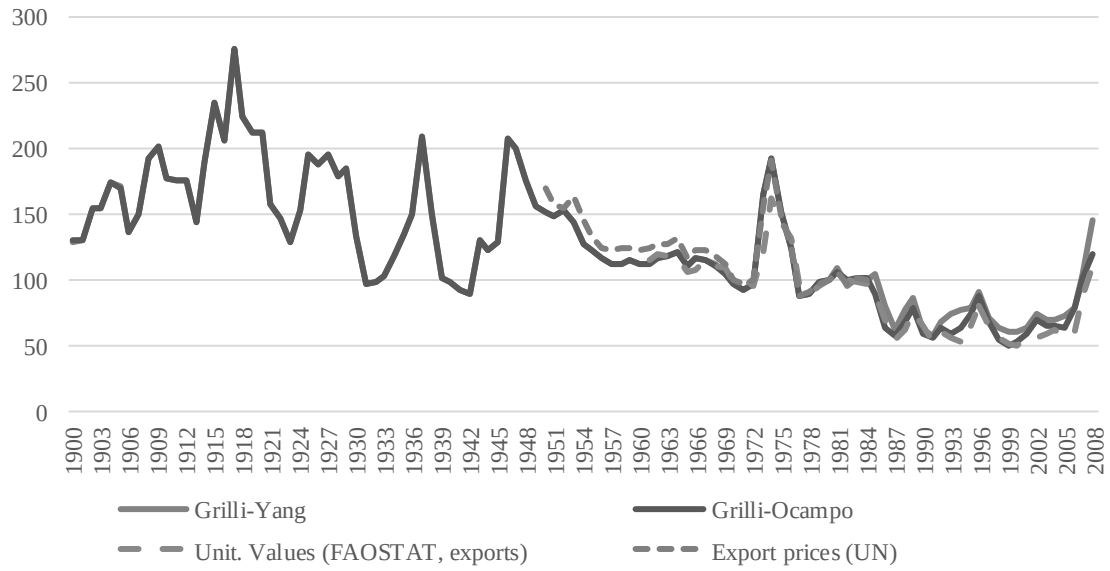
The issue of wheat prices has strongly affected the organization of wheat trade throughout the 20th Century. Plummeting wheat prices were at the core of the 'wheat problem' before WWII and, as mentioned above, most governments intervened heavily in their respective domestic wheat markets in order to deal with it. Prices recovered during the war, but the issue was far from solved at the end of the War. In fact, the persistent tendency towards falling real wheat prices (see figure 1.15), together with the issue of price instability, have been a major concern for both exporting and importing countries ever since. Many factors have been pointed out to explain wheat price trends in the 20th Century (Roe et.al., 1986; Bredahl et.al. 1979), yet it seems that the most important single cause of the overall downward trend in prices has been the permanent tendency for production to exceed demand (Schroeder and Goodwin, 1990). Beginning in 1933, a number of international actions were taken to assure price stability while providing an answer to the problem of accumulating surpluses in exporting countries. The first International Wheat Agreement (IWA) was signed for that purpose in 1933, and eight more came into being between the end of the War and 1971[21]. All those agreements functioned as multilateral contract devices: importing countries agree to buy a specific quantity or a specific share of their total imports from participating exporting countries, and exporting countries "agree to make available to the importing country a sufficient quantity to satisfy its needs" (O'Connor, 1982, 235). Of course, a price range is negotiated in the agreement: "if prices rise above the maximum of the specified range, the exporter is, nevertheless, required to sell the specified quantity for no more than the maximum

[21] 1948, 1949, 1953, 1956, 1959, 1962, 1967 and 1971 (Ali, 1982).

price. Conversely, when prices fall below the minimum set forth in the agreement, importers are still required to purchase the specified quantity for the minimum price" (O'Connor, 1982, 235). Additional obligations were also typically negotiated within these agreements. For instance, the IWA of 1933 included the commitment by importing countries not to promote wheat production within their own territories, and to reduce custom tariffs on wheat. The agreement also mandated a significant reduction of wheat acreage in the main exporting countries. The main problem, however, was that the mode enforcement of such commitments was not clearly specified (Callear and Blandford, 1981). In fact, the established export quotas in 1933 proved unenforceable and the first IWA collapsed in 1934. The Second World War solved the problem of wheat surpluses for a while, but the fear of an 'overproduction → falling prices → falling income' cycle reappeared soon after the end of the conflict. This led to the IWA of 1949, which incorporated a flexible price range but did not introduce production controls. Subsequent IWAs –from 1949 to 1968 – were ratified by a growing number of nations, but often omitted key trading countries "which believed that the terms would not act in their own interests" (Callear and Blandford, 1981, 4). For instance, the USSR occasionally signed on as an exporter, but never as an importer, and the United Kingdom and Argentina did not participate in the agreements, at different times, due to discrepancies over prices or market shares. Significant changes were introduced in the IWA of 1959, since import quotas for wheat were expressed as a percentage of the country's total wheat imports – rather than in absolute terms – and the agreement applied only throughout the price range and was not applicable at the minimum price level (Ali, 1982). The effectiveness of the agreement was thus reduced, "since exporters were no longer guaranteed specific quantities of wheat sales nor a percentage of the total sales under the IWA" (O'Connor, 1982, 242). Other changes were taking place in the global wheat trade in those years: while the IWA of 1949 clearly put the emphasis on price stability (Farnsworth, 1956), the focus during the late 1950s and 1960s shifted towards the huge surplus stocks piled up in North America. The global wheat trade had fallen into disarray due to the widespread domestic farm support programs, and particularly as a result of certain developments not envisioned in 1949, such as the establishment of the CAP (Johnson, 1987). In addition, massive wheat-aid/surplus disposal programs had been initiated in the United States and Canada, and the U.S. had made "repeated invocations to widen the basis of 'burden sharing'" (Callear and Blandford, 1981, 5). Five years of discussion in the Kennedy round of negotiations under the GATT led to the signing of the International Grains

Arrangement (IGA) in 1968, which, despite its name, was applicable only to wheat (Ali, 1982). This agreement was ambitious in scope, and for the first time linked together two independent legal instruments: the Wheat Trade Convention (WTC) and the Food Aid Convention (FAC). While the WTC was the successor to the previous IWAs – in fact, it was another multilateral contract between importing and exporting countries, covering prices and trade commitments – the FAC provided a minimum guaranteed level of wheat aid to developing countries, thus establishing a sharing of responsibility for food aid (O'Connor, 1982).

Figure 1.15 Real wheat prices, 1900-2010 (different sources)



Source: author's elaboration from FAO (2016) and Grilli and Yang (1988)

It has been argued that the active IWAs in the 1950s and 1960s facilitated a cooperative duopoly market structure for wheat (Wilson, 1986). The seminal work of McCalla (1966) concluded that Canada could be characterized as the price leader, the United States as a price follower, and the rest of the competitors as price takers. Other authors have claimed that Canada and the United States were "a two-nation wheat cartel that saw its long-term interests served by keeping prices low enough to discourage other countries from growing more of their own supplies or, worse still, going into the wheat-exporting business themselves" (Morgan, 1979, 103). With regard to the observed price stability from 1953 to 1967 (see figure 1.15), the FAO attributed it to the storage policies of Canada and the United States (FAO, 1970). Yet, while it may be considered that the IWAs were successful in their aim of price stability, it has also been argued that they only

translated price instability into variations in the level of wheat stocks (Josling, 1977). Some scholars were even more skeptical and asserted that "the suspicion remains, however, that wheat prices from 1933 to 1972 would have been much the same on average, in the absence of any formal agreements" (Callear and Blandford, 1981, 13). In fact, the Wheat Trade Convention of 1968 collapsed because it failed to tackle the problem of overproduction and, as a result, wheat prices plummeted once again in the late 1960s (FAO, 1970). Moreover, since most exporters decided to contravene the floor price and liquidated their wheat stocks, it was claimed that "the IGA had failed to build a system that would endure adequate reserves to cover periods of poor harvests, *despite* the tendency towards overproduction" (Callear and Blandford, 1981, 5). These temporary shortages of wheat would create unprecedented problems for importing countries in the 1970s.

As figure 1.15 shows, the general trend of falling prices was severely disturbed when wheat prices skyrocketed in 1972. Grain production in the USSR had been much lower than expected, and the Soviet Government decided to shift domestic policy by purchasing as much as 440 million bushels of U.S. wheat in the commercial market (Morgan, 1979). This historic episode was known as 'the great grain robbery', since the Brézhnev administration negotiated in secret with the American grain companies, and the Soviet purchases were subsidized by the U.S. taxpayers to the tune of $150 million (Morgan, 1979). Increased world demand for wheat caused a severe reduction in world stocks, and escalating wheat prices raised important concerns about food security in both importing and exporting countries. In fact, all the major industrialized importers and exporters implemented consumer and/or producer subsidies and export taxes in order to isolate their domestic market from the international market from 1972 to 1975 (Josling, 1979; Gerlach, 2009)[22]. The spectacular surge in wheat prices in the 1970s made clear that the relative price stability that had prevailed in the 1950s and 1960s had not been due to the IWAs' mechanisms: wheat prices had been kept within the range mostly because the governments of Canada and the United States had had the ability to hold them there (Callear and Blandford, 1981). The new circumstances of the 1970s – i.e. inflationary

[22] For instance, Canada and Australia taxed wheat exports through discriminatory pricing policies in the 1973/74 crop season. The idea was to keep domestic prices low but raise export prices (Grennes et.al. 1978). At the same time, the European Community removed both export subsidies and the variable levy; Japan subsidized grain imports; Argentina imposed a grain embargo; and the United States reduced producer support significantly while increasing consumer subsidies (Callear and Blandford, 1981; Josling, 1979;).

pressures of high food prices and significant wheat import dependency in many developing countries – revealed an urgent need for a new Wheat Trade Convention. Importantly, it became increasingly obvious that such an agreement should include an internationally-coordinated scheme of stock provisions. However, the likelihood of reaching that kind of agreement was surely diminished by discrepancies on issues such as the 'fair' sharing of costs and the size of the reserves (Callear and Blandford, 1981). As a result of the continuous failures to achieve a new IWA, a growing number of countries, including the United States, relied on bilateral agreements in order to stabilize wheat markets (O'Connor, 1982). As opposed to the formal contracts to supply specific amounts of wheat, bilateral agreements instituted a fairly stable communications framework between the exporting and the importing country. They lacked, however, the "coordinated effort necessary to balance supply and demand" in wheat markets (O'Connor, 1982, 259). Although the need for codes of conduct in the world grain trade was emphasized in the Tokyo Round of negotiations under the GATT (1973-79), it was not until the Uruguay round (1986-94) that such a multilateral effort was made.

This historic URAA accomplished "what has eluded the GATT for a long time, that of putting agricultural trade under the same umbrella as that of other sectors (e.g., manufacturing)" (Fabiosa, 1999, 11). With regard to wheat, significant changes and regulations were introduced in five areas of importance to wheat growers: market access, domestic support, state trading, sanitary and phytosanitary issues, and export subsidies (Young, 2000). Nontariff barriers – such as quotas, variable levies, voluntary import restraints, and discretionary import licensing – were converted to tariffs, and a maximum level for the tariffs was set in many cases. Price support policies were grouped by their impact on trade and production into three categories: the 'green', 'amber' and 'blue' boxes. Policies included in the 'amber box' were those considered to have the greater impact on production and trade – i.e. non-decoupled policies such as administered prices for wheat, marketing loans, storage payments… – and many significant importing and exporting countries agreed to reduce this kind of support significantly over the following years (USDA-ERS, 1998; Young, 2000). Additional measures were taken in order to prevent countries from using sanitary and phytosanitary regulations as a way to protect their domestic agriculture, and reform of STEs was also strongly encouraged. Finally, it has been claimed that the major change in the wheat market was the limit imposed on export subsidies, and particularly that imposed on subsidized EU wheat exports: "from

the high EU wheat export of 20 mmt in the early 1990s (with a large portion subsidized), it had to operate within the maximum allowable subsidized wheat export of 16.8 mmt in 1997/98" (Fabiosa, 2000, 14). It is undeniable that the world wheat market has become less distorted since the URAA, yet most of the historical issues that have affected wheat trade are still far from being solved. Dirty tariffication[23] has limited the reduction of effective protection: for several countries, the URAA ad-valorem rate for wheat in 1995 was higher than in 1986-88 (Ingco, 1995). Governments in high-income countries have continued to provide substantial support to producers, particularly under the 'green-box' policies that were not subject to reduction commitments under the GATT (Fabiosa, 2000). The United States and the European Union no longer use wheat export subsidies but still use other surplus disposal schemes, such as export credits and non-emergency aid (Mitchell and Mielke, 2005). Although there has been a substantial trend towards liberalization in importing countries' domestic wheat markets –and the percentage of imports accounted for by STEs has declined significantly – the EU and certain other significant wheat importers, such as Japan and Korea, are unlikely to support further reform (Young, 2000). A significant number of developing countries, including India, have also expressed opposition to further reform, "arguing that developing countries have not gained from the Uruguay Round and that the URAA deals only with issues of importance to developed countries" (Young, 2000, 19; WTO, 1999).

With regard to the structure of international wheat exporters, some authors have argued that the duopoly described in McCalla (1966) for the 1950s and 1960s evolved and gave way to a somewhat different situation in the 1970s. The consolidation of Australia as a major wheat exporter meant that the international market structure for wheat could be more accurately described as a triopoly among the United States, Canada, and Australia (Alaouze et.al., 1978). Since Argentina's exports increased progressively over the following years and the EU also emerged as a powerful exporter, it was concluded that the world wheat market in the 1980s and 1990s should be understood as an oligopoly (Paarlberg and Abbott, 1986; Smith et.al.,1995; Ghoshray, 2006). It is clear that single-desk sellers such as the CWB or the AWB have been capable of exerting market power, but recent studies do not agree on who has been the price leader; for instance, while some authors find evidence of price leadership for Canada (Smith et.al.

[23] The term 'dirty tariffication' refers to "the use, during the tariffication process, of artificially high domestic prices and artificially-low world market prices in order to set a particular tariff at a level higher than it should be" (O'Connor, 2003, 8).

1995), other works assert that the United States acted as the price leader (Goodwin and Shroeder, 1991), and other studies find no distinctive leader (Mohanty et. al., 1999)[24]. Importantly, all existing studies of the international wheat trade have persistently characterized the world wheat market as imperfectly competitive, despite the process of liberalization that most exporting STEs have been experiencing (Ghoshray, 2006; Young, 2000). However, it is important to note that, as occurred in the 1950s and 1960s, the enduring oligopolistic structure of world wheat exports did not impede the continuation of the secular downward trend in real wheat prices after the 1970's crisis. The deteriorating trend in the purchasing power of wheat from 1976 to 2007 was mostly due to the increased supply "both in the exporting and importing countries, caused by large production subsidies in developed countries and food security concerns in the importing countries" (Gómez Plana and Devadoss, 2004, 1643). The declining trend in the real prices of wheat was only interrupted in 2007, when a new and abrupt price crisis again raised concerns about food security in importing countries, and undoubtedly diminished their willingness to further liberalize the wheat trade. Moreover, many international reactions resembled those of the price crisis of the 1970s: while there was a protectionist reaction in importing countries, key wheat exporters – in this case, some former USSR countries, such as Russia – instituted export taxes in order to isolate its domestic market from price volatility and protect national consumers (Götz et.al., 2013).

1.4.3.2 Trade explanation and recapitulation

In section 1.2.2.3 ('Trade Flows: 1945-2010), we presented an overview of the main world trade trends in wheat by continents and by Malembaum's groups of countries. This allowed us to identify some of the main processes that have taken place in the world wheat market over the last 65 years, namely **(1)** the European Importers' transition from being the most significant importer group to standing as a crucial net exporter, **(2)** the prevalence of the Overseas Exporters as key wheat-exporting nations, even while their share of global wheat exports has diminished greatly, **(3)** the critical role of the Ex-European Exporters (most notably the USSR) as wheat importers in the 1970s and 1980s, and their re-emergence as key wheat exporters after the 1990s, **(4)** the spectacular growth of wheat imports in the group of Ex-European importers and in the group of 'others' throughout the whole period. The continental analysis showed that Europe as a whole

[24] It has been pointed out that the absence of agreement with regard to price leadership may be due to the inaccurate assumption that wheat is a homogeneous product (Ghosray, 2006).

(including the countries belonging to the former USSR) ceased to be a net importer of wheat in the 1990s and consolidated as a major net exporter in the 2000s. North America has remained as the most significant exporter, and Oceania (Australia) has progressively improved its trade balance in wheat throughout the whole period. The relative weight of South America in total wheat trade has barely changed over this 65 year period. On the other hand, Africa and Asia have been the recipients of rapidly growing amounts of wheat. The purpose of this section is to provide a synthetic explanation of those transformations, taking into account the supply trends analyzed in section 1.4.1, the demand patterns described in section 1.4.2, and the institutional transformations summarized in section 1.4.3.1.

One of the most significant changes that have taken place in the world wheat market over the last 70 years has been the **(1)** transition of some countries belonging to the traditional European Importers – i.e. the United Kingdom and France – from being crucial net importers to acting as major exporters. While this group of countries accounted for roughly 75% of total world imports in 1939, their joint share was only 20% in 2010. Moreover, the European Importers' share in total world wheat exports came to be around 30% in the peak years of the 1990s[25]. At the end of the Second World War, the situation in the group of traditional European Importers was one of acute shortages of food. All European governments had intervened significantly in their own agricultural sectors during the war years, and widespread intervention was maintained with the aim of achieving self-sufficiency once the conflict was over. In the postwar years, these countries received vast amounts of food aid through the Marshall Plan of European Reconstruction and soon, food shortages disappeared. However, price supports for wheat were maintained, even when short supplies were no longer a problem, thus revealing that the main driver of agricultural policy was the political willingness to provide income support to farmers. Since that moment, the history of wheat among the European importers has been one of supply outstripping demand. The growth of *per capita* wheat production from the 1950s to the 2000s was indeed outstanding, and it can only be explained by the spectacular improvement in land productivity. Production subsidies were consolidated

[25] It is important to note, however, that studying the overall trends of the European Importers as a whole usually hides a substantial degree of heterogeneity within the countries belonging to the group. For instance, although the average trend in the traditional European Importers has been one of reducing dependence upon foreign wheat, some countries –such as Spain or Italy– have actually deepened their dependence upon wheat imports throughout the studied period.

under the CAP, and guaranteed high prices for wheat – together with credit facilities and public investment – motivated the widespread adoption of new production techniques based on labour-saving machinery and the massive utilization of pesticides and fertilizers. However, the rapid growth of wheat production was not accompanied by a similar increase in wheat demand. Most countries belonging to the European Importers group had attained significant levels of income *per capita* by the 1960s, and the commonly low – or even negative – income-elasticity of demand for wheat products at high income levels meant that the possibilities of increasing *per capita* demand were certainly limited. In fact, increasing wheat utilization *per capita* in the 1970s, 1980s, and 1990s had much to do with the growing use of wheat as feed (which in turn was directly related to the distortion of relative prices under the CAP). Since population growth has been low throughout the whole period, and wheat utilization *per capita* has grown at much lower rates than production, European importers have tended to produce much more wheat than they have consumed. And, since domestic prices for wheat have usually been set above world prices, export subsidies and various surplus disposal schemes have been needed in order to get rid of excess production. Most of these countries have made commitments to reduce specific supports to wheat growers and eliminate export subsidies under the URAA, yet they have found alternative ways to maintain protection and keep wheat flowing from their ports.

The **(2)** Overseas Exporters group accounted for roughly 90% of total world wheat exports in 1945. Although their relative importance in the international export market for wheat gradually diminished over the following 65 years – in 2010, their share of total exports was only 50% – these countries have managed to maintain their position as the most prominent wheat exporters throughout the whole period. The United States and Canada were pioneers in struggling with the farm-income problem prior to WWII, and their agricultural policies in postwar years were indeed motivated by a desire to give farmers a 'fair' income. The GATT, signed in 1947, was specifically designed to permit the domestic farm programs then in existence in the United States (which required tariffs and other measures of protection to function). Several schemes for limiting domestic output were implemented, with the aim of preventing wheat prices from falling more, but the problem of overproduction persisted and new ways of surplus disposal had to be found. Public Law 480 was approved by the U.S. congress in 1954, and it institutionalized a way of getting rid of wheat surpluses by shipping them to developing countries at

subsidized prices. Since the United States and Canada overwhelmingly dominated the international wheat market in the 1950s and 1960s, they were able to coordinate price policies and tried to prevent other countries from growing more wheat. This was partly achieved through the eight International Wheat Agreements signed between 1945 and 1971. Yet despite all this, and even while Australian and Argentinian wheat exports were also gradually increasing, the Overseas Exporters' share of total world exports fell steadily. In fact, the relative weight of the Overseas Exporters in the wheat export market further accelerated its downward trend from the 1980s onwards. This was, of course, related to supply trends in those countries: while overall world wheat production continued its upward trend between 1980 and 2010, production in the Overseas Exporters leveled off and remained fairly steady over this period. The stagnation of production was one consequence of the evolution of yields and area harvested. First, probably due to climate and soil conditions, wheat yields in the Overseas Exporters group remained much lower than those in certain European countries, such as France, Germany, and the United Kingdom. Second, the area harvested in the United States and Canada followed a downward trend from 1980 to 2010, due to the implementation of wheat-land diversion programs and the progressive abandonment of direct supports to wheat growers. This process was, in turn, related to the loss of the European market for wheat due to the successful establishment of the CAP: US-EEC negotiations in the 1960s ended up with North American soybeans being exempted from EEC import duties in exchange for European protection against wheat. With regard to Argentina, its agricultural policies have probably been the most prominent exception among wheat exporters throughout the whole period, since wheat exports have usually been taxed rather than subsidized. The case of Argentina is one example of wheat production and exports being directly discouraged through incentive-distorting government policies.

The **(3)** role of the European Exporters in the international wheat trade is particularly interesting, for two reasons. First, because most of the countries belonging to this group have been centrally-planned economies for most of the studied period; and second, because they were significant net importers of wheat for roughly two decades (from the early 1970s to the mid-1990s) but in recent times they have returned to their traditional position as major exporters. Their changing role in the world wheat market has been, of course, deeply influenced by government policies that have affected both supply and demand trends. The agricultural sector in the Soviet Union was completely devastated

during the Second World War, and the government tried to increase wheat production as rapidly as possible in the immediate postwar years. This was achieved through the Virgin Lands Campaign, which expanded wheat cultivation to 40 million hectares of marginal land. The growth of wheat production in the 1950s and 1960s was indeed remarkable, yet it was based on area increases rather than on enhanced land productivity. Distorted peasant incentives due to collectivized agriculture also limited the improvement in yields. Meanwhile, demand for wheat was also rapidly increasing as a result of the growing use of wheat as feed and the rising meat consumption of Soviet citizens. This meant that, by the early 1970s, Soviet self-sufficiency in wheat could no longer be maintained. The so-called Great Grain Robbery – massive purchases of subsidized wheat from North American grain companies in 1972 – marked the beginning of roughly two decades in which the USSR acted as a major net importer in the world wheat market. The situation would only be reversed when the whole centrally-planned system of the USSR collapsed in the early 1990s. The re-emergence of the European Exporters as significant net exporters of wheat over the 2000s was strongly related to supply and demand trends from the 1990s onwards, and particularly with the declining use of wheat as feed that occurred as a result of the transition to free-market capitalism. Wheat yields moderately improved thanks to better land allocation and increased use of fertilizers from the mid-1990s onwards, and this led to a discrete growth of wheat production. However, rising wheat exports in the 2000s were mostly the result of radical changes in demand patterns: the extraordinary protections that had been granted to the livestock sector under the Soviet regime were removed during the transition, and rising meat imports meant that much lower amounts of wheat were required for feedstock.

Finally, **(4)** the group of 'others' is composed of countries whose importance in the world wheat trade in 1945 was negligible. They neither consumed nor produced significant amounts of wheat at the end of WWII. However, their wheat imports multiplied by 20 over the following 65 years and, by 2010, they had come to absorb roughly half of total world wheat imports. This group of countries has played a key role in solving the 'wheat problem' in exporting countries, since they have been the recipients of growing amounts of wheat coming from the overproducing developed regions. Wheat products were almost unknown in most of these countries in 1945, but a transformation of diets took place, slowly but steadily, and a significant shift towards wheat products occurred from the 1950s onwards. Although *per capita* demand for wheat has not come

to be as high as in Europe and North America, wheat has become a staple in the diet of many urban consumers of these countries, successfully displacing traditional local products in their food baskets. This was partly the result of the active promotional activities carried out by national and international agencies, such as the USDA and the FAO, but it was also the consequence of other underlying processes, such as growing income, urban migration, and the rising opportunity cost of time. Importantly, despite the fact that growing wheat consumption *per capita* was a necessary condition of raising total demand in these countries, population growth has probably been the most important factor. Wheat production has grown significantly over the whole period, yet it has not kept pace with the spectacular rise in demand. This is directly related to two issues. First, most countries belonging to the group of 'others' are located in areas not suitable for wheat production, and environmental and soil conditions have limited land productivity. And second, most of these countries applied anti-agricultural-biased policies in the 1950s and 1960s with the aim of fostering industrialization via cheap food imports and low food prices for urban workers. In most cases, this strategy revealed itself as ineffective, but also as extremely dangerous in terms of ensuring adequate food supplies to their population. The wheat-price crisis from 1972 to 1975 raised serious concerns about food security in these countries, leading to a reduction of the anti-agricultural bias of their policies over the following decades. However, in spite of this, most countries belonging to the group of 'others' became more dependent upon wheat imports between 1975 and 2010. Their agricultural sector had been disregarded for many years, and the productivity gap that existed between wheat production in these countries and in the main exporting regions widened. In addition, the new consumption habits of their populations, including their growing preference for wheat products, showed no sign of slowing down.

1.5 Conclusions

The world wheat market showed evident signs of disintegration during the late 1920s and 1930s: trade and prices plummeted, and governments of both exporting and importing countries intervened worldwide in order to deal with the associated problems. This situation was referred to as 'the wheat problem', and the writings of the time reveal that the outlook for the world wheat economy was indeed gloomy. However, the available data shows a dramatic increase in wheat trade in the 65 years that followed the end of the Second World War. A solution to the 'wheat problem' was found – at least as far as market disintegration was concerned – via the attempt to put an end to a perturbing

paradox: while wheat overproduction was an essential part of the problem in exporting/developed regions, millions of people remained hungry in the developing countries. Since the problem was, of course, that no effective demand for wheat existed in those countries – wheat products were virtually unknown and there were also institutional and income barriers preventing people who may have wanted to buy wheat from getting it – an institutional international effort was made in order to promote the transfer of wheat surpluses from overproducing regions to deprived countries. The reconstruction of the international wheat trade that is delineated in this paper clearly shows that that was indeed what happened between 1939 and 2010. It also shows, however, that wheat trade flows have been affected by a large number of economic and institutional variables, with those variables differing in time and space. The theoretical model provided in section 1.3 puts together all those variables and illustrates some of the complex interactions between them. It also serves as an inspiration for the organization of the paper, and differentiates between the supply side, the demand side, and the institutional side. A detailed discussion of the underlying reasons for the observed trends in global wheat trade is carried out in section 1.4, so there is no need to repeat it here. Yet, three general conclusions may be extracted.

First, state policies have significantly affected the international distribution of wheat trade flows. Developing countries that have achieved a certain degree of self-sufficiency in wheat – i.e. China, India, Pakistan – have done so through extensive state intervention. Industrialized countries that have gone from being major wheat importers to being significant wheat exporters – i.e. France, the United Kingdom, Germany – have done so thanks to massive programs of governmental support and protectionist measures at the border. Traditional wheat exporters, such as the United States and Canada, have benefited from large export subsidies and other surplus-disposal schemes in order to dump their wheat abroad. On the other hand, most countries whose trade balance in wheat has deteriorated – Colombia, Ghana, Jordan, Kenya, Nigeria, Indonesia, among others – have systematically disregarded domestic wheat production and have not restricted wheat imports. It is not clear whether or not widespread state intervention in the wheat sector has restricted the total amount of wheat traded: while measures that directly discourage imports have imposed limits, policies directed towards promoting exports may have actually led to expansion. It is obvious, however, that these policies have been responsible for large losses, in terms of efficiency costs, at the aggregate level. The main problem is

that the national rationales behind those policies have usually been entirely understandable.

The second conclusion is, in fact, directly related to those rationales: wheat policies – in both exporting and importing countries – have not been an end in themselves, but rather an instrument to achieve various national goals. These objectives, ranging from raising farm income to attaining food self-sufficiency, have systematically overridden other considerations regarding international trade. Wheat trade policies have been an adjunct of domestic policies aimed at tackling unresolved domestic issues. This means that the actual distribution of world wheat consumption, production, and trade has been affected by concerns not directly related to wheat. In addition, there are reasons to believe that many of the theoretical considerations and normative statements that have been made regarding state intervention in wheat markets have also been strongly influenced by those other issues.

A final corollary emerges from all the above. It has been said that the 'wheat problem' ceased to be an issue because wheat trade resumed its growth after WWII and the signs of market disintegration disappeared. Yet, this is only partially true. While the wheat trade has surely increased over the last 70 years, the primary forces that initially motivated the 'wheat problem' are still extant and have not been given a universally satisfactory solution. Real prices of wheat have followed a marked downward trend since the end of WWII and, while it is true that income support for wheat growers in exporting countries is now commonly decoupled from production, the farm-income problem still strongly influences trade policy. There is no doubt that the structural change process has contributed to moderate the dimensions of this issue, but it is clear that the farm problem still overrides most other considerations regarding the design of wheat-trade policies in high-income exporting countries. On the other hand, recent experiences of wheat price-crisis have shown that no global solution has been provided on the issue of price volatility and its devastating effects on wheat importing countries. The collapse of the Doha Development Round in 2008 perfectly illustrates that no global consensus has been reached on the issue of how to balance wheat trade liberalization with domestic aims, such as increasing farm income or guaranteeing food security. International wheat flows, national wheat policies, and international negotiations over those policies are still subject to the old, unresolved questions.

Appendix

About the data

Data on wheat production (tonnes), area harvested (hectares) and trade (tonnes) has been obtained from FAO (2016), FAO Production and Trade Yearbooks (1948-1961), Institut International d'Agriculture (1947) and, in some cases, Mitchell (2013). Data on population is from World Bank (2016), United Nations (2013) and Mitchell (2013).

Data on wheat consumption has been calculated as *production minus net exports* (apparent consumption). Wheat yields have been estimated as *production / area harvested* (tonnes / hectares). Wheat imports and exports have been constructed as wheat equivalents (*wheat + wheat flour*), applying the standard conversion factor of 1.39 (1 tonne of wheat corresponds to 0.72 tonnes of wheat flour).

Several adjustments have been made in order to estimate longer and homogeneous series:

* In the few cases where data was not found for a given year and that year was located between two years with data, linear interpolation has been applied.

* There is a significant group of countries lying in the tropical belt between 23 degrees south latitude and 23 degrees north latitude which do not report official data on production. There are good reasons to believe that wheat production in those countries has been either not significant or inexistent over the period studied[26]. For all purposes, wheat production in those countries have been considered as if it were zero.

* In the cases when one country reported values for wheat trade but provided no information on trade of wheat flour, the latter has been considered as inexistent for the purpose of estimating wheat equivalents.

* Finally, in some countries data on population has been extrapolated in order to obtain population series from 1945 onwards.

Data provides information from 135 *countries* in Europe (26), Africa (45), Asia (35), North America (14), South America (11) and Oceania (4). A number of transformations have been made in order to obtain continuous series. The 15 countries belonging to the former USSR have been treated as if the USSR had not been dismembered. The same is true for the countries belonging to the former Yugoslavia and Czechoslovakia. Other countries have been grouped together for the purpose of the analysis: Belgium with Luxembourg, Ethiopia with Eritrea, and Malaysia with Singapore. The USSR has been considered as a European country.

[26] For instance, see Byerlee (1987), pp 308. The full list of countries comprises: Arab Emirates, Benin, Burkina Faso, Cambodia, Cape Verde Islands, Costa Rica, Cote d'Ivoire, Cuba, Djibouti, Dominican Republic, El Salvador, Ethiopia-Eritrea, Fiji, Gabon, Gambia, Ghana, Guinea, Guyana, Haiti, Hong Kong, Indonesia, Jamaica, Liberia, Madagascar, Malaysia-Singapore, Malta, Mauritius, Nicaragua, Panama, Papua, Philippines, Republic of Congo, Senegal, Sierra Leone, Sri Lanka, Thailand, Togo, Trinidad-Tobago, and Vietnam.

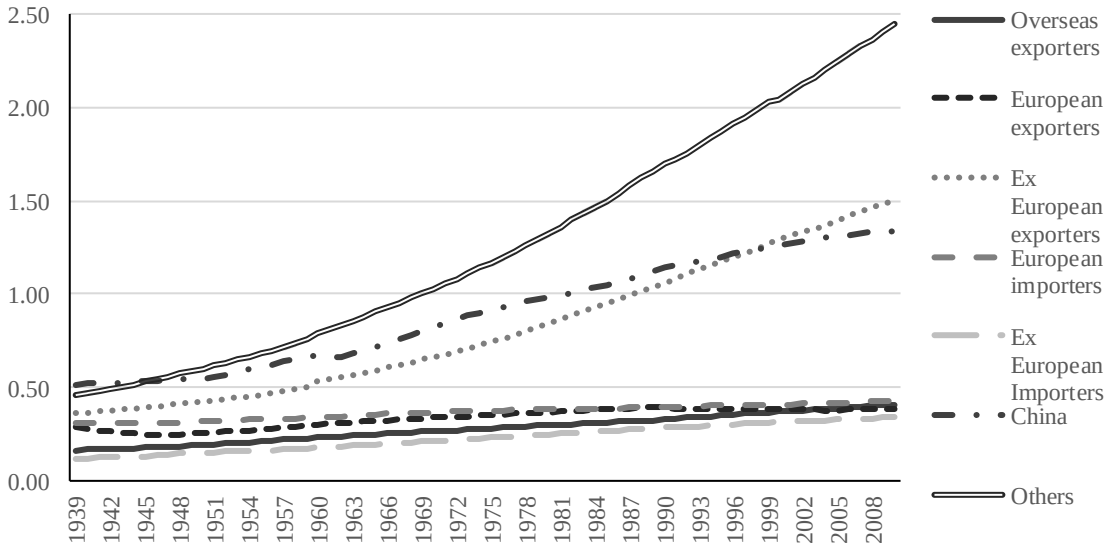
Table 1.A.1 Countries, by continent

Europe	Africa	Asia	North America	South America	Oceania
Albania	Algeria	Afghanistan	Canada	Argentina	Australia
Austria	Angola	Arab Emirates	Costa Rica	Bolivia	Fiji
Belgium-Luxembourg	Botswana	Bangladesh	Cuba	Brazil	New Zealand
Bulgaria	Burkina Faso	Benin	Dominican Republic	Chile	Papua
Cyprus	Burundi	Bhutan	El Salvador	Colombia	
Czechoslovakia	Cameroon	Cambodia	Guatemala	Ecuador	
Denmark	Cape Verde Islands	China	Haiti	Guyana	
Finland	Chad	Hongkong	Honduras	Paraguay	
France	Cote d'Ivoire	India	Jamaica	Peru	
Germany	Djibouti	Indonesia	Mexico	Uruguay	
Greece	Democratic Republic of Congo	Iran	Nicaragua	Venezuela	
Hungary	Egypt	Iraq	Panama		
Ireland	Ethiopia-Eritrea	Israel	Trinidad Tobago		
Italy	Gabon	Japan	United States		
Malta	Gambia	Jordan			
Netherlands	Ghana	Kuwait			
Norway	Guinea	Lebanon			
Poland	Kenya	Malaya-Singapore			
Portugal	Lesotho	Mongolia			
Romania	Liberia	Myanmar			
Spain	Libya	Nepal			
Sweden	Madagascar	North Korea			
Switzerland	Malawi	Oman			
United Kingdom	Mali	Pakistan			
USSR	Mauritania	Philippines			
Yugoslavia	Mauritius	Qatar			
	Morocco	Saudi Arabia			
	Mozambique	South Korea			
	Namibia	Sri Lanka			
	Niger	Syria			
	Nigeria	Taiwan			
	Republic of Congo	Thailand			
	Republic of South Africa	Turkey			
	Rwanda	Vietnam			
	Senegal	Yemen			
	Sierra Leone				
	Somalia				
	Sudan				
	Swaziland				
	Tanzania				
	Togo				
	Tunisia				
	Uganda				
	Zambia				
	Zimbabwe				

Source: author’s elaboration

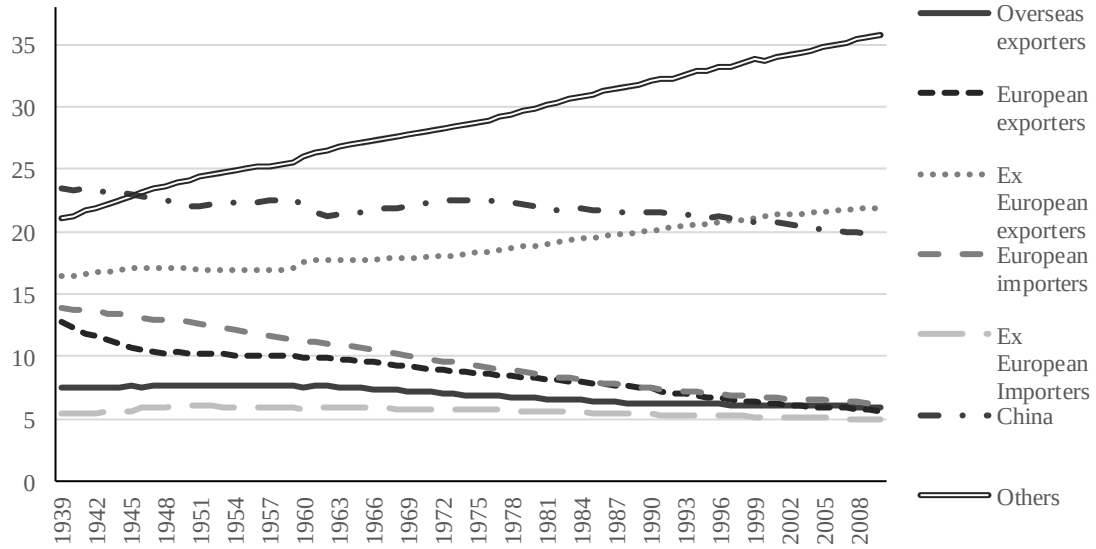
Figure 1.A.1 Population, by Malembaum's groups and by continent

1.A.1 (a) Total population (billions), by Malemabum's groups



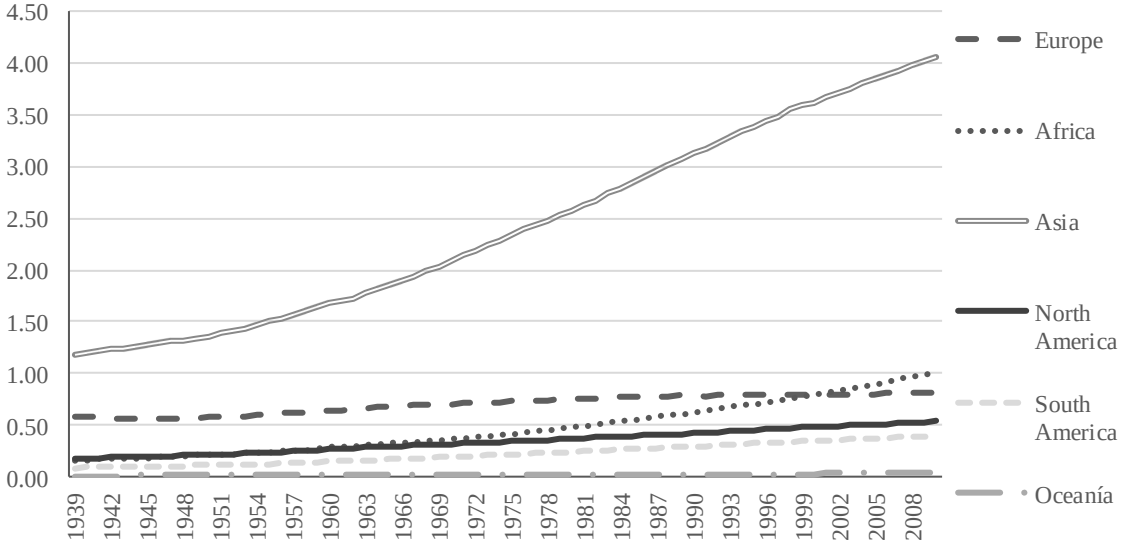
Source: author's elaboration from World Bank (2016), United Nations (2013) and Mitchell (2013)

1.A.1 (b) Population shares (% of world population), by Malembaum's groups



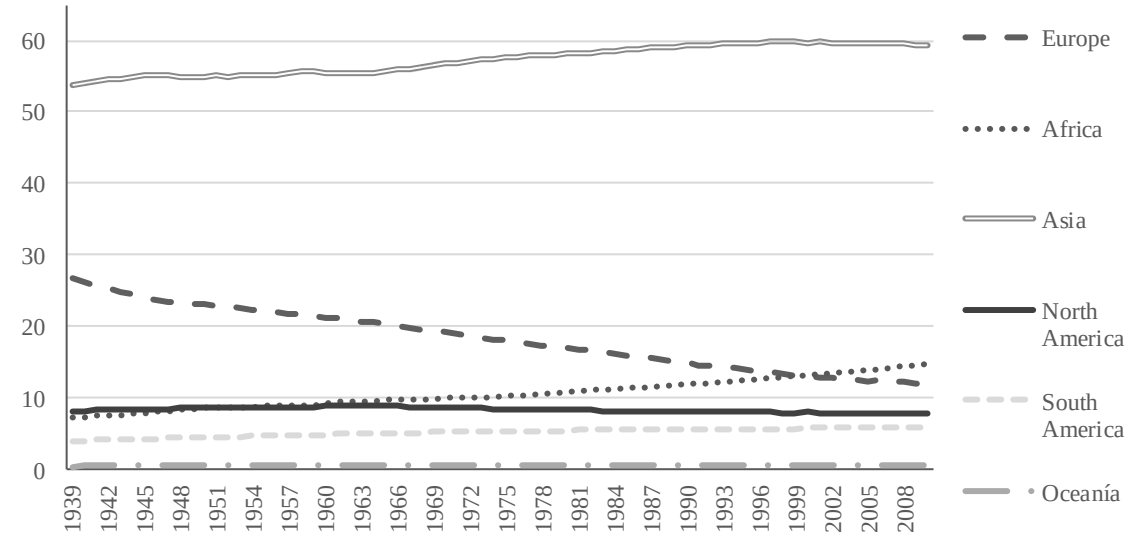
Source: author's elaboration from World Bank (2016), United Nations (2013) and Mitchell (2013)

1.A.1 (c) Total population (billions), by continent



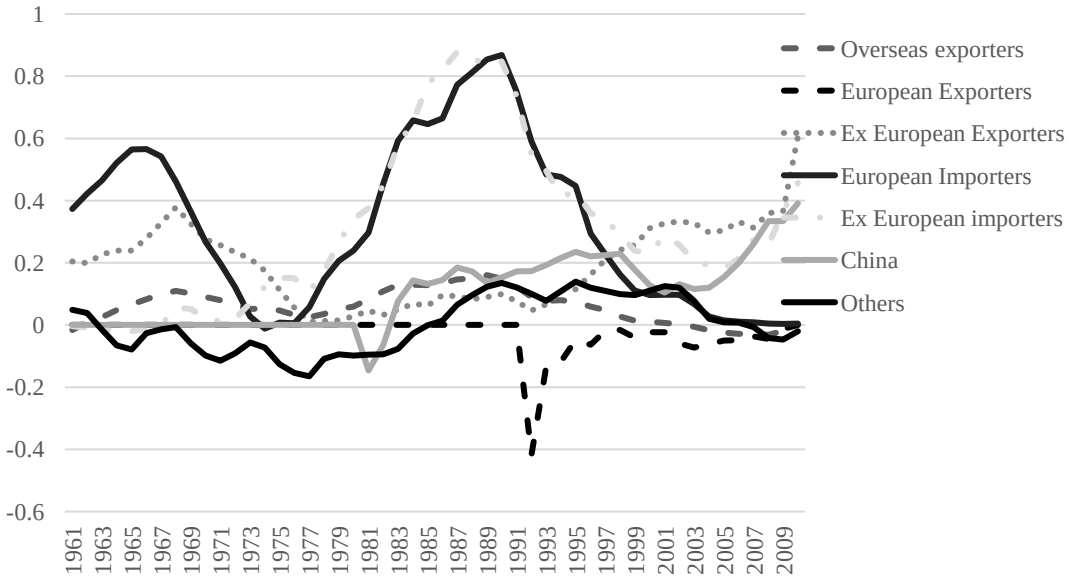
Source: author's elaboration from World Bank (2016), United Nations (2013) and Mitchell (2013)

1.A.1 (d) Population shares (% of world population), by continent



Source: author's elaboration from World Bank (2016), United Nations (2013) and Mitchell (2013)

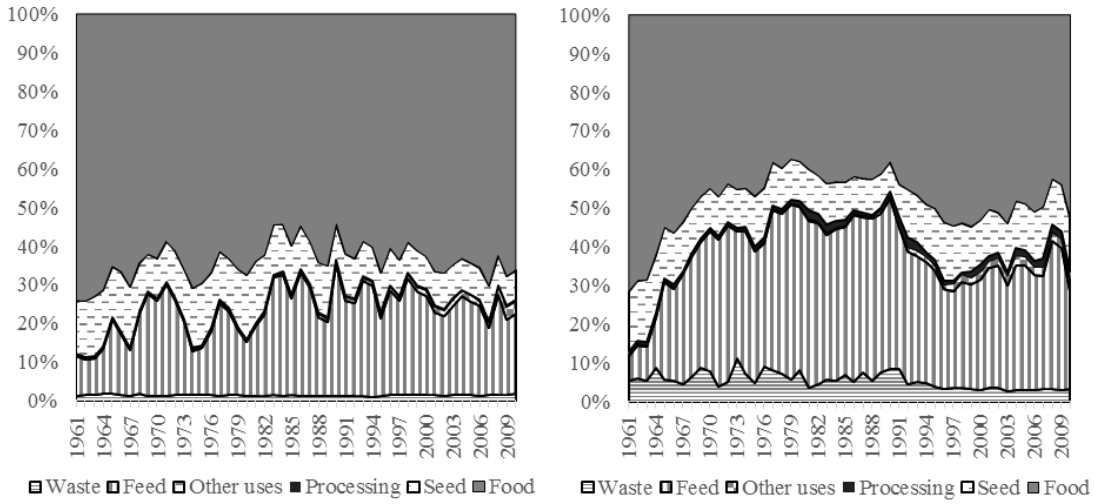
Figure 1.A.2 Nominal rates of assistance to wheat, by Malembaum's groups, 1961-2010



Source: author's elaboration from Anderson and Valenzuela (2008) and Anderson and Nelgen (2012)

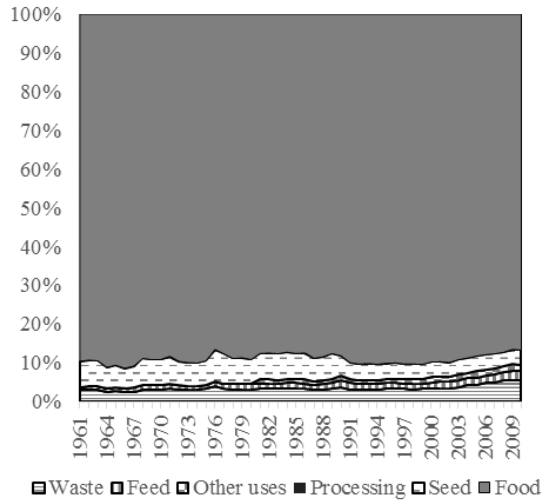
Figure 1.A.3 Wheat uses by Malembaum's groups, 1961-2010

1.A.3 (a) Overseas Exporters **1.A.3 (b) European Exporters**

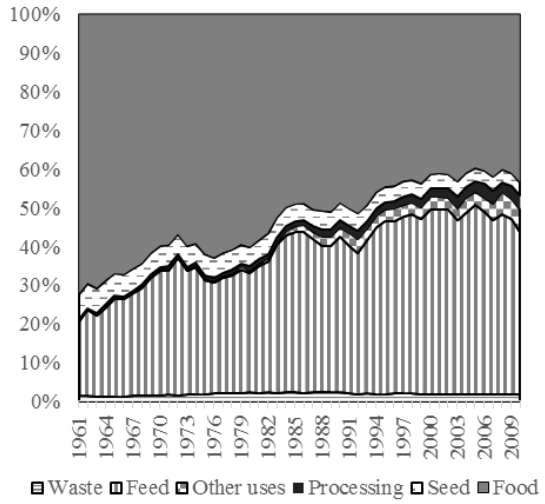


Source: author's elaboration from FAO (2016)

1.A.3 (c) Ex European Exporters

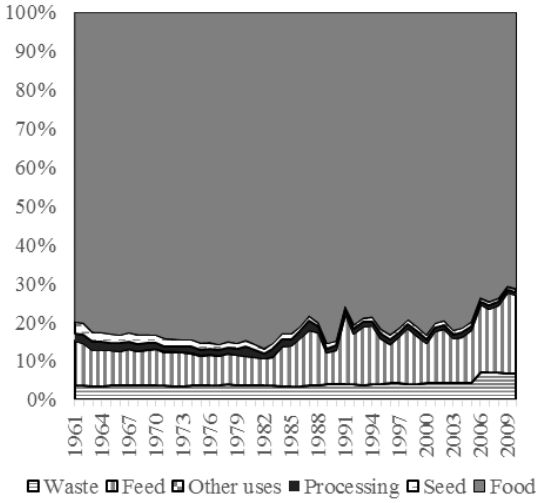


1.A.3 (d) European Importers

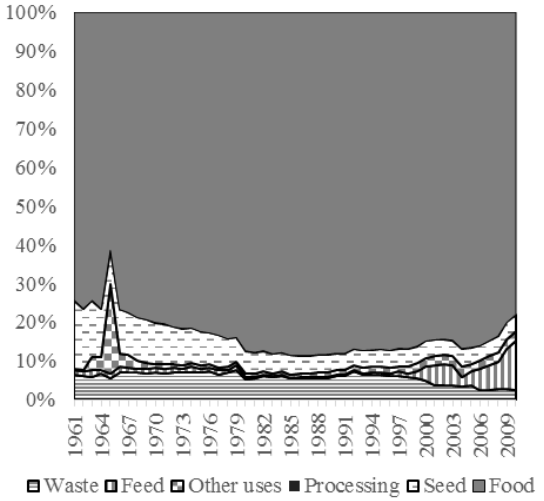


Source: author's elaboration from FAO (2016)

1.A.3 (e) Ex European Importers

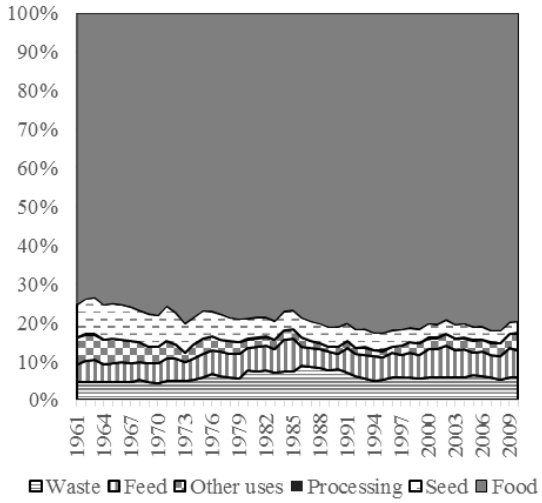


1.A.3 (f) China



Source: author's elaboration from FAO (2016)

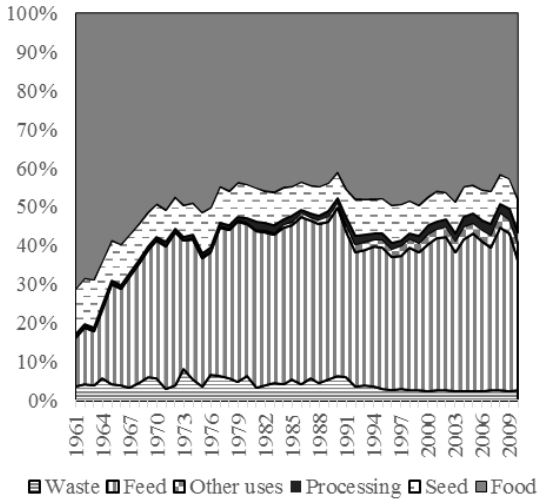
1.A.3 (g) Others



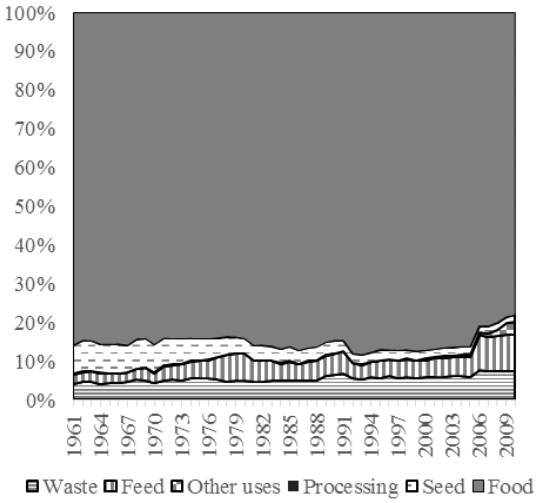
Source: author's elaboration from FAO (2016)

Figure 1.A.4 Wheat uses by continent, 1961-2010

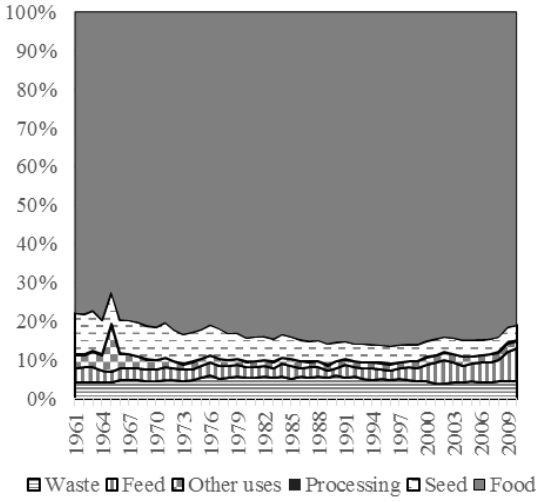
1.A.4 (a) Europe



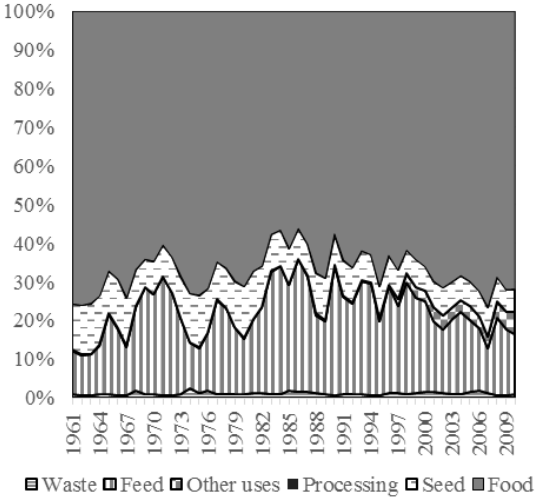
1.A.4 (b) Africa



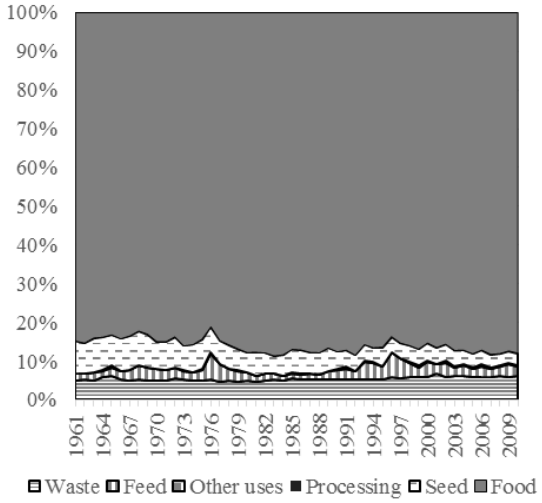
1.A.4 (c) Asia



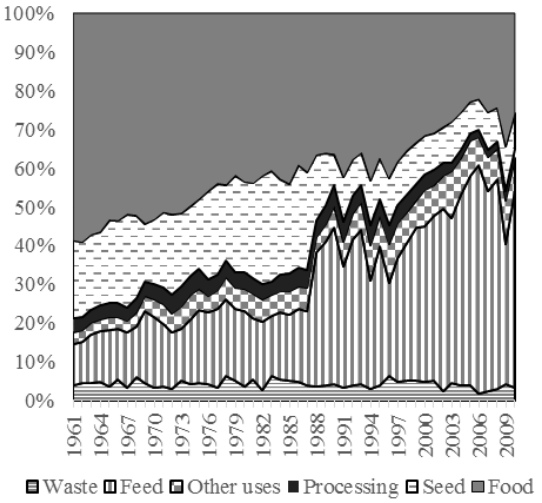
1.A.4 (d) North America



1.A.4 (f) South America



1.A.4 (g) Oceania



Source: author's elaboration from FAO (2016)

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Chapter 2. Patterns of world wheat trade, 1945-2010: the long hangover from the second food regime

2.1. Introduction

This paper aims to modestly contribute to the broad field of food regime analysis by focusing on certain economic aspects of the regimes that followed the end of World War II. More specifically, the paper is concerned with the historical evolution of a major cornerstone in food regime analysis: the international wheat trade. Wheat is particularly relevant to the food regime approach and to the political economy of agriculture, for two reasons. First, as we shall explain, wheat was central to the emergence of the first food regime and it played a key role in shaping the international framework that governed the postwar regime. Second, wheat has become a staple food in many part of the worlds and, for that reason, it has tremendous importance in the state of world nutrition and in the general welfare and national security of many countries.

The paper is organized as follows. Section 2.2 offers a summary of the literature on the food regime approach. Section 2.3 briefly delineates the general contours of the first food regime and then, more extensively, discusses the main characteristics of the postwar regime. Section 2.3.1 is concerned with the actual evolution of wheat markets and the distribution of world wheat consumption over this period. More specifically, it provides detailed empirical support for the theses of Friedmann and McMichael on increasing wheat dependence in developing countries. The rest of the paper is concerned with the concrete behavior of wheat markets since the end of the second food regime. An international analysis of wheat imports dependence – based on a categorization of countries that considers net trade in calories and national income per capita – is carried out in section 2.4, taking into account the evolution of consumption and production trends in those groups of countries, and contending that the increasing wheat dependence of poor and insecure countries over the last 40 years may be considered as a lagged outcome of the international framework of the second food regime. Section 2.5 presents a discussion of our main findings.

2.2 The food regime approach

It has been said that, due to its complexity and evolving character, the concept of 'food regime' has a broad 'genealogy' (McMichael 2009; Ríos-Núñez 2014). The first formulation came from Friedmann (1987) and was thoroughly systematized in Friedmann and McMichael (1989). The notion of a 'food regime' was partially derived

from prior research on the political-economy determinants of the so-called 'postwar international food order' (Friedmann 1982) and it has indeed evolved significantly since its original conception. Importantly, while a 'food regime' may refer to a period of time with specific economic and institutional characteristics, the term 'food regime analysis' also refers to a particular research *method*.

As a method of study, food regime analysis aims to explain the strategic role of food and agriculture in the "development of the world capitalist economy and in the trajectory of the state system" (Friedmann and McMichael 1989, 93; McMichael 2013). To do so, it adopts a "holistic, non-determinist historical interpretation of evolving social and ecological relations" (Magnan 2012, 374). As many scholars have pointed out, the food regime approach is deeply influenced by two strands of macro-sociological theory: regulation theory (Aglietta 1979) and world-systems theory (Wallerstein 1974). From the French Regulation School, food regime analysis took the idea that different forms or regimes of accumulation have existed throughout capitalist history, each with its own conditions of stability. By adopting a world-system perspective, food regime analysts shifted the focus "from national states to the system of states, and from industry to agriculture" (Friedmann 2009, 335). Thus, the food regime approach is concerned with identifying "stable periods of capital accumulation associated with particular configurations of geopolitical power, conditioned by forms of agricultural production and consumption relations within and across national spaces" (McMichael 2009, 139). This is the basic idea underlying a 'food regime', although other definitions have been suggested by other scholars and have provided the basis for identifying different 'food regime' periods over the last 150 years.

The simplest definition of a 'food regime' is probably that provided by H. Friedmann: a food regime is a "rule-governed structure of production and consumption of food on a global-scale" (Friedmann 1993, 30). Yet other – somewhat more precise – characterizations have been suggested. For instance, food regimes have also been defined as "stable sets of complementary state policies whose implicit coordination creates specific prices relative to other prices, a specific pattern of specialization, and resulting patters of consumption and trade" (Winders 2009, 132). It is possible to distinguish between two major components of a food regime: the geopolitical framework and the economic organization. Regarding the geopolitical framework, food regime analysts have focused mainly on the extent of state regulation, the set of national and

international agricultural policies (with special regard to commercial policy), the political nature of international or supranational organizations such as the World Trade Organization (WTO), and the presence or absence of a hegemonic country leader (Kindleberger 1973). With regard to the economic organization, food regime analysis is primarily concerned with the distribution of food production, consumption, and trade on a global scale, the international division of labor and capital, the relative prices of agricultural products, and the different forms of global production and distribution. It is argued that specific combinations of all those variables –both geopolitical and economic– may result in "stable periods of capital accumulation" that can be catalogued by scholars as 'food regimes'. Given the complexity of this task, the absence of agreement regarding the historical dating of different 'food regimes' is entirely understandable.

It is worth mentioning that two fundamental characteristics have been central to the discussion of the emergence and demise of food regimes. First, one major feature of a 'food regime' must be stability: "stable food regimes have emerged when key actors –farmers, consumers, states, and capital– agree on implicit rules tying them into predictable relations of food production, consumption and trade" (Magnan 2012, 372). Paradoxically, the other defining feature of a 'food regime' is the existence of internal contradictions that can ultimately burst it asunder and lead to the collapse of the regime itself (Winders 2009). Outstandingly, social movements are understood to serve as "engines of regime crisis and formation" in the transition between food regimes (Friedmann 2005, 229; Fairbairn 2008).

Academics tend to agree on placing the first food regime, approximately, between 1870 and 1914 and there is also consensus on the emergence of a second food regime in the years following World War II. Yet, it is less clear whether or not it is possible to talk about a third food regime, nor is the date of finalization of the second food regime clearly delineated. One problematic issue is that the main topics of conversation between food regime scholars are not only empirical, but also definitional (Friedmann 2009). Apart from the task of empirically identifying 'food regimes', there is always a broader question concerning "the status of the concept itself" (McMichael 2009, 148). Of course, this may affect researchers' considerations in locating 'food regimes' in time. Considering this, in the following section, we delineate the contours of the first food regime, and then run through the theoretical discussion of the postwar

regime. Section 2.3.1 will deal with the fundamental changes in wheat markets over the peak years of the second food regime. The rest of the paper is concerned with the actual evolution of wheat markets over the last 40 years. It will be argued that deepening dependence on wheat markets over this period can be considered as an outcome of the second food regime.

2. 3 The second food regime

The first food regime – also referred to as the "prewar international food order" (Friedmann 1982) or the "colonial-diasporic food regime" (Friedmann 2005) – has been defined as "a historically specific set of rules, institutions and practices that regulated food and agriculture on a world scale under British hegemony" (Magnan 2012, 371). Two major foundations of this regime were the existence of free markets and the flow of grains from the periphery to the core (Winders 2009). Depending on the author's approach, it has been dated between 1870-1914 (Friedmann 2005), 1870-1930s (McMichael 2009) or 1860-1914 (Winders 2009). On the geopolitical or institutional side, this food regime was characterized by minimal agricultural regulation, low trade tariffs, the gold standard, and the stabilizing influence of U.K hegemony. With regard to the economic organization, the regime was anchored in the consolidation of a stable trade pattern: settler-states exported wheat, meat, and other food staples to Europe in exchange for manufactured goods, capital, and migrants (hence the term 'colonial-diasporic'). It has been argued that the whole system depended on a new international division of labor and, more specifically, on the formation of the 'family farm': a new class of commercial farming household "dependent on the unpaid labor of women, men, and children, and, as a result, able to undercut the price at which food could be produced in Europe" (Magnan 2012, 376; Friedmann 1978). Cheap food from settler-states – complemented with imports of tropical foodstuffs from the colonies – served as a means of reducing labour costs in European manufacturing, and it is for this reason that this regime of capital accumulation has been considered 'extensive' (McMichael 2009). There were, however, a number offactors or 'internal tensions' that eventually led to the end of the regime. World War I spelled the end of the gold standard and a significant weakening of U.K hegemony. The War also revealed the "vulnerability that came with heavy food import dependence in the UK" (Magnan 2012, 377). And perhaps more importantly, the world grain market collapsed –both in volume and in

prices– in the mid-1920s, eventually leading to widespread state regulation of agriculture. In this sense, the approval of the Agricultural Adjustment Act (AAA) in the United States in 1933 can be considered ‘the beginning of the end of laissez faire’ (Winders 2009a).

The second food regime has been referred to as the "postwar international food order" (Friedmann 1982), the "postwar food regime" (Friedmann 1993), and the "mercantile-industrial food regime" (Friedmann 2005). It has also been called the "aid regime", the "U.S regime" and the "cold war regime" (Älmas 2012). Scholars usually agree in placing the beginning of this food regime around 1947, coinciding with the creation of the General Agreement on Tariffs and Trade (GATT) and the exclusion of agriculture from the Agreement. However, again depending on the approach, and therefore on the aspects that are prioritized in the analysis, there are different opinions regarding the date of finalization of this regime. While Friedmann and McMichael consider that soaring grain prices and massive grain sales to the Soviet Union in 1972 marked the end of the regime, other authors argue that the regime lasted until 1996, coinciding with the approval of the FAIR Act, which ended price supports and production controls in US agriculture (Winders 2009). Since this regime was fundamentally based on strict agricultural regulation, and also on grain flowing from the core to the periphery, it has been described as a 'mirror-image' of the first food regime (Winders 2009). Again, it is possible to distinguish between (1) the institutional and geopolitical framework of the regime (country leader, international trade framework, national agricultural policies...) and (2) the 'resulting' economic organization (direction of trade flows, world distribution of production and consumption, relative prices of food, international division of labour, farm incomes...). Although it is often assumed that the 'economic side' of the regime is shaped by the political-institutional organization, it is important to note that both the economic and the political factors are interrelated and mutually dependent. As we will see, US politics after World War II contributed to shape the direction of agricultural trade flows on a global scale. Yet, farm policy in the United States – which can be understood as an expression of a political economy equilibrium within the country itself – was, in turn, deeply motivated by its peculiar agricultural situation and also by the economic and political conditions in other countries.

The United States emerged as the new consolidated hegemonic power after the Second World War (Patel 2007). In contrast to the situation in most European countries, American farmers ended the war in a healthy economic position (Collingham 2011). In fact, rather than facing food shortages, the United States was soon troubled again by the problem of surpluses. Postwar agricultural policy in the United States was indeed deeply motivated by the so-called 'farm adjustment problem': "a persistent tendency for the aggregate supply of agricultural commodities to grow faster than the aggregate demand for them, so that agriculture is persistently burdened with an excess supply of labour, even when business is expanding and there are ample job opportunities in non-agricultural industries" (Schultz 1945). The enormous wartime demand for food alleviated the problem of surpluses for a while but, just as American agronomists had been anticipating during the military conflict, the end of the War brought about a sudden collapse in demand for food that was visibly perceived as unsafe. With America's food production at unprecedented levels, a return to the economic depression, unemployment, and food surpluses of the 1930s was feared by many (Collingham 2011, 477). The main political issue – fundamentally rooted in the farm-adjustment problem – was that gains in agricultural efficiency and output were not being matched by a comparable advance in farm incomes[27]. As a means of boosting farm earnings in the postwar years, the U.S. government implemented a set of agricultural policies comprising price supports and production controls. This set of policies, which can be understood as a continuation of the Agricultural Adjustment Act (AAA) approved in 1933 (Winders 2009a), marked the ultimate end of *laissez-faire* in agriculture and indeed conditioned U.S. foreign policy, particularly trade policy.

As mentioned above, scholars often situate the beginning of the second food regime in 1947, coinciding with the coming into force of the GATT. It is well-documented that the role of the United States was crucial in 'excluding' agriculture from the agreement, and therefore in institutionalizing state agricultural regulation on a global scale. According toJohnson (1987), restrictive trade measures in agriculture were adopted, not for their particular benefits, but because they made it possible for domestic measures to function. Price support schemes in the U.S required certain techniques

[27] Before the War, President Herbert Hoover (1929-1933) had said that the farm issue was the most important problem the nation was facing (Winders 2009a). In the late 1940s, surpluses and low farm incomes still posed a big problem for family enterprises and the politically-organized farm sector.

for preventing imports from entering the US market, and the GATT served to legitimize those techniques. As Hathaway points out, "not only did agriculture receive special treatment in the GATT, but the special treatment also appears to have been tailored to fit the US farm programs then in existence" (Hathaway 1987, 187). The full range of U.S. interference in agricultural trade was ultimately "sanctified" in the Section 22 Waiver of 1955, which allowed the US to apply import quotas to agricultural products without adopting measures to limit domestic production (Rausser 1995, 6). Importantly, this waiver applied only to the U.S and not to other members of the GATT (Ingersent and Rayner 1999). Although there was indeed opposition to this institutionalization of agricultural protectionism – coming mainly from efficient agricultural producers such as Australia, and from developing countries that were being denied the means to protect domestic manufacturing with instruments similar to those allowed for agriculture – the actual GATT treatment of agriculture reflected U.S political hegemony and served as a vehicle for the spread of the regime (Winders 2009b).

The set of policies comprising price supports, acreage controls, and government loans has been referred to as 'supply management policy' (Winders 2009a) or more generally, as an 'agricultural welfare state' (Sheingate 2001)[28]. These policies were relatively successful in achieving higher incomes for American farmers in the short term, but failed to tackle the problem of surpluses. In fact, one paradoxical outcome of price supports was that they stimulated increased production, thus aggravating the problem of excess supplies and low food prices in the long run (Tracy 1964). Solutions had to be found in order to adapt supply to demand, while giving farmers a 'fair' income, and soon food aid revealed itself as a practical tool for that purpose. First, the Marshall Plan for European reconstruction served as an outlet for US agricultural surpluses in massive shipments of food aid (Magnan 2012, 378). European countries happily embraced American aid because their agricultural systems had been devastated by the War and their agricultural output per capita had fallen well below prewar levels (FAO 2000). In fact, one of the major aims of European governments in postwar years was to increase agricultural production as rapidly as possible. In order to do so, they

[28] In fact, the term 'agricultural welfare state' is a broader concept. It was coined by A. Sheingate to situate farm policies within the larger context of American political development (Sheingate 2001). First, agricultural commodity programs are rooted in the expansion of government regulation during the 1930s. Second, these commodity programs resemble some sort of social insurance, insofar as they provided counter/cyclical spending. Lastly, like other welfare state programs, agricultural subsidies have been at the core of debates over how to cut spending (Sheingate 2001, 3).

replicated the US model of agricultural regulation (Friedmann 1993) and, as a consequence, they soon faced similar problems of unsold food surpluses. This meant that the United States had to find an alternative destination for their excess supplies, and it found it in the decolonizing, less-developed countries.

The Food for Peace program – also known as Public Law, or P.L 480 – served as the perfect means for US surplus disposal (Eggleston 1987). Approved in 1954, it has sometimes been called "the 'marriage of convenience' whereby U.S agricultural surpluses were used as aid to less developed countries of the world" (Hedley and Peacock 1970, 1). The most important feature of P.L. 480 was a provision that allowed 'concessional sales' of US surplus agricultural goods to 'friendly' countries – thus excluding the USSR, China, and other countries belonging to the sphere of influence of communism – in exchange for local currencies. Since exporting countries normally ask for payment in hard currencies, sales of commodities for local, non-convertible currencies represented a saving of foreign exchange to the importing countries (Hedley and Peacock 1970). Then, U.S agencies could use those currencies for a variety of development activities, such as infrastructural projects, supplies for military bases, loans to US companies, trade fairs, and locally-produced goods and services (McMichael 2000, 62). The food for peace plan served US economic and political interests: it allowed the US government to dispose of its surpluses while maintaining agricultural price supports, and it also pursued foreign policy goals during the Cold War period (for instance, it has been held that one of the initial motivations of the program was "combating the spread of communism" (Hedley and Peacock 1970). In any case, export subsidies in the form of international food aid became a crucial feature of US farm policy, alongside price supports and production controls" (Winders 2009a, 8). In this way, food aid became pivotal to the second food regime by considerably distorting trade flows and by promoting a period of 'cheap food' flowing from the core to the periphery. One of the major consequences was, of course, the increased food dependence of poor countries.

In addition to this kind of 'politically constructed international trade', anchored in rigid state regulation, another defining feature of the second food regime has frequently been stressed: the rise of an "industrialized agrofood sector, eventually to be dominated by large agrofood corporations" (Magnan 2012, 377). Agricultural price supports in high-income countries encouraged farmers to maximize production, and

they did so through industrial intensification (Magnan 2012, 378). In Friedmann's characterization of the second food regime (Friedmann 2005), while the term 'mercantile' accounted for its protectionist dimension, the term 'industrial' referred to the widespread adoption of machinery, pesticides, chemical fertilizers, and new crop varieties. It is important to note that, whereas this process of agricultural industrialization was common to all major high-income countries, it was actually restricted to only a few 'strategic development states' in the Third World[29]. In those countries (e.g. India, Pakistan, the Philippines, Egypt, Indonesia, Turkey, Mexico...) the Green Revolution was to some extent promoted as a tool "not only for the rebuffing of Communism, but staunchly for the advance of capitalism" (Patel 2012, 26). According to McMichael, the Green Revolution naturalized markets and commodification and, in doing so, it was an essential part of the 'development project': "a politically orchestrated initiative following the Second World War, incorporating postcolonial states into an imperial field of power to legitimize and expand capitalist markets as the vehicle of 'national' economic growth and modernity" (McMichael 2005, 141). The adoption of the Green Revolution technological package allowed some of these countries to achieve a remarkable increase in agricultural production and yields[30], and significant dietary improvements were attained thanks to complementary food aid. Yet, in many other countries (particularly in Africa) the Green Revolution was fundamentally absent (Frankema 2014), and food dependence expanded dramatically, due to subsidized food imports. For instance, Friedmann points out that "whereas the Marshall Plan set resources, such as fertilizer and machinery, to reconstruct European agriculture, P.L. 480 centered on sending food, with little effort to build up agriculture" (Friedmann 1982). Importantly, most of these developing countries welcomed food aid as a means of providing cheap food for urban workers in an attempt to foster industrialization. In contrast to the high-income countries – which were already struggling with the farm

[29] Although the category 'Third World' was initially conceived to define countries that remained non-aligned with either NATO or the Communist bloc in the Cold War period, in this paper 'Third World' will be used as if it were a synonym of 'low-income countries', 'periphery', 'global South' or 'developing countries'. Although each of these categories has its own particular connotations – for instance, the term 'global south' would be anachronistic if used to define low-income countries prior to the collapse of the Soviet bloc – all those categories will be used to indistinctly define a group of countries with relatively low GDP per capita and little bargaining power in the main international forums of negotiation. For the purpose of the analysis, it will be assumed that this group of countries remained a relatively stable category throughout the studied period, even when some of these countries may have experienced significant changes both in income and in their relative geostrategic position.

[30] However, it has been pointed out that the Green Revolution also caused a loss of dietary diversity, as well as agronomic diversity in many of those countries (Shiva 1993).

income problem – most Latin-American, African, and Asian countries in the postwar years were following industry-driven development strategies, which often had an anti-agricultural bias (Anderson 2007; FAO 2000).

2.3.1 The Wheat Complex in the Second Food Regime

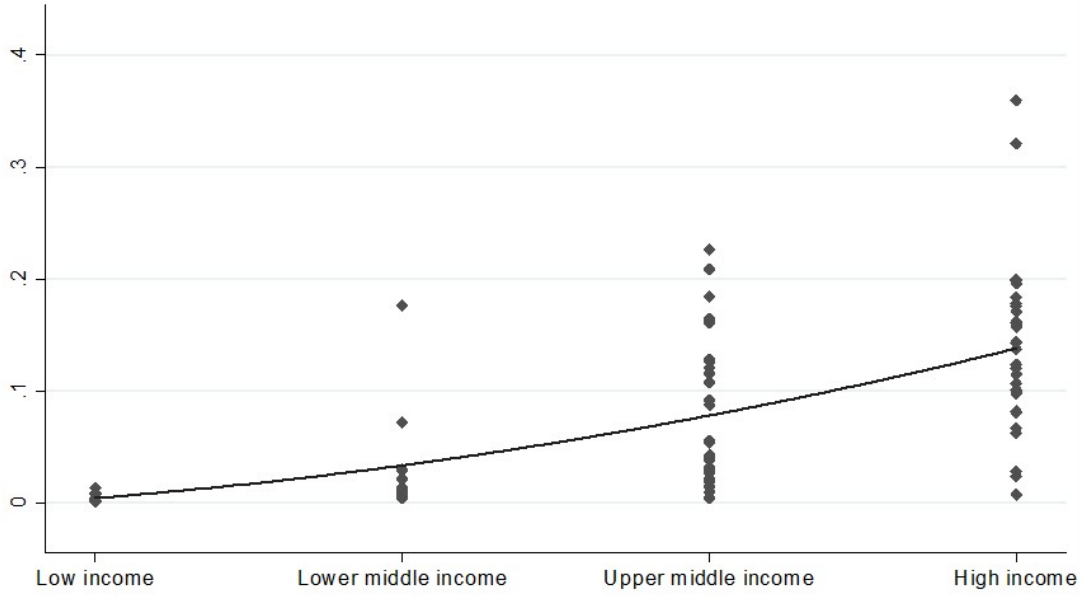
Wheat was central to the construction of both the first and the second food regime. Globalization in wheat markets marked "a radical rupture in the history of food provisioning, as entire populations (e.g., the United Kingdom) became dependent on distant supplies of food for survival, and food exchanges bound together states, farmers, and eaters in new ways" (Magnan 2012, 371). Rather than being a specifically-pursued goal, the globalization of world wheat markets after the 1870s served as a means of making possible what actors really wanted to do: "wheat was the substance that gave railways income from freight, expanding states a way to hold territory against the dispossessed, and diasporic Europeans a way to make an income" (Friedmann 2005, 231). Yet despite the importance of wheat in the first food regime, wheat was no less crucial in the construction of the second. In fact, it has been said that many of the changes and developments in the regime can be traced through 'the wheat complex'.

Friedmann's analysis of the postwar food economy (Friedmann 1992) distinguished between three different 'complexes' (i.e. "chains of production and consumption relations, linking farmers and farm workers to consuming individuals, households, and communities" (Friedmann 1992, 371)). Those complexes were the 'durable goods' complex, the livestock complex, and the wheat complex The durable goods complex comprised production activities that involved deep industrial linkages (for instance, the turning of commodity crops such as soy and maize into inputs for industrial production). Biological or chemical substitutes for industrial raw materials were found by food manufacturing industries, leading to a declining demand for traditional (tropical) exports from less developed countries. The livestock complex was characterized by turning agricultural commodities into industrial inputs in the manufacture of animal feeds for intensive meat production (Magnan 2012, 378). This pattern – which both promoted and was encouraged by high meat consumption in industrialized countries – began in the United States and was later replicated in Europe. It is of great significance that this complex shifted from a national to a transnational phenomenon when the European Economic Community (EEC) exempted US animal feed from import tariffs in

exchange for European protection against wheat (Friedmann 1992). Lastly, the 'wheat complex' –which surely involved fewer industrial linkages than the durable goods and the livestock complexes – induced food import dependency in low-income countries.

At the end of the War, wheat consumption was largely restricted to upper-middle or high-income countries (see figure 2.1). Yet, this would change significantly over the second food regime period.

Figure 2.1 Wheat consumption per capita (tonnes / population / year), 1946/50, by country and income group



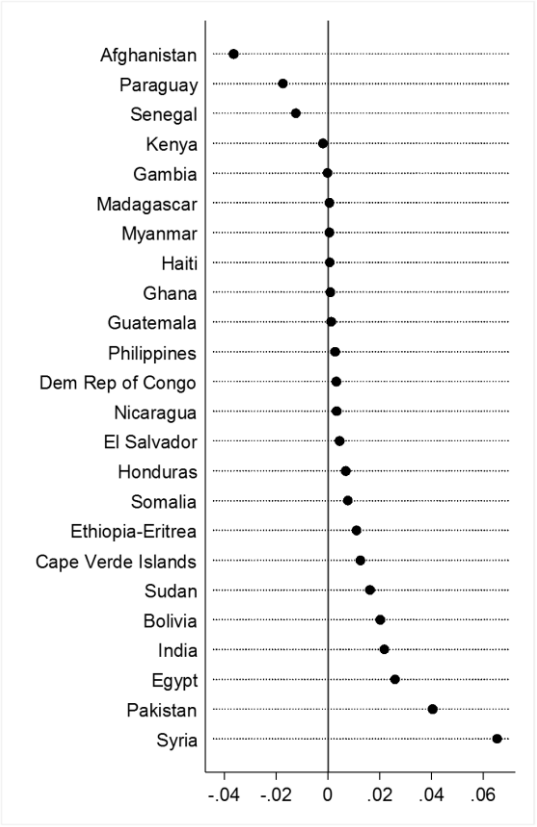
Source: author's elaboration from FAOSTAT (1961-2010), FAO Production and Trade Yearbooks (1948-61) and Institut International d'Agriculture (1947). Data on population from Mitchell (2013) and United Nations (2013)

Unlike in the case of other cereals, such as maize, the bulk of wheat production in postwar years was destined directly for human consumption (Byerlee 1983). This meant that trends in per capita wheat consumption from 1947 to 1972 were highly influenced by direct income elasticities of demand, which tend to be zero or negative at high income levels. As figure 2.2 shows, per capita consumption of wheat fell or remained unchanged in most developed countries (and in certain developing countries that already had high per-capita wheat consumption and relatively high per-capita incomes after the War). On the contrary, most developing countries significantly increased their wheat consumption per capita over this period, even while most of them also experienced high population growth. Importantly, while in some of these coun-

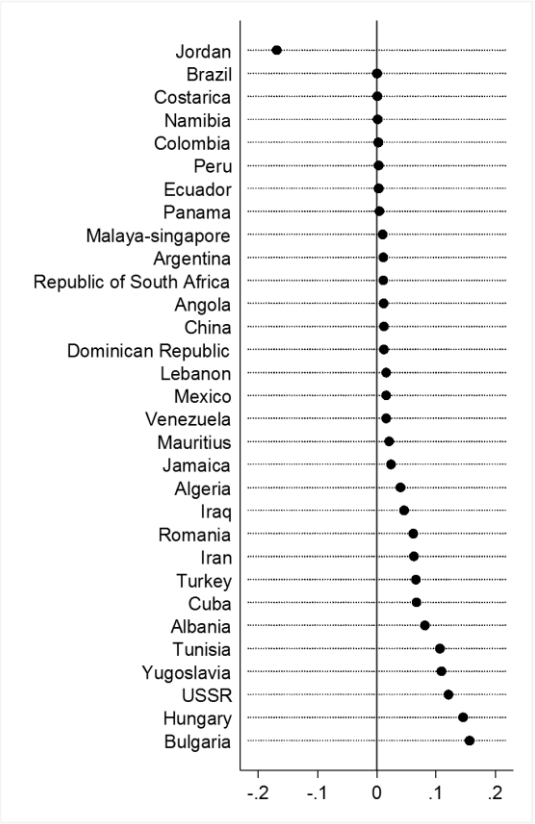
tries increasing wheat consumption only represented a continuation of an already-initiated process, in others it was the result of a marked and unexpected dietary shift towards wheat products.

Figure 2.2 Variation of wheat consumption per capita (tonnes / population) between 1951/56 and 1971/76, by country and income group

2.2 (a) Low and lower middle income



2.2 (b) Upper middle income



Source: author's elaboration from FAOSTAT (1961-2010) and FAO Production and Trade Yearbooks (1948-61). Data on population from Mitchell (2013) and United Nations (2013)

2.2 (c) High income

Source: author's elaboration from FAOSTAT (1961-2010) and FAO Production and Trade Yearbooks (1948-61). Data on population from Mitchell (2013) and United Nations (2013)

Consumption patterns in developing countries were indeed affected by multiple variables, and it is hard to isolate the effects of each. Yet there are sound historical reasons to believe that the increase in wheat consumption per capita in low-income countries was fundamentally driven by certain institutional aspects of the second food regime. In his seminal work on the world wheat economy, W. Malembaum pointed out that excess wheat supplies in exporting countries after WWII coexisted with the unfilled nutritional needs of millions of hungry people in many parts of the world (Malembaum 1953). He suggested that the United States should use its wheat surpluses as a "positive tool of foreign economic policy", but he also noted that a transfer of wheat surpluses "would have involved a basic shift in the pattern of consumption in the underdeveloped areas" (Malembaum 1953: 213). There was no real demand for wheat from the undernourished areas that the market itself did not fill, yet it was clear to everyone that there was a fundamental imbalance in the market, and that "it might seem untimely to talk of surpluses when shortages were lasting so long, and paradoxical to call them surpluses when hundreds of people still lacked many of the basic

necessities of life" (FAO 1947: 10). The view of the Food and Agriculture Organization after the War was that there may be institutional and income barriers preventing people around the world who wanted to buy wheat from getting it. In contrast to certain economists who advocated measures to reduce supply, FAO advocated action to raise demand (FAO 2000: 109). This meant that there was an institutional effort to promote wheat consumption in countries where wheat was not the preferred grain, or was not consumed at all.

This kind of 'dietary proselytizing' was primarily directed towards developing countries, but also towards certain industrialized countries, such as Japan. It has been said that "conquerors have always influenced the cultures and life-styles of the vanquished, but seldom in history have they changed the food and meals of the defeated as America did after WWII" (Morgan 1979, 100). Wheat bread was almost unknown in Japan when General Douglas MacArthur began importing wheat into the occupied nation in 1946. Rationales such as 'bread is nutritious' were soon found, and wheat bread began to be extensively used to feed school children and civilians. The United States Department of Agriculture (USDA) sponsored school lunch programs, trained bakers, and funded department-store exhibits that introduced the Japanese to such American foods as pancakes (Morgan 1979, 104). The South Korean government also began to exalt the virtues of eating wheat and actively promoted a shift from rice noodles to wheat noodles (Rupiya 2004, 85). In Taiwan, "President Chiang Kai-shek gave a helping hand by having his propagandists announce that 'wheat eating is patriotic'" (Morgan 1979, 100). This soon changed the staple food patterns of large parts of South Asia (Rupiya 2004, 85).

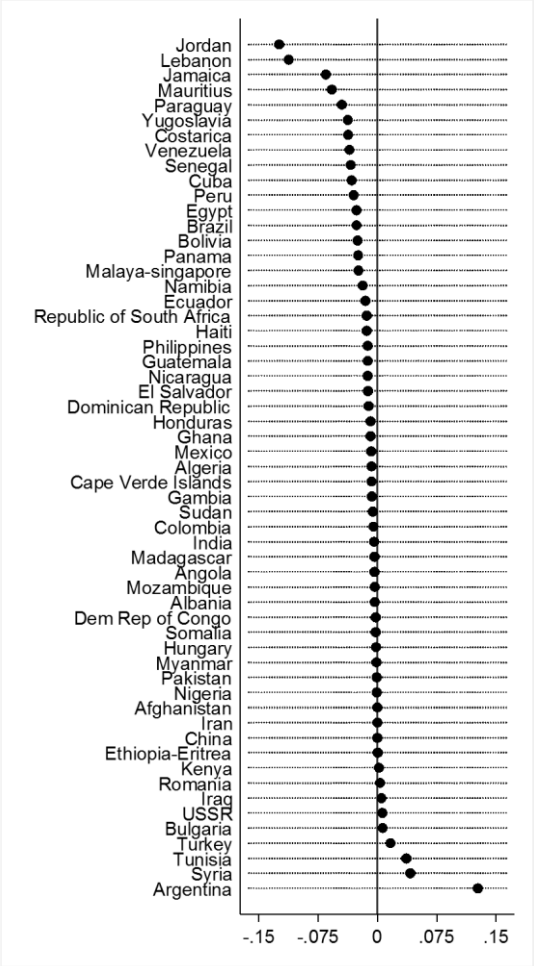
The efforts of U.S. officials were also directed towards creating new markets for wheat in Africa and Latin America, especially after the enactment of P.L. 480 in 1954. In most Sub-Saharan countries, bread was virtually unknown as a food until European colonialists arrived in the nineteenth century. In the first half of the twentieth century only European migrants imported small amounts of flour for their own needs. However, a slow but steady change took place in the diet of the African urban population soon after the first shipments of U.S. wheat aid. The efforts of the USDA's representatives went hand-in-hand with the active promotion and 'market development' by the main grain trading companies (Morgan 1979), who contributed to create a new

system of food distribution around imported flour, and a vast network of bakeries appeared in African cities and towns. For instance, by the time the French company 'Continental' arrived in Zaire in 1967 – with a proposal for a modern flour mill – "bread was displacing the more traditional Congolese foods in the capital. […] Agricultural attaché Williams, an enthusiast of 'market development' was to note in a report to Washington that bread was winning against chikwanga at breakfast" (Morgan 1979, 229). It is important to note that bread had been the staple diet of the colonial masters and was adopted by the elite. In the case of Zaire, bread was eaten by Mobutu's elite corps of bodyguards (Morgan 1979). This helps to explain why bread consumption was identified with progress and modernity for the masses in many parts of Africa.

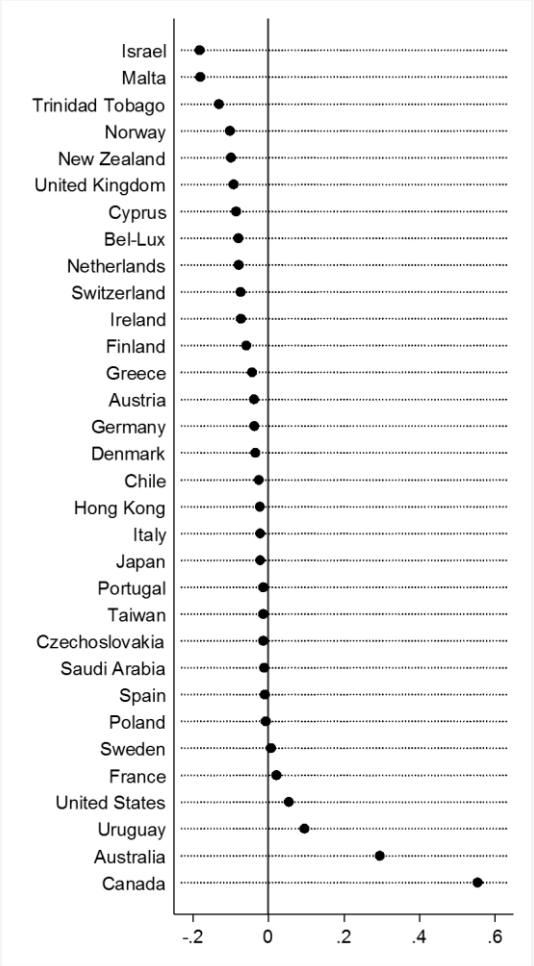
In general, it was cheaper and noticeably easier to import flour to feed the rural-urban migrants than to increase agricultural production and improve the rural distribution and transportation systems. Of course, increases in wheat consumption per capita in developing countries were not matched by a similar increase in national production. In the immediate postwar years, there were only four significant wheat exporters: the United States, Canada, Australia, and Argentina (according to our data, those four countries together accounted for roughly 90 % of total world exports of wheat in 1945). This meant that most countries – including most Western European countries – were net importers of wheat in postwar years (although they had degrees of self-sufficiency, depending on their production levels and consumption requirements). Figure 2.3 illustrates the situation in wheat markets (net exports per capita) in 1951/55.

Figure 2.3 Net exports per capita (tonnes / population) in 1951/55 (mean), by country and income

2.3 (a) Low income, lower middle income, and upper-middle income countries



2.3 (b) High income countries



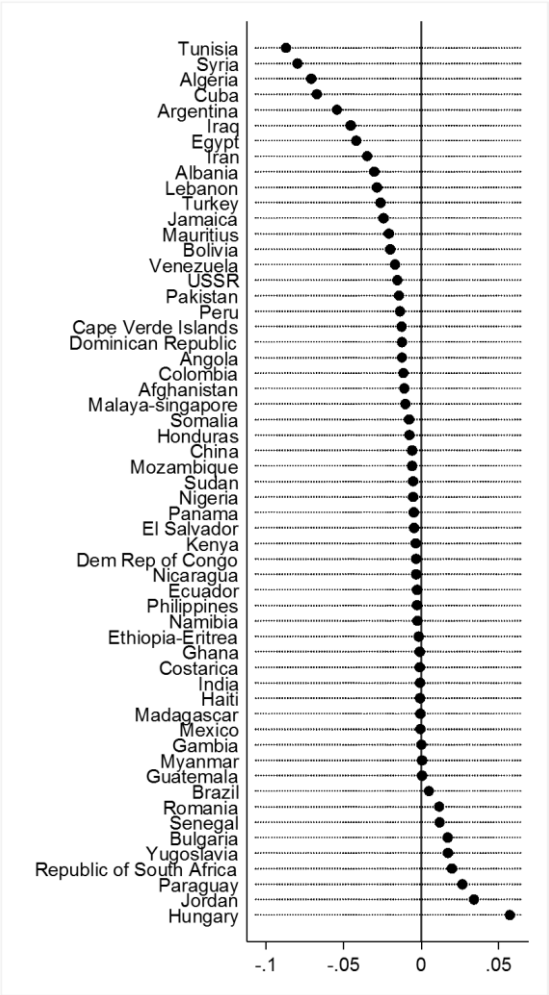
Source: author's elaboration from FAO Production and Trade Yearbooks (1948-61) and Institut International d'Agriculture (1947). Data on population from Mitchell (2013) and United Nations (2013).

This situation would change dramatically over the second food regime. On the one hand, most high-income countries significantly improved their wheat trade balance over this period. The US and Canada resorted to price supports and food aid to deal with the twin problems of low farm income and excess wheat supplies. In Western Europe, many countries implemented price support schemes with the aim of increasing production after the War. As mentioned above, the US allowed EEC countries to protect their wheat industries in exchange for the exemption of US animal feed from import tariffs. Some of these European countries – particularly, France – were exceptionally successful in this task, and soon had to rely on export subsidies in order to dispose of their wheat surpluses. As a result, they not only managed to reduce wheat dependence, but became significant

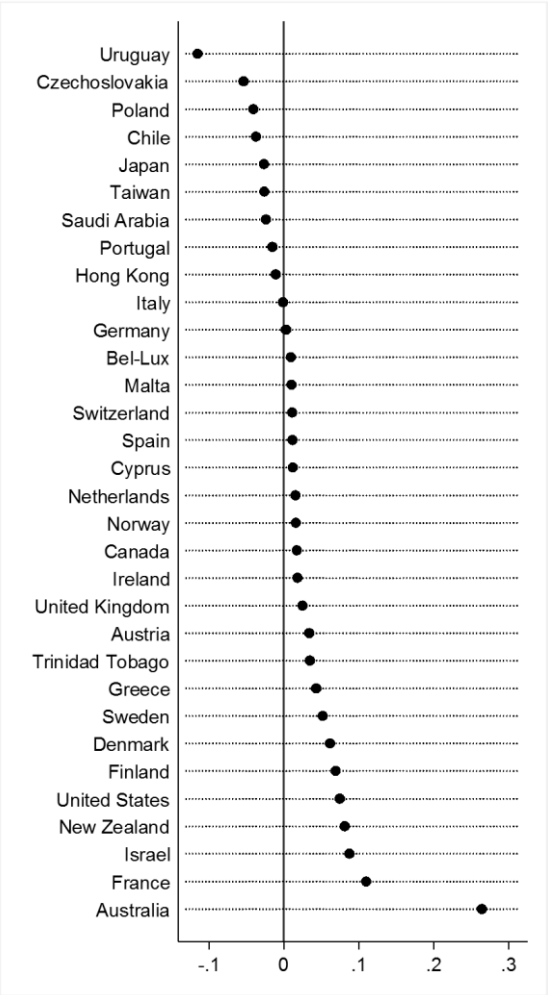
wheat exporters. On the other hand, the bulk of developing countries had to dramatically increase wheat imports to meet their higher consumption levels (figure 2.4).

Figure 2.4 Difference between net exports per capita 1971/76 and net exports per capita 1951/56. Wheat + wheat flour equivalent (tonnes / population)

2.4 (a) Low / lower middle / upper middle income countries



2.4 (b)High-income countries



Source: author's elaboration from FAOSTAT (1961-2010) and FAO Production and Trade Yearbooks (1948-61) Data on population from Mitchell (2013) and United Nations (2013)

Although there were certain developing countries that slightly improved their trade position – notably traditional exporters, such as Argentina and Tunisia, or countries that greatly benefited from the Marshall Plan, such as Turkey – and there were also some developed countries that increased their dependence on wheat imports, it is possible to distinguish a clear pattern: the wheat complex facilitated food import dependency for low income countries. As Friedmann has pointed out, "when previously self-provisioning countries began to import food in the 1950s and 1960s, the food they imported most of all was wheat, no matter what the customary dietary staples" (Friedmann 1992, 372). The

reasons for this phenomenon are to be found in the institutional construction of the food regime: the wheat trade was not organized through markets but through international aid mechanisms and politically-constructed agreements, mainly bilateral arrangements between the United States and Third World states. The geopolitical component of the regime – which was in turn shaped by the internal economic considerations of the US as the world hegemonic leader – resulted in increased wheat consumption and dependence in most developing countries. Cheap wheat was cheerfully welcomed by many of these countries because it was seen as a means to create an urban working class, and because "the ideology of development focused on industrialization to the point of obsession" (Friedmann 1992, 373). Yet, wheat dependence revealed itself as unsafe in the long term, particularly when international wheat prices rose in the 1970s. The following section will deal with what happened later, when the foundations of the second food regime disappeared.

2.4 Patterns of wheat trade after the second food regime

As mentioned above, food regime scholars tend to agree that there were a number of institutional and economic factors that put an end to the second food regime in the early 1970s. While it can be argued that changes in the institutional framework favored an economic restructuring of the regime, it is also conceivable that the institutional changes came about via changing economic conditions. In any case, there are several factors and events that are usually interpreted as signals of the collapse of the regime. First, the so-called 'Cold War economic dam' was broken in 1972. The sudden entry of the USSR into international wheat markets created unexpected shortages and pushed food prices up considerably (particularly wheat prices). Since the US food regime was anchored in cheap food, soaring grain prices marked a fundamental departure from the second food regime foundations: US surpluses disappeared and food aid plummeted[31]. With regard to the shape of institutional regulation of agriculture –which is considered one of the major defining features of a food regime – there is also wide support for the notion of a significant shift from extensive state regulation during the 1970s. According to Sheingate, "agriculture provides us with an example of successful welfare state retrenchment [...] Beginning in the 1970s, agricultural policy came under attack from a variety of quarters. Over a two-

[31] This is, however, a polemic topic. While it is true that grain prices skyrocketed in 1972, it is indeed controversial to consider this episode as the end of the cheap food era. In fact, there was a strong and clear deterioration in the terms of trade for agricultural products, over the period 1970-2000 (Pinilla and Serrano 2011). This was true for all major foodstuffs, and especially for wheat.

decade period, consumer advocates, budget hawks, and other critics of farm programs successfully pressed for reductions in agricultural subsidies" (Sheingate 2002, 3). The culmination of this process is usually considered to be 1996, coinciding with the passage of the Federal Agriculture Improvement and Reform Act (FAIR), which removed nearly all restrictions on agricultural production in the US and replaced market price supports with fixed annual payments (decoupled from production and prices).

While the 'wheat complex' was central to the second food regime, now the complex is considered to have lost its distinct existence (Friedmann 1992). According to Friedmann, the proliferation of new uses for wheat have accelerated the diversification of the anachronistic grain companies – which were closely tied to family wheat farms in the second food regime – and have encouraged them to adopt new industrial practices linking them to the durable food and livestock complexes (Friedmann 1992). Furthermore, there is the idea that the shift from food aid to commercial sales during the 1970s – coinciding with massive wheat sales to the USSR and the sudden disappearance of wheat surpluses – put an end to what had been the main foundations of the complex during the second food regime. Soaring wheat prices after the chaotic irruption of the USSR into international markets led to increasingly fierce competition over wheat exports, and definitively ended the U.S supremacy in global wheat sales.

Food regime analysts have paid much attention to the incorporation of agriculture into the multilateral trading system. Specifically, they have long wondered whether the inclusion of agriculture would coordinate a new stabilized regime that would "resolve" the turmoil of the 1980s (Pritchard 2009). Some authors are of the opinion that the collapse in the WTO Doha round of negotiations changed "precisely nothing" (Pritchard 2009). It has been held that the WTO has served as a tool to maintain Northern subsidy regimes while forcing liberalization on the rest of the world (Pritchard 2009; McMichael 2012) but it has also been acknowledged that the new multilateralism has provided an arena for hegemonic contestation (Pritchard 2009). In this sense, the collapse of the Doha round may well be understood as a consequence of the absence of a hegemonic power (since "both the global North and the global South are willing the exertion of influence over the WTO, and neither is unequivocally prevailing" (Pritchard 2009, 304)). This international trade framework has been described as a "hangover" from the second food regime, and it has been argued that "the WTO is more appropriately theorized as a carryover from the politics of the crisis of the second food regime, rather than representing

any putative successor" (Pritchard 2009, 305). Thus, it has been argued that – regardless of whether or not it is possible to talk about a third food regime – the world institutional framework that has shaped agricultural relations over the last 40 years has been deeply influenced by the second food regime. Similarly, we argue that there is also a substantial lag from the second food regime when it comes to the economic aspects of the new 'emergent' regime, and this is particularly true regarding the evolution of international wheat markets.

As mentioned above, the end of the second food regime is often dated around 1972. Other than the aforementioned reasons – grain sales to the USSR, end of surpluses and soaring grain prices, shift from food aid towards commercial sales, a new trend towards supply management policy retrenchment... – there are two other factors that are frequently considered to indicate the end of the regime. Both have to do with the wheat complex and led to reduced dependence on US wheat. The first is the new ability of many industrialized countries – primarily members of the European Community – to compete with the United States in the game of export subsidies (Friedmann 1992). Although wheat surpluses disappeared in the early 1970s, they had reappeared again by the end of the decade and exporting countries had to find new ways to dispose of them. Trade wars and increasingly fierce competition over export markets led to a diminishing share of US wheat exports, and this trend was further exacerbated when the Soviet bloc entered international wheat markets as an exporter, following the fall of the Berlin Wall. The second concerns the success of certain developing countries in applying Green Revolution techniques and showing results for import substitution (Friedmann 1992). This could be interpreted as a source of reduced wheat dependence in Third World countries, and therefore as a reversion of the trend initiated after the War. Yet, since the data on the wheat trade reveal different patterns of wheat dependence in developing countries over the last 45 years, this observation must be nuanced.

In order to analyze the evolution of wheat dependence after the second food regime, we use a categorization of countries based on both national income *per capita* and on net trade in food (measured in calories). This categorization is inspired by McMahon (2013), and it will be useful for the analysis, insofar as it will allow us to study the evolution of the wheat trade according to the relative position of each country in the international food system. Hence, countries will be classified into the following five groups: (1)

established food exporters (2) emerging food exporters (3) the (barely) self-sufficient (4) rich food importers, and (5) poor and insecure countries[32].

(1) Established food exporters: these are the countries whose major challenge has been how to deal with overproduction. Pioneers in establishing the complex set of policies known as 'supply management policy', they have been "the powerhouses of the global food system, both as exporters and as designers of international trade policy" (McMahon 2013, 26). In addition to being blessed by nature – and also being located in areas particularly suitable for growing wheat – greater labour productivity in these countries is anchored in the early adoption of the 'modern agricultural revolution': farms are large, heavily capitalized, and mechanized. These countries are both economically advanced and net exporters of food, and the most prominent among them are the USA, Canada, Australia, and France.

(2) Emerging food exporters: middle-income countries endowed with a large amount of arable land per person and competitive agricultural sectors capable of producing their own surpluses. Many of these countries have been part of the CAIRNS group, a coalition of emerging agro-exporters that have been "the most vocal opponents of rich-world subsidies and tariffs, blaming these policies for lowering world prices and giving less efficient producers in Europe and North America unfair advantage" (McMahon 2013, 32). This group includes countries from Asia –Vietnam, Thailand, Myanmar...–, Latin America –Argentina, Uruguay, Brazil... –, and some countries belonging to the former Soviet Union, such as Russia, Ukraine, and Kazakhstan. Note that some of these countries, even when classified as "emerging" exporters, were already significant food (and wheat) exporters prior to 1918 (for instance, Argentina and some countries that later became part of the USSR)).

(3) The (barely) self-sufficient: eager participants in the Green Revolution process of the 1960s and 1970s, these countries – mostly developing Asian countries – have managed to increase national food production in order to meet their high population growth. Land productivity in these countries is similar to that of their North American and European counterparts, but output per farm worker is significantly lower. This is mainly due to their more labour-intensive and less capitalized agricultural sector. China, India, and other populous Asian countries are illustrative of the success of this group of countries in

[32] This categorization is based on GDP per capita and net trade in food in 2005/07 (see McMahon 2013).

achieving a certain degree of food self-sufficiency. Importantly, success in raising food production has been the result of government policy and wide state regulation, rather than a triumph of liberalization policies (McMahon 2013).

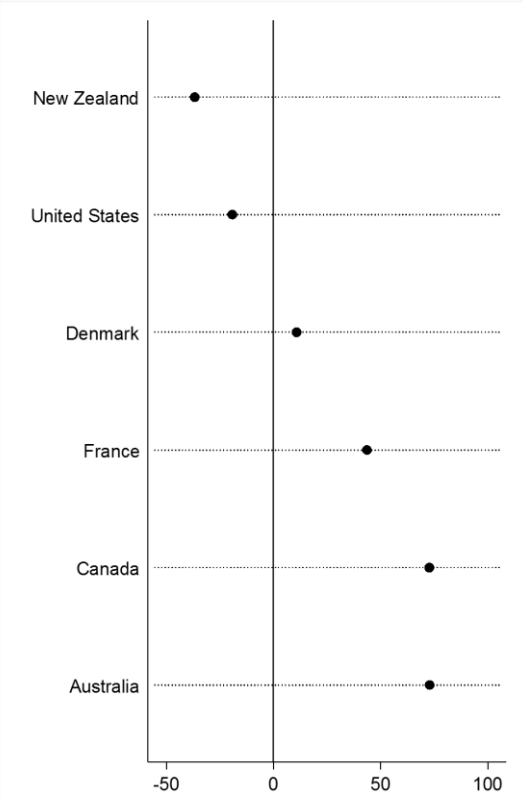
(4) Rich food importers: high-income countries that either "have dense populations, small amounts of fertile land, limited quantities of freshwater, or all three" (McMahon 2013, 35). They pay for their food imports either through 'hydrocarbon exports' – oil, gas... – or through exports of other goods, such as manufactures. These are countries belonging to different regions: Asia (Japan, South Korea), the Persian Gulf (United Arab Emirates, Kuwait, Saudi Arabia...), and Europe (the United Kingdom and many other countries of the European Union). In these countries, wheat dependence does not necessarily imply food insecurity.

(5) Poor and insecure countries: this group includes developing countries that are net importers of calories. These countries are mainly in Central America, Asia, and Africa, and are characterized by low agricultural yields and rapidly-growing populations. Most were recipients of extensive food aid and eventually became hooked on cheap grain from more advanced agricultural regions. It has been said that the WTO "forced these countries to dismantle import tariffs and farm subsidies as part of a drive towards freer trade [...] but there was a strong whiff of hypocrisy about this, as American and European policymakers urged these governments to get out of agriculture while maintaining subsidies for their own farmers and dumping food on markets at artificially low prices" (McMahon 2013, 41). In many of these countries, dependence on wheat imports has proven to be an essential source of food insecurity.

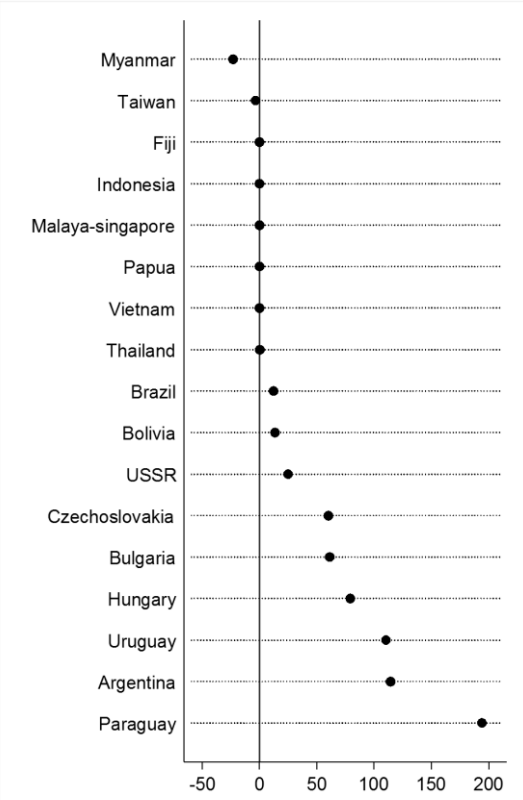
One useful indicator of the degree of wheat dependence is the self-sufficiency ratio. This indicator is constructed as follows: *[production / (production + imports - exports)]* 100*. Thus, while net exporters of wheat will have a SSR > 100, net importers will have a SSR < 100. In general, the lower the SSR, the greater the degree of dependence upon wheat from international markets. Figure 2.5 shows how self-sufficiency ratios in wheat have changed with respect to the last years of the second food regime.

Figure 2.5 Variation in self-sufficiency ratios (SSR) in wheat between 1966/10 and 2006/10, by country and group

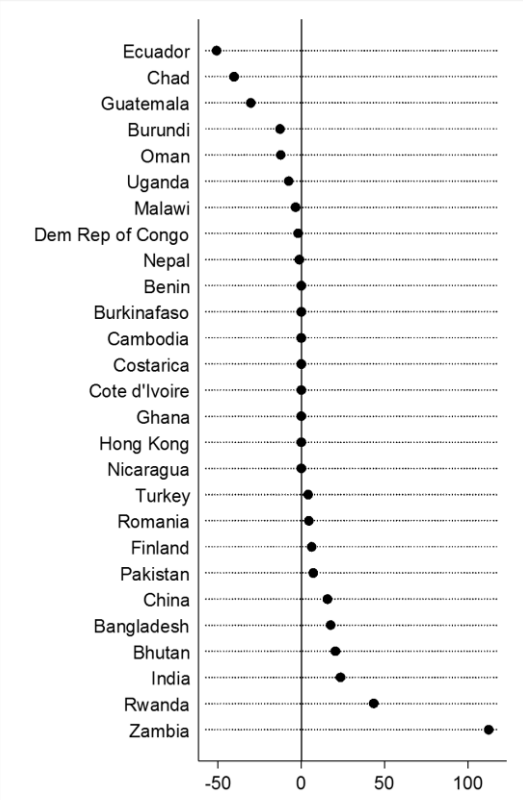
2.5 (a) Established food exporters



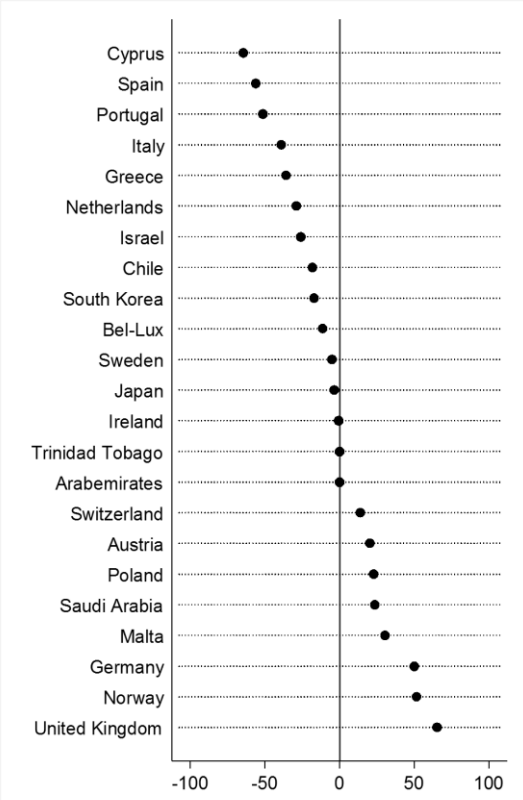
2.5 (b) Emerging food exporters



2.5 (c) The (barely) self-sufficient

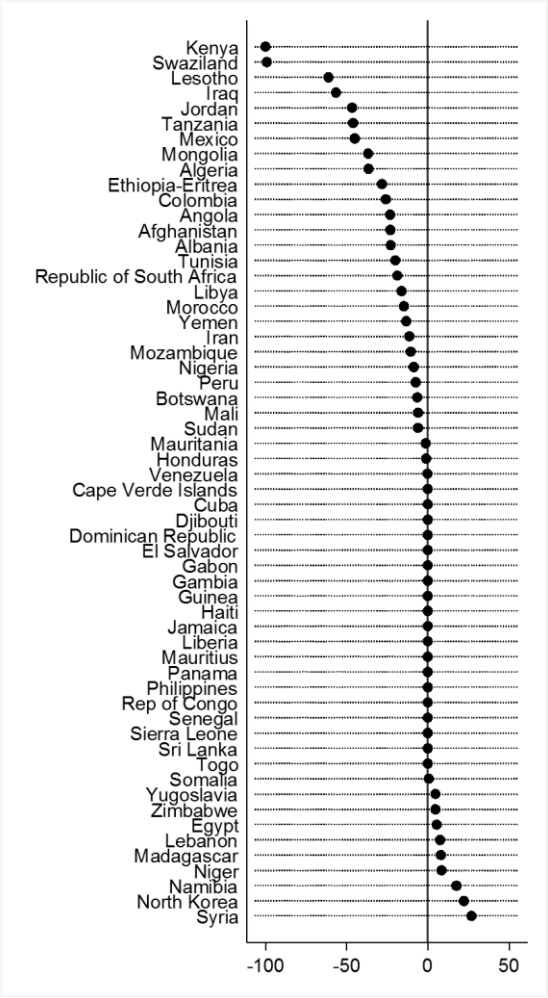


2.5 (d) Rich food importers



Source: author's elaboration from FAOSTAT (1961-2010)

2.5 (e) Poor and insecure countries

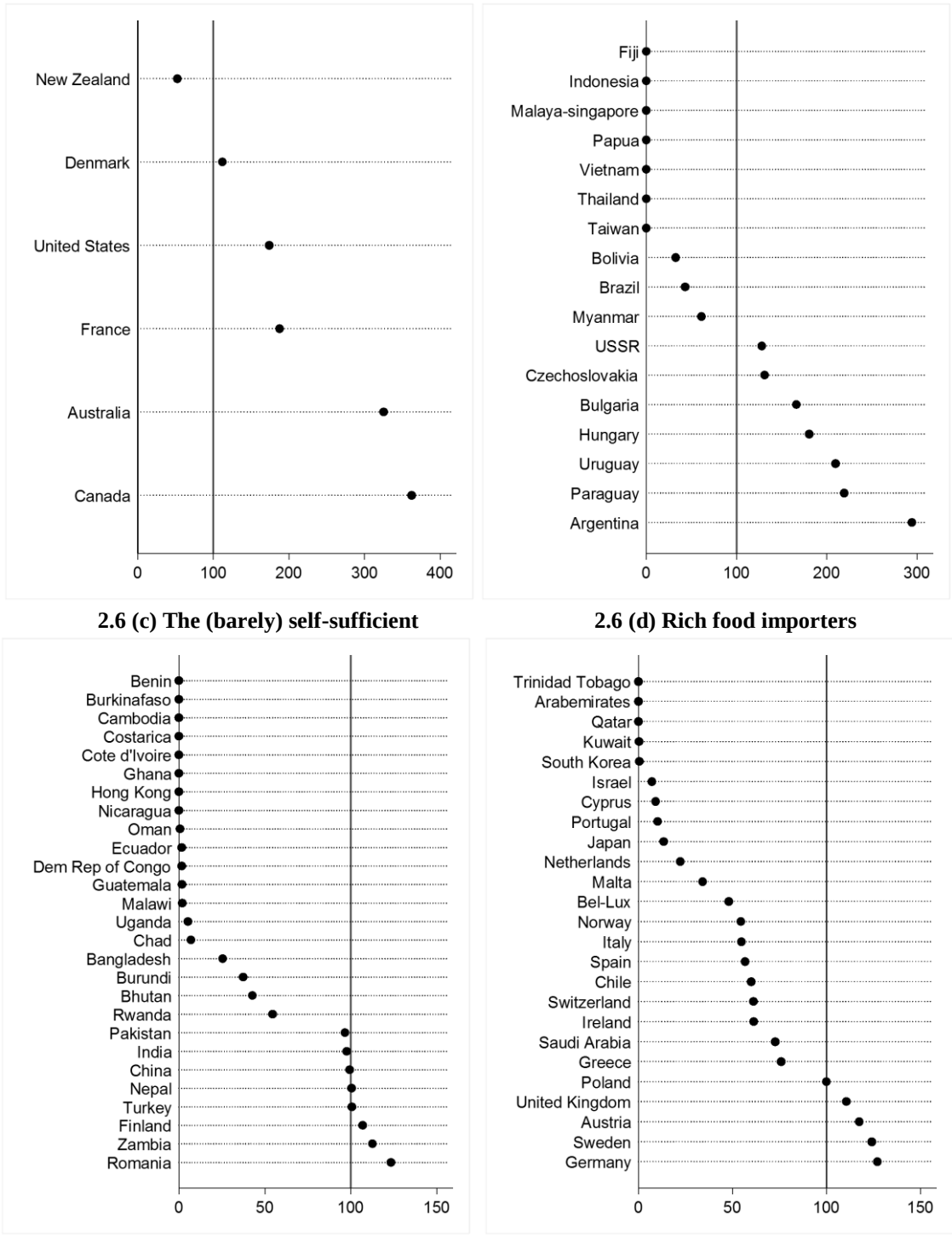


Source: author's elaboration from FAOSTAT (1961-2010)

With the exception of the United States and New Zealand – which has traditionally been a net importer of wheat – the established food exporters solidified their position as wheat exporters over this period. The group of emerging-developing exporters (Argentina, Uruguay, Paraguay, countries from the former USSR...) improved their self-sufficiency in wheat, and the same is true for many countries belonging to the '(barely) self-sufficient' group (most notably India, China, Pakistan, Bangladesh, and Turkey). Yet, other countries that have managed to achieve a certain degree of self-sufficiency in food over those years (such as Ecuador, Chad, Guatemala, and Burundi) have actually worsened their position when it comes to wheat. It is worth mentioning that most of these are located in areas that are not particularly suitable for wheat production. There is no clear trend in the group of rich importers: while some have managed to reduce wheat imports, or even to become net exporters (Germany, the UK...), others have indeed increased their import dependency (most notably, Southern European countries such as Spain, Portugal,

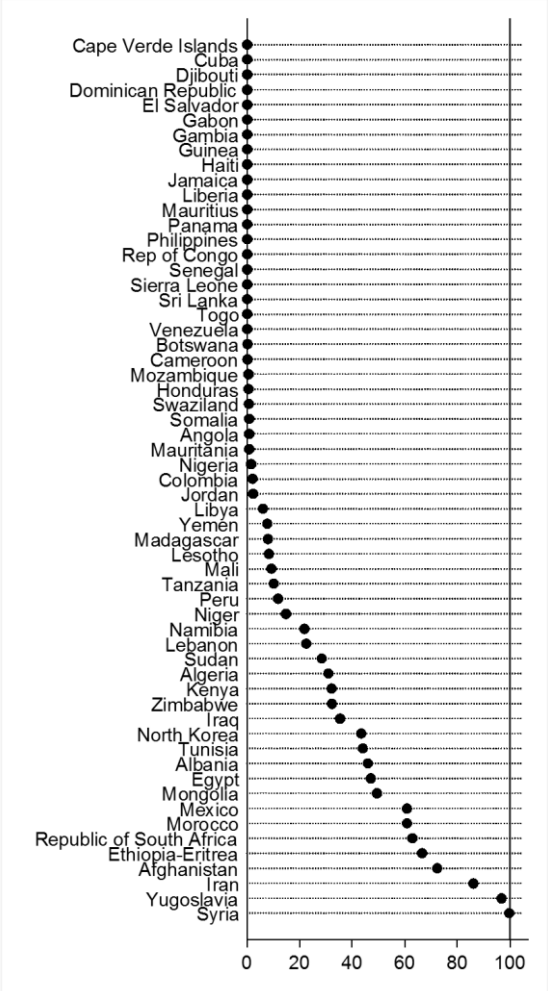
Italy, and Greece). Finally, most countries belonging to the 'poor and insecure' group have not improved, but rather deepened their dependence on wheat imports. This is particularly striking because, as we shall see, they came from an already fragile position.

Figure 2.6 Self-sufficiency ratios (SSR) in wheat in 2006/10 (5 year average), by country and group



Source: author's elaboration from FAOSTAT (1961-2010).

2.6 (e) Poor and insecure countries



Source: author's elaboration from FAOSTAT (1961-2010).

As figure 2.6 shows, there is a group of influential, high-income countries that preserve their status as significant wheat exporters: Australia, Canada, France, and the United States (even when the latter has lost an important share of international export markets over the last 30 years[33]). Argentina and Uruguay are still among the most significant developing countries that export wheat, but other emergent countries have made their appearance as wheat exporters, primarily from Eastern Europe: Bulgaria, Hungary, Czech Republic, and countries belonging to the former USSR. There is also a significant group of developing states that were dependent on wheat imports during the second food regime, but are now relatively self-sufficient (most notably India, China, and Zambia) and another group of countries whose national wheat production has roughly kept pace

[33] While more than 40% of total world exports came from the United States in the late 1970s, the US accounted for only 20% of total exports in 2010. More information about the evolution of wheat exports can be found in the appendix (Table 2).

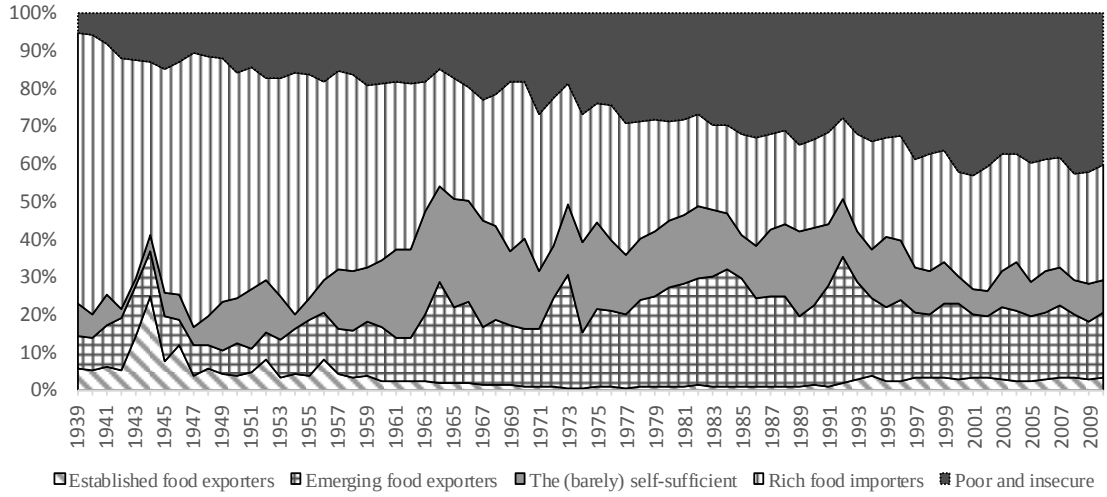
with consumption since the end of the War (Pakistan, Nepal, and Turkey). All have actively participated in the so-called Green Revolution process, which has shown positive results when it comes to achieving national self-sufficiency and reducing import dependency. Finally, there is a group of rich countries that have always been net importers of food – and still are net importers of calories – but have managed to become self-sufficient or even major net exporters, when it comes to wheat. This is the case of Germany, Sweden, Austria, and the United Kingdom. This situation may be attributable to particularly good conditions for growing wheat but also, and perhaps more importantly, to the farm programs that exist in these countries.

Yet, most countries in the world today are net importers of wheat and, as mentioned above, there are a great number that have worsened their position since the end of the second food regime. First, there are a number of developing countries that are net exporters of food (or roughly self-sufficient), but at the same time are highly dependent on wheat imports. Most of these countries produce no wheat at all (Fiji, Indonesia, Thailand, Vietnam, Cambodia, Malaysia, Nicaragua, Costa Rica, Ghana, Malawi, Rwanda, Uganda) but are specialized in other kinds of agricultural production and exports. Importantly, although most of these countries have experienced a dietary shift towards wheat products, wheat has not yet become the preferred grain of these populations (for instance, the previously cited Asian countries eat much more rice than wheat). Second, there are the rich food importers of the Middle East (Arab Emirates, Kuwait, Qatar, Saudi Arabia) the European Union (Norway, Belgium, Spain, Italy, Portugal, Greece) and Asia (Japan, South Korea), that have no problem paying for wheat by exporting other things. Finally, there is a group of poor and insecure states in which no country has managed to significantly reduce wheat dependence. Roughly half of the countries belonging to this group do not currently produce any wheat, which means that all wheat consumption must be supplied from imports (these are the countries whose self-sufficiency ratios are zero, or close to it). As mentioned, the majority of such countries are located in areas not suitable for wheat production, mainly Central America (El Salvador, Honduras, Panama) the Caribbean (Cuba, Dominican Republic, Jamaica, Haiti), Asia (Philippines, Sri Lanka), and Sub-Saharan Africa (Angola, Sierra Leone, Gambia, Guinea, Somalia). Importantly, wheat consumption per capita in these countries has grown significantly since 1970. Other countries in this group do produce – or did produce, at some point in their history – certain amounts of wheat, but production levels have not been able to keep pace with

population growth and increased per-capita consumption. These countries are, again, primarily located in Latin-America (Colombia, Mexico, Venezuela), North Africa (Egypt, Tunisia, Algeria, Morocco), Asia (Afghanistan, Iran), and Sub-Saharan Africa (Ethiopia, Zimbabwe, Namibia, Niger, South Africa).

Thus, while it is true that the end of the second food regime was followed by reduced wheat dependence in a selected group of lower-middle income countries, it is also true that the most common trend among developing countries after the 1970s has been one of increasing dependence. In this sense, rather than a break with the previous food regime, data on the wheat trade reveals a degree of continuity in the trend initiated following World War II. Figure 2.7 illustrates the increasing importance of wheat imports in the group of poor and insecure countries. While this group of countries accounted for roughly 20% of total wheat imports at the end of the second food regime, their share had risen to approximately 40% by 2010. The trend has been strong and steady[34].

Figure 2.7 Wheat imports 1939-2010: shares of total world imports by groups of countries



Source: author's elaboration from FAOSTAT (1961-2010), FAO Production and Trade Yearbooks (1948-61) and Institut International d'Agriculture (1947). Data on population from Mitchell (2013) and United Nations (2013)

The reasons behind increased wheat dependence in low-income countries during the second food regime have been explained in section 2.3: protectionist schemes in rich countries, wheat aid and export subsidies to eliminate surpluses, and an active 'market development' in poor countries. Yet despite the disappearance of most of those conditions

[34] More information about the distribution of wheat imports and exports since 1939 can be found in the appendix (Table 1 and Table2).

in the 1970s – and parallel to the reconfiguration of the food regime – wheat dependence in poor countries has increased over the last 40 years. This may be considered as an enduring effect of the second food regime, and it has to do with some sort of path dependence on the demand side, the supply side, and the institutional configuration of the emergent regime.

With regard to the demand side, it is important to note that, *caeteris paribus*, consumption habits do not tend to change much. Wheat consumption per capita in poor countries increased between 1945 and 1980 as a result of the international wheat dumping and market promotion carried out by USDA officials, grain trading companies, and international agencies (Collingham 2011). Wheat displaced traditional food staples such as millet, sorghum, and cassava as the main staple food in many Latin American, African, and Asian countries. As figure 2.8 illustrates, this dietary shift was stronger in the group of poor and insecure countries than in any other group, including that of the '(barely) self-sufficient' countries. This figure shows the changing importance of wheat consumption in relation to that of the traditional staples, by groups of countries. In addition, figure 2.9 shows the growing importance of wheat over other major cereals in the average grain consumption of developing countries.

Figure 2.8 Wheat consumption (kcal/capita/day) / [Total consumption of wheat + millet + sorghum + cassava (kcal/capita/day)], 1961-2010, by groups of countries

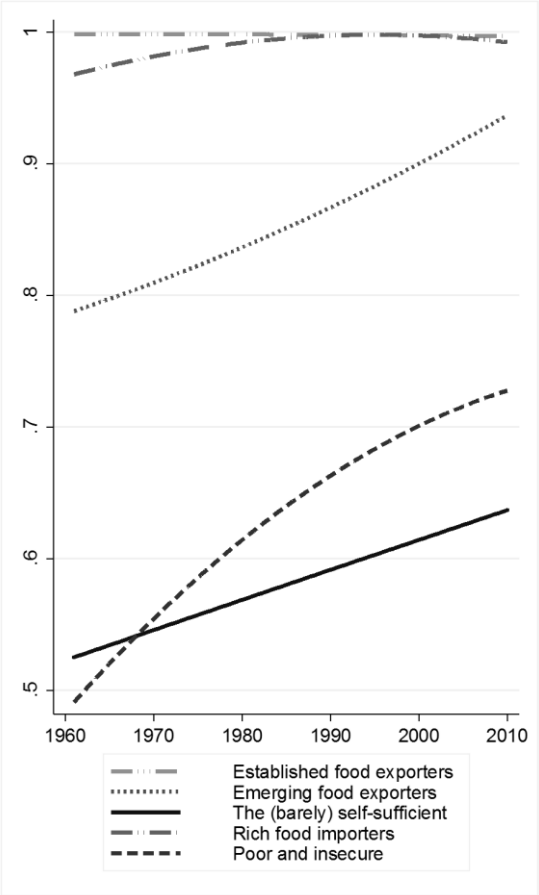
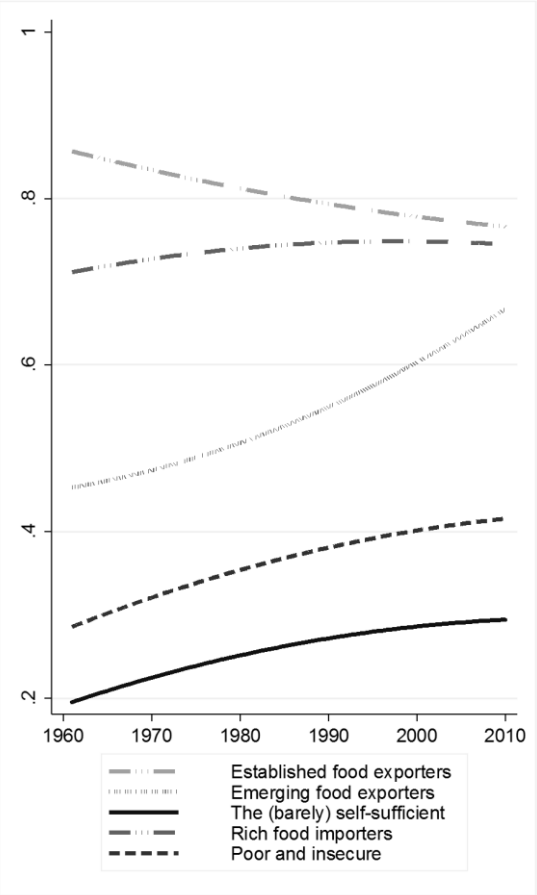


Figure 2.9 Wheat consumption (kcal/capita/day) / Total cereal consumption (kcal/capita/day), 1961-2010, by groups of countries



Source: author's elaboration from FAOSTAT (2015). Each point corresponds to one country-year pair. Coloured lines are quadratically fitted values, by groups of countries

Wheat has been increasingly consumed (in relation to cassava, sorghum, and millet) in the group of poor and insecure countries throughout the whole period. Importantly, this dietary change has not stopped yet, although the tempo of displacement has been slower over the last 30 years. In any case, as figure 2.9 illustrates, wheat has also been progressively more consumed – on average – in relation to other cereals, such as maize or rice, in developing countries (the 'barely self-sufficient', the 'emerging food exporters' and 'poor and insecure countries')[35]. Second food regime policies were successful in promoting an initial shift towards wheat consumption in countries where it was virtually unknown. Yet other factors have accelerated this growing wheat consumption trend. The

[35] Total cereal consumption includes the consumption of wheat, maize, rice, rye, oats, barley, sorghum, millet, and other minor cereals.

popularity of bread in these countries also arose for practical reasons: "the American diet did not, of course, spread around the world only because a few bureaucrats wished it to do so. The overflowing populations of Asian and South American cities could most easily be fed with wheat, just as the European industrial workers were in the nineteenth century" (Morgan 1979, 100). In general, shifts towards wheat consumption have been strongly correlated with the process of urbanization (Delgado and Reardon 1991; Pingali 2004; Fabiosa 2006). Urbanization changed employment patterns, along with the value of women's time, and increased the cost of returning home for the midday meal (Delgado and Reardon 1991). Bread was relatively inexpensive, it tasted better than other food staples, such as manioc, and washed down with tea or cola, it was ideal for the lunch boxes of workers in certain African countries (Morgan 1979). Large urban markets created the scope for the establishment of large supermarket chains and enabled the massive spread of fast food establishments, such as McDonalds (Pingali 2004). Growing supermarket power has been cited as a distinctive feature of the third/emergent food regime (Magnan 2012, 379) and it should also be considered as an indirect source of wheat dependence for low- income countries (insofar as it has encouraged the massive consumption of wheat-based products, relative to the traditional meals of those countries)[36]. Importantly, higher wheat consumption per capita in poor and insecure countries has led to a huge aggregate demand for wheat in international markets, due to the significant population growth of these countries over the last 40 years.

With regard to the supply side, many of the countries that began eating wheat due to subsidized P.L.480 wheat shipments, or other food aid schemes, are located in areas that are essentially unsuitable for wheat production. In other developing countries, that can actually produce wheat, foreign wheat aid – which was welcomed as a way to foster industrialization – restricted national agricultural production because it postponed essential agricultural reforms, failed to give agricultural investment sufficient priority, and

[36] The collapse of the foundations of the second food regime in the early 1970s was accompanied by a global reconfiguration of agrofood relationships that implied new forms of integration and marginalization for producers and regions (Magnan 2012). Wheat lost some of its distinctive importance in favor of other commodities such as soy, which could be better integrated in the burgeoning livestock complex. For instance, Argentina shifted from being a major wheat exporter to a major soy exporter, latterly for Chinese intensive livestock. Yet it is possible to argue that, for many low-income countries, it was precisely the third/emergent food regime that encouraged the consumption of wheat over the traditional staples of those countries (see figure 2.8). Friedmann talks about the 'lineaments' of a third food regime, characterized by diverging quality conventions and growing supermarket power over agrofood commodity chains (Friedmann 2005). In this sense, it can be said that traditional crops, such as millet, cassava, and other roots and tubers, were not as successful as wheat in adapting to the new private standards and to the requirements of agrofood corporations in those countries.

maintained policies with an anti-agricultural bias (Bovard 1998). The major outcome of these surplus-disposal schemes – notwithstanding their vague humanitarian goals – was that many developing countries became hooked on the most expensive grain when, roughly around 1972, wheat prices soared and aid programs gave ground to commercial sales. Despite the gradual disappearance of the anti-agricultural bias in low-income countries over the last 40 years (Anderson 2007), wheat production in most of these countries has not been able to catch up with their consumption requirements (nor has it been able to be as efficient as it would have been if not for years of institutional neglect). To some extent, the productivity gap that exists between wheat production in developed countries and in some developing countries may be considered as an outcome of second food regime policies. While the wheat sector was highly protected in rich countries, it was disregarded in many low-income countries until the late 1970s. Following Chang's argument (Chang 2002), poor countries would have required even higher levels of protection than those of industrialized countries after WWII, in order to compensate for roughly 30 years of second food regime policies. However, as we shall explain, the international institutional framework that emerged after the collapse of the regime and developed over the last 40 years has not been favorable to that type of agricultural regulation.

It is possible to argue that some aspects of the second food regime remained essentially unaltered after its collapse. The wheat trade during the second food regime period was anchored in the fundamental exceptions conceded by GATT to agriculture. In particular, the GATT was specifically designed to accommodate the farm programs then in existence in industrialized countries (which would be the essential cause of growing wheat surpluses and would later become the cornerstone of a 'politically constructed wheat trade'). Following the end of the second food regime, new forms of multilateralism appeared and agriculture was formally integrated into the global free trade agenda. Yet, it has been held that "the period from the inception of the Uruguay Round in 1986, until the Seattle meeting in 1999, exhibits a global politics of food in which elite northern interests strategized to create and use the WTO as a tool to preserve their own subsidy regimes, while at the same time enforcing liberalization on the rest of the world" (Pritchard 2009, 302). Northern countries have shown no desire to alter the paradigms within which their domestic food policies were framed, and in this sense the new institutional framework regulating wheat trade may be seen as a 'hangover' from the second food regime. This institutional lag has its counterpart in the actual evolution of the wheat

trade over the last 40 years. While it is true that major developing countries, such as China and India have managed to reduce wheat imports, the data on the wheat trade reveal that the most common trend among low-income countries has been one of increasing dependence. In the 1970s, these countries faced unprecedented dilemmas of capitalist development, because they could not easily repeat the development strategy of Japan, or many European countries (to import food and pay for it with industrial exports), neither could they imitate the food export model of countries such as the US, Canada, and Australia (Friedmann 1990). In addition, the new multilateral trade framework has been, to some extent, a new source of induced wheat dependence for those countries. Importantly, high wheat dependence revealed itself as catastrophic when international wheat prices skyrocketed in 2007, 2008, and 2011.

2.5 Conclusions

This article comprises both a theoretical and an empirical part. The theoretical section is concerned with certain aspects of the food regime approach. Following a brief review of the literature on the history and methods of food regime analysis, we present a characterization of the first and second food regimes. The empirical part is centered on a cornerstone of food regime analysis: the evolution of international wheat markets. The analysis is based on data from a range of sources and provides detailed information about trends in wheat consumption and trade on a global scale. Several categorizations of countries are employed in order to capture phenomena such as the concentration of world wheat exports in only a few countries, and the relationship between net exports per capita and national income. We find that a trend of increasing wheat dependence in poor and insecure countries began after World War II and accelerated following the 1970s. Our thesis is that increasing wheat dependence over the last 40 years may be considered as an enduring effect of the second food regime, since there have been path dependence mechanisms influencing the evolution of the demand side (wheat consumption trends), the supply side (wheat production), and the institutional side (the new international trade framework and the WTO).

It is important to note that dependence on food imports does not necessarily mean food insecurity, and wheat imports, as such, are not negative. For instance, many countries belonging to the "rich food importers" group have been dependent on wheat imports

and have shown no signs of food insecurity. Yet wheat dependence may well be a significant source of food insecurity, when combined with other variables (such as, for example, low income levels). It has been acknowledged that the concept of food security is complex and has multiple levels: food availability, food access, utilization, and stability (FAO 2006). Thus, identifying import dependency with food insecurity would be a mistake, mainly because the latter is a much broader concept. A *cereal import dependency ratio* is only one of many indicators that have been suggested to measure food insecurity (FAO 2006), and is included among the indicators concerned with *stability*, a concept that may refer to both the availability and access dimensions of food security (FAO 2006). First, it is widely acknowledged that high import dependency tends to increase a country's vulnerability to external market shocks (for instance, sudden price spikes). Second, it has been pointed out that imports of basic foods such as wheat, on which many people, and especially poor people, depend, can easily become a geostrategic "weapon" (Hoering 2013). To sum up, in situations of high import-dependency, people may not get enough food due to mechanisms – market forces, political-economic outcomes in other parts of the world…– that are beyond the control of the governments themselves. Therefore, high wheat import dependency may be considered as a matter of food security in low-income countries, insofar as wheat-based products account for a relatively high percentage of their total cereal consumption (or, more generally, of their total caloric intake). This may well not yet be the case in some developing countries, but it has become a reality in many others.

Identifying high wheat import dependence with food insecurity is problematic, even when it comes to the group of the poorest countries of the world. Yet the trends are so clear that they are worthy of analysis. This paper traces the roots of wheat import dependence in low-income countries, using a food regime approach. We suggest that today's food insecurity in many parts of the world has its origins in a process originating after World War II, during the so-called second food regime. Moreover, our analysis suggests that increasing wheat dependence in low-income countries after the 1970s may be understood as a lagged outcome of the international framework of the second food regime.

Appendix

Table 2.A.1 Wheat imports, 1940-2010. Market share by groups of countries, and shares of the 5 most significant importers

	McMahon Classification					Income Classification				Most significant importers				
	Established Food Exporters	Emerging Food Exporters	The (barely) Self-Sufficient	Rich Food Importers	Poor and Insecure	Low income	Lower middle income	Upper middle income	High income	United Kingdom	USSR	China	Egypt	Brazil
1940	5.02	8.89	5.88	74.76	5.43	0.76	1.23	15.77	82.22	40.14	-	3.57	0.01	5.32
1945	7.64	11.75	6.51	59.22	14.86	1.81	5.96	22.97	69.24	25.17	-	1.78	0.87	7.40
1950	3.81	8.65	11.88	59.91	15.73	2.42	14.73	16.99	65.84	18.09	-	0.05	2.61	5.71
1955	3.90	14.80	5.63	59.32	16.33	3.00	7.10	22.13	67.74	18.69	0.12	0.00	0.91	6.86
1960	2.23	14.49	17.80	47.04	18.41	2.50	24.74	18.52	54.23	12.59	0.33	0.00	2.93	5.46
1965	1.75	20.27	28.55	32.25	17.15	1.86	22.59	38.65	36.88	8.35	11.95	11.70	3.66	3.33
1970	0.94	15.34	23.89	41.85	17.96	4.06	18.86	31.07	45.98	9.15	3.96	10.89	2.21	3.57
1975	0.85	20.61	22.90	31.65	23.97	5.18	25.04	35.41	34.34	4.89	12.96	5.63	5.11	2.84
1980	0.86	26.55	17.63	26.25	28.68	3.78	16.42	50.79	28.99	2.28	16.21	11.95	5.49	4.82
1985	0.85	28.78	11.34	26.88	32.12	4.03	18.01	48.98	28.97	1.54	20.66	6.19	6.66	3.85
1990	1.19	21.08	20.51	23.92	33.28	3.98	19.09	50.56	26.36	0.84	14.52	13.01	6.07	1.85
1995	2.32	19.65	18.43	26.38	33.19	3.94	20.78	45.05	30.21	0.83	6.56	11.40	4.80	5.53
2000	2.74	20.08	7.39	27.50	42.26	6.15	20.87	41.12	31.84	0.97	6.69	1.83	3.82	6.06
2005	2.27	17.01	9.39	31.44	39.87	6.51	23.24	35.08	35.15	1.00	3.98	3.79	4.28	3.73
2010	3.11	17.21	8.92	30.63	40.11	7.98	24.62	32.35	35.03	0.77	3.84	1.66	6.62	4.51

Source: author's elaboration from FAOSTAT (1961-2010), FAO Production and Trade Yearbooks (1948-61) and Institut International d'Agriculture (1947).

Table 2.A.2 Wheat exports, 1955-2010. Market share by different groups of countries, and shares of the 5 most significant exporters

	McMahon Classification					Income Classification				Most significant exporters					
	Established Food Exporters	Emerging Food Exporters	The (barely) Self-Sufficient	Rich Food Importers	Poor and Insecure	Low income	Lower middle income	Upper middle income	High income	United States	Canada	Australia	Argentina	France	USSR
1955	69.88	24.48	1.18	1.80	2.64	0.00	2.63	23.92	73.43	27.17	22.94	9.47	13.67	10.87	7.67
1960	72.90	21.84	0.67	3.55	1.01	0.00	0.05	22.95	76.99	40.32	19.40	8.82	6.36	4.57	15.11
1965	77.30	16.07	0.56	4.05	2.00	0.15	0.32	17.85	81.67	34.69	22.47	11.45	11.81	8.45	3.59
1970	74.22	16.26	0.66	8.46	0.38	0.17	0.34	16.51	82.97	33.39	20.10	12.77	4.22	7.78	10.35
1975	81.19	9.01	1.03	8.61	0.14	0.01	0.02	10.00	89.95	43.14	16.01	11.12	2.60	10.63	4.71
1980	81.85	8.32	1.43	8.15	0.23	0.01	0.22	9.31	90.44	37.19	17.74	15.12	4.57	12.09	2.12
1985	75.08	13.72	0.99	10.00	0.19	0.01	0.36	13.79	85.82	25.09	16.73	15.19	9.33	18.26	1.61
1990	73.47	8.72	0.46	16.33	0.99	0.03	0.50	9.10	90.36	26.57	16.85	10.74	5.59	17.87	1.00
1995	68.36	15.49	3.07	11.79	1.27	0.18	1.38	15.65	82.78	29.47	14.95	6.86	6.28	16.26	3.44
2000	66.69	15.96	3.32	12.64	1.37	0.14	1.20	16.90	81.75	22.75	14.96	14.17	9.05	15.43	5.11
2005	54.72	28.07	4.63	11.16	1.39	0.06	2.55	28.21	69.16	20.91	10.83	10.91	8.01	13.05	16.25
2010	53.66	26.49	4.54	13.09	2.20	0.20	0.90	28.20	70.68	17.89	11.91	10.19	3.32	14.07	17.45

Source: author's elaboration from FAOSTAT (1961-2010), FAO Production and Trade Yearbooks (1948-61) and Institut International d'Agriculture (1947).

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Chapter 3. The determinants of world wheat trade, 1963-2010: a gravity equation approach

3. 1 Introduction

Wheat is the most traded staple food and it is grown on a larger area than any other crop. It has long been a staple in many countries and is widely consumed, even in places where its production is virtually impossible. Contrary to other staples, such as rice, it can be preserved and stored quite easily. This helps to explain its predominant role within the total agricultural trade. Wheat-based products have been at the core of many countries' diets, so the functioning of the international wheat market has often been crucial for world food security. Agricultural policy –including commercial policy– has always paid special attention to wheat, both in industrialized and in developing countries. Wheat has been the most important traded food for low-income countries and the major component of food aid (Callear and Blandford, 1981). It also played a key role in geo-strategic relations during the Cold War period (Morgan, 1979) and has been a chief protagonist in major technological changes in agricultural methods and plant breeding (Perkins, 1997).

This paper aims to identify the main drivers of world wheat trade over the period 1963-2010. More specifically, it is concerned with the factors that explain the geographical distribution of the wheat trade (bilateral trade flows). For that purpose, we follow a cliometric approach. First, we consider the historical and institutional framework of the wheat trade over the studied period. This framework was deeply affected by the pre-war situation in wheat markets, and consolidated its distinctive and longstanding characteristics over the immediate post-war years. The history of the trade cannot be detached from the very peculiar institutional configuration that ruled the world agricultural trade after WWII. This framework evolved over time, certainly affecting the volume and direction of wheat trade flows. Further complicating matters is the fact that national and international wheat policies implemented throughout this period were usually the result of economic policy goals that were not directly related to wheat. While in some countries wheat policies were primarily driven by the aim of assuring farmers a 'fair' income, in other countries wheat policies were fundamentally aimed at achieving self-sufficiency in food. In other cases, wheat policies were designed to solve balance of payments problems. The trade in wheat does not occur in an empty geopolitical/institutional space, but in a very complex institutional framework that is resistant to analysis, let alone to incorporate in an econometric model. There are, however, powerful physical and economic forces that explain a substantial part of the observed wheat trade flows. This is why we estimate several econometric models based on the gravity principle of international trade and discuss the

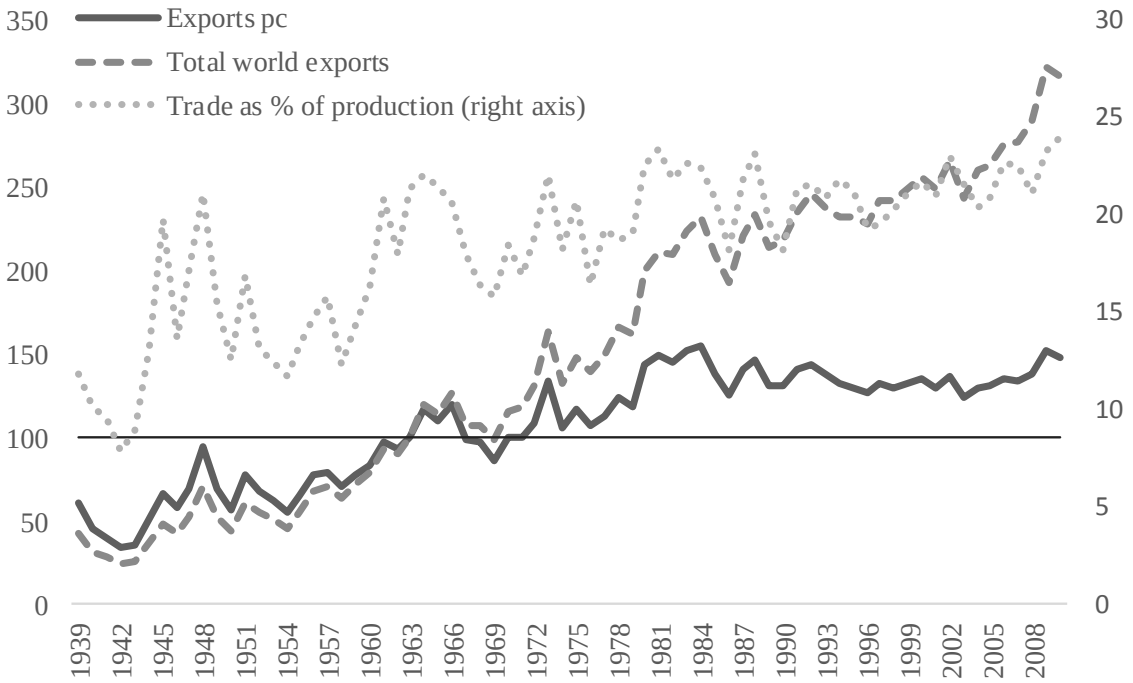
results, taking into account the historical/institutional conditions that prevailed in wheat markets over the studied period.

The paper is structured as follows. A rough description of the evolution of the world wheat trade between 1939 and 2010 is carried out in section 3.2. This section also draws on other academic and historical sources to depict the institutional and geopolitical background in which the trade occurred. Section 3.3 deals with the theoretical and empirical foundations of the gravity equation (GE), and discusses the advantages of using the Poisson Pseudo Maximum Likelihood Estimator (PPML) over other alternative estimation methods for our case study. The dataset is presented in Section 3.4, in which several econometric models are also estimated and discussed. The main conclusions of the paper are set out in Section 3.5.

3.2 The world wheat market

It is well known that wheat markets experienced serious troubles during the 1930s. Total wheat trade dropped significantly both in volume and in prices between 1925 and 1938, due to excess supply in the producing regions and to the protectionist measures that were undertaken in the main importing countries to deal with the so-called "wheat problem" (de Hevesy, 1940). World wheat markets showed evident signs of stagnation and the outlook for the world wheat economy was markedly dismal. Yet the situation changed significantly after World War II. The signs of market disintegration disappeared, a solution to the 'wheat problem' was found, and total wheat trade began an upward trend that continues today. In fact, the world wheat trade in 2010 was roughly seven times greater than it was in the 1930s. As figure 3.1 illustrates, the growth in wheat trade was noticeably higher than that of world population over the period 1945-1985 (*per-capita* wheat trade grew at a significant rate between the end of WWII and the 1980s, and then leveled off). In addition, a growing percentage of total wheat production was internationally traded between 1945 and 2010, even when wheat production also grew significantly.

Figure 3.1 World wheat trade (total exports, tonnes) [1963=100], *per-capita* wheat trade [1963=100], and wheat trade as a percentage of world production [%, right axis], 1939-2010



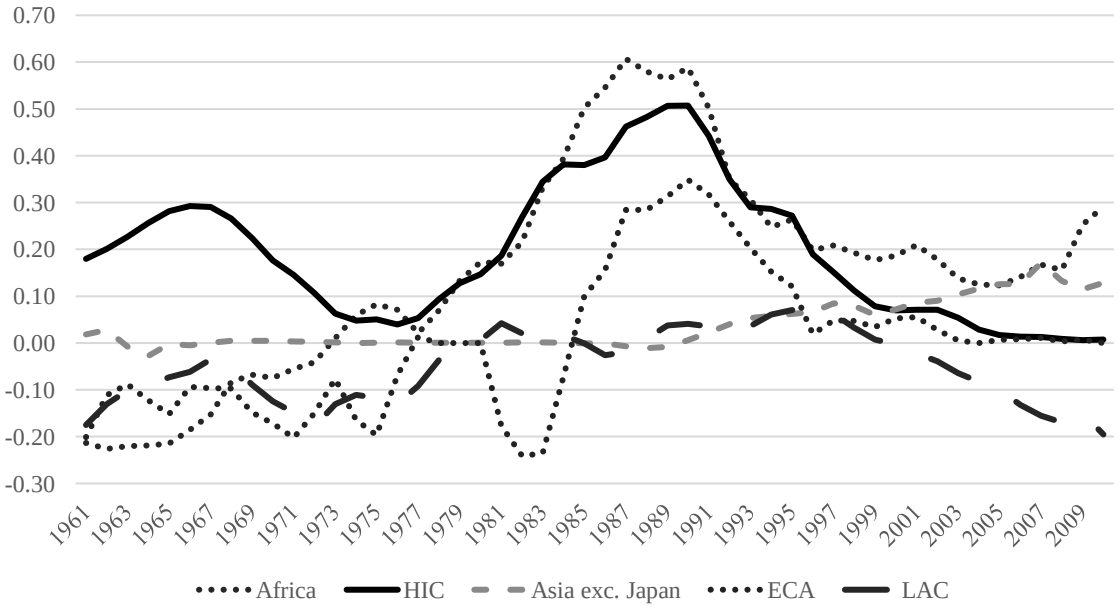
Source: author's elaboration from FAO (2016), FAO Production and Trade Yearbooks (1948-61) and Institut International d'Agriculture (1947)

The reasons behind the extraordinary expansion of the wheat trade that occurred over the 65 years following WWII have been thoroughly analyzed in González Esteban (2017a). This work also describes the institutional framework in which the trade took place and, in order to do so, it goes back to the interwar period, when the 'wheat problem' was at its peak. The collapse of wheat prices in the late 1920s and 1930s was largely caused by the growth of worldwide supply in excess of demand (Aparicio and Pinilla, 2015; Malembaum, 1953). Exporting countries were eager to dispose of their wheat surpluses and threw them on the market at almost any price (de Hevesy, 1940: 3). Farm income plummeted, importing countries established severe protectionist measures, and the world wheat trade collapsed. Importantly, excess wheat supply in the main producing countries coexisted with another stark reality: the unfulfilled nutritional needs of millions of hungry people in developing regions (Malembaum, 1953). The problem was, of course, that no effective demand for wheat existed in those regions. The Second World War alleviated the problem of overproduction for a while, yet surpluses reappeared soon after the end of the conflict and industrialized/exporting countries applied a number of measures to deal with the farm-income problem. This set of policies was relatively successful in assuring a 'fair' level of income to farmers, but failed to tackle the problem of

overproduction. Although some countries – most notably the United States – established acreage restrictions with the aim of limiting output, price support schemes tended to encourage wheat production, thus fostering the 'overproduction → falling prices → falling income' cycle. Exporting countries soon resorted to export subsidies to dispose their wheat surpluses abroad. Public Law 480, approved by the US Congress in 1954, is often cited as the most significant example of this kind of surplus-disposal policy (Eggleston, 1987; Friedmann, 1982; Winders, 2009). The General Agreement on Tariffs and Trade (GATT), approved in 1947, had actually been designed to permit trade-distortive policies in agriculture: domestic agricultural programs in industrialized countries required protectionist measures at the border in order to function (Hathaway, 1987; Johnson, 1987; González Esteban et.al. 2016). In fact, it has been argued that agricultural trade policies in high-income countries were typically adopted as "an adjunct" of their domestic farm policies, and that GATT rules were written to fit the particular case of the United States (Hathaway, 1987). With regard to the importing countries, they applied different types of policy after the end of the War. On the one hand, some industrialized importing countries – most notably Western European countries – set in motion protectionist schemes and price support policies in order to recover from the War shortages. These policies aimed to achieve, whenever possible, self-sufficiency in food, but were also designed to raise farm income. The problem – as in the case of other industrialized countries, such as the United States and Canada – was that the overproduction issue was not properly addressed. This meant that countries such as France were soon troubled with more unwanted surpluses and eventually resorted to export subsidies to get rid of their excess wheat supplies. The establishment of the Common Agricultural Policy (CAP) in 1962 may be considered as the culmination of this kind of interventionist policy. On the other hand, most developing countries followed industrialization policies that often had an anti-agricultural bias (Anderson et.al., 2013). The underlying idea was to foster industrialization via low food prices and low wages for urban workers. This strategy soon proved to be ineffective with regard to its main goal (Son, 1986), and also generated much controversy because it promoted wheat import-dependency in many developing regions (Friedmann, 1990; Winders, 2009; González Esteban, 2017b). When wheat prices skyrocketed in the 1970s, many developing countries found that they had become hooked on the most expensive grain and began moderating the anti-agricultural bias of their policies. Since high-income countries also began to reduce their national rates of assistance to agriculture from the mid-

1980s onwards, some authors talk about an international process of convergence in agricultural policies between 1985 and 2010 (Anderson et.al., 2013). This may be better seen in figure 3.2, which has been plotted to illustrate the evolution of national government support to wheat by regions[37].

Figure 3.2 Nominal rates of assistance to wheat, by region (1961-2010)



Source: author's elaboration from Anderson and Valenzuela (2008) and Anderson and Nelgen (2012)[38]

Prior to the price-spikes of the 1970s, high-income countries strongly supported their wheat sector, while African and Latin American countries penalized domestic production heavily. The effective support to wheat in high-income countries was reduced over the 1970s as a consequence of skyrocketing wheat prices, but resumed and deepened after the crisis. Certain aspects of the postwar institutional framework began to change in the 1980s and the world wheat market gradually became less distorted, as high-income countries dismantled their hitherto ample support to domestic production. However, it has been argued that the postwar configuration of agricultural trade – a multilateral organiza-

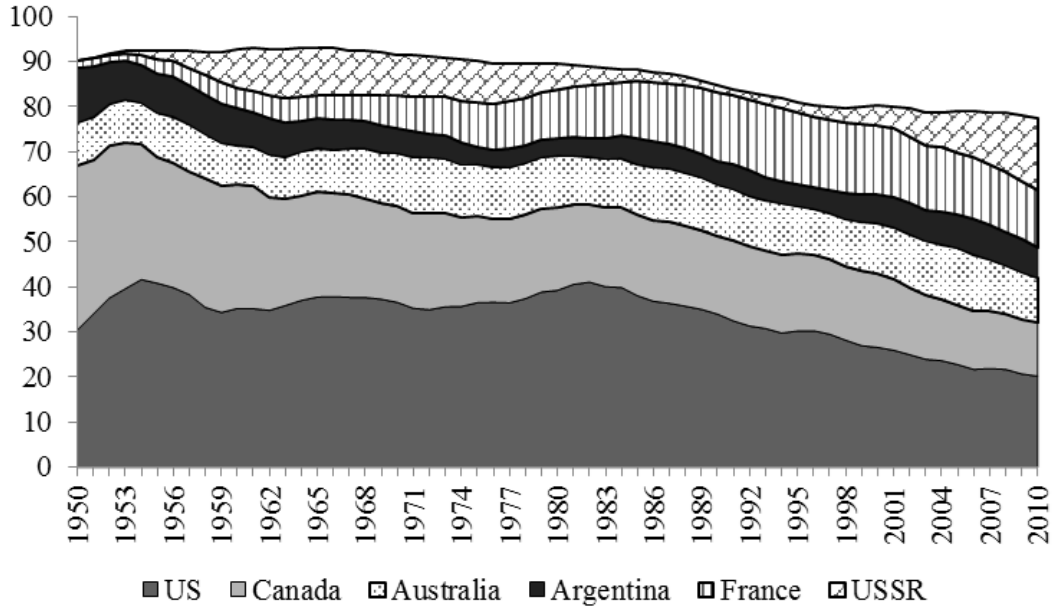
[37] Nominal rates of assistance (NRA) for wheat should be understood as "the percentage by which government policies have raised gross returns to farmers above what they would have been had the government not intervened (or the percentage by which government policies have lowered gross returns, if NRA <0)" (Anderson et. al., 2013, 428). Therefore, this indicator measures distortions imposed by governments, creating a gap between domestic prices and "the prices that would exist under free markets" (Anderson et. Al, 2013, 48).

[38] HIC = High income countries; ECA = European Transition and Mediterranean; LAC = Latin American Countries. NRAs by country have been weighted by wheat production each year.

tion of trade that allowed surplus disposal schemes in exporting countries while encouraging cheap imports in many importing countries – affected the direction of wheat trade flows, even when its distinctive features no longer existed. More specifically, increasing wheat dependence in low-income countries after the 1980s may partially be understood as a lagged outcome of the postwar international framework (González Esteban, 2017b).

As follows from the above, the extraordinary expansion of the wheat trade that took place between 1963 and 2010 occurred mostly within a framework of widespread state intervention in the sector. It is not clear, however, how this broadly interventionist context affected the total amount of wheat traded: while protectionist measures such as tariffs and quotas directly discouraged imports – thus imposing limits to trade growth– export subsidies and other surplus-disposal programs surely fostered trade. It is somewhat clearer that the world wheat trade would have not grown as much as it did if newly-significant sources of demand had not been "created", mostly in developing countries (González Esteban, 2017a, 2017b). From all of the above, it follows that the wheat trade not only grew significantly between 1945 and 2010, but that its geographical distribution – and particularly the distribution of imports – also changed dramatically. Figure 3.3 shows the evolution of the export-shares of the top 6 exporters between 1950 and 2010, and figure 3.4 does the same with the import-shares of the most significant importers.

Figure 3.3 Wheat export shares (% of total world wheat exports). Top 6 exporters, 1950-2010, [10 year moving averages]

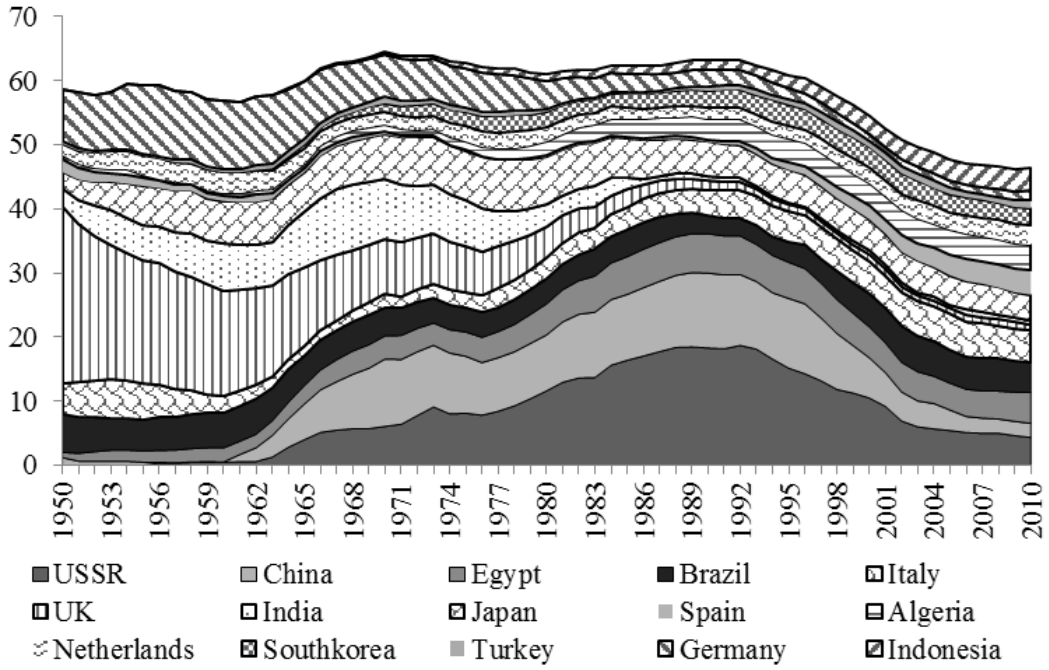


Source: author's elaboration from FAOSTAT (2016) and FAO Production and Trade Yearbooks (1950-1960)

The so-called 'overseas exporters' – the United States, Canada, Australia, and Argentina – together accounted for roughly 90% of total world wheat exports in the early 1950s. Their joint share followed an overall downward trend during the whole period, mainly due to the emergence of France as a powerful exporter, but also due to the participation of the USSR as an active exporter between the 1950s and the 1980s (and to the rising export shares of some former USSR republics after the fall of the Berlin wall). The studied period was also characterized by the growing importance of other minor exporters, most notably some Western European countries, such as Germany and the United Kingdom. Since wheat export markets were highly concentrated, the most significant exporters – i.e. the United States and Canada – had a much greater ability to set international wheat prices to their own advantage (McCalla, 1966; Morgan, 1979; Goshray, 2006).

The import side has always been less concentrated than the export side, and, as figure 3.4 shows, this trend deepened throughout the studied period (and particularly since the 1990s).

Figure 3.4 Wheat import shares (% of total world wheat imports). Most significant importers, 1950-2010, [10 year moving averages]



Source: author's elaboration from FAO (2016) and FAO Production and Trade Yearbooks (1950-1960).

The United Kingdom was indeed the most significant wheat importer after the Second World War. In fact, the UK alone accounted for almost 30% of total world imports in 1950. However, its role as a major importer gradually lost importance over the following decades, and its share of world imports became insignificant in the late 1990s. Two other populous countries came to replace the UK and emerged as major importers between the 1960s and the 2000s: the USSR and China. However, their participation as chief importers followed a downward trend from the 1990s onwards, leading to a more even distribution of world wheat imports. A growing number of countries joined the international wheat market as importers from the 1950s onwards, and non-traditional importers were responsible for larger shares during the last 20 years of the studied period.

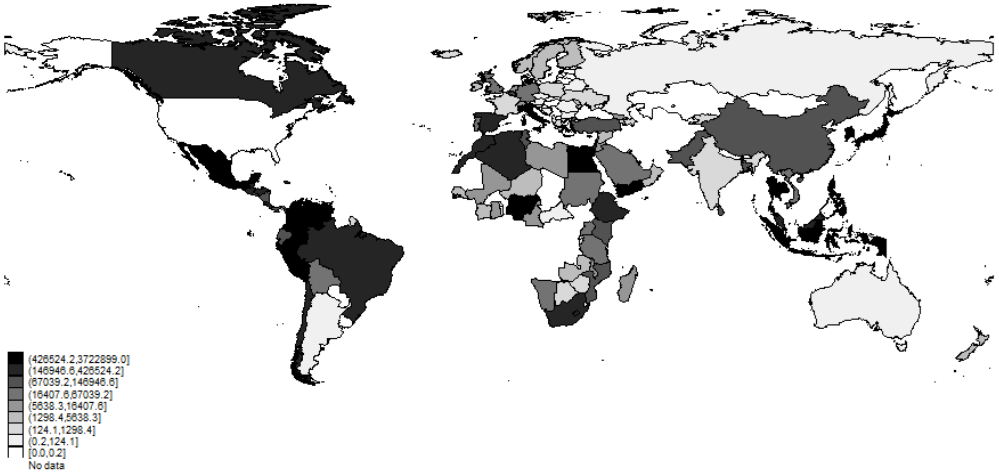
The situation in 2010 was one of more importers and exporters than ever before. Therefore, not only has the wheat trade grown, it has also expanded dramatically in geographical terms. Of course, this is the consequence of a significantly more diverse geographical distribution of world wheat consumption (and, to a minor extent, of world wheat production). Several maps have been plotted in the appendix in order to show this phenomenon. Figures 3.A.1, 3.A.2, 3.A.3 and 3.A.4 illustrate the world distribution of wheat production and consumption in 2006/2010. In addition, figures 3.A.5 and 3.A.6 show the geographical distribution of wheat exports in 2006/10 (total and *per capita* respectively), and figures 3.A.7 and 3.A.8 do the same with imports. As can be observed, wheat is extensively consumed all over the world, this fact being true even in regions where its production is virtually negligible (most notably in the countries closest to the equator)[39]. These figures also suggest that certain variables, such as the country size, should necessarily be taken into account when trying to explain the world wheat trade.

With regard to the bilateral trade flows, figures 3.5 to 3.9 have been plotted to illustrate the main recipient countries of the exports proceeding from the top-5 major exporters in 2006/10: the United States, Canada, Australia, Argentina, and France. As expected, these maps clearly show the importance of distance and proximity. While Argentina's exports are mostly directed to South American countries, Australia exports most of its wheat to Asia. Wheat produced in France is typically acquired by other European

[39] More information about the evolution of wheat production, consumption and trade between WWII and 2010 and on the main factors behind those trends can be found in González Esteban (2017a).

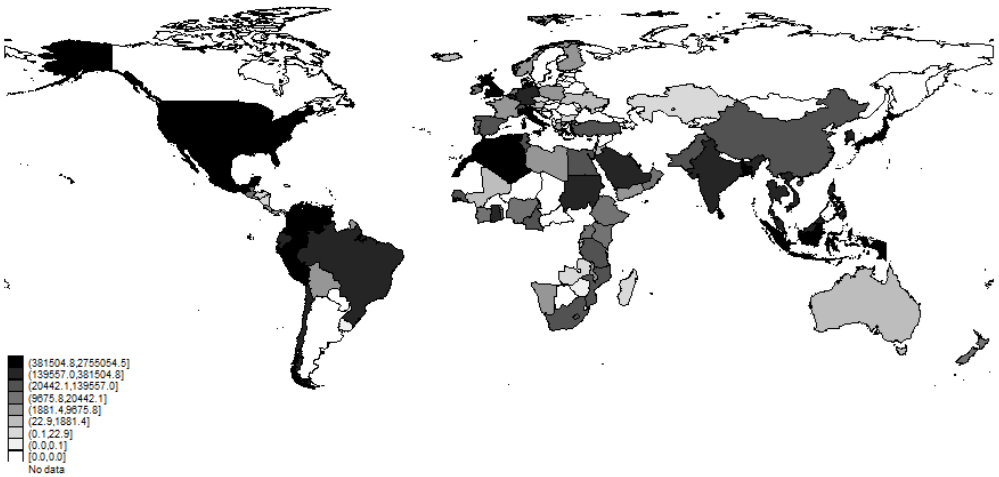
countries and by many North African countries. Meanwhile, the United States and Canada export significant amounts of wheat to each other, but also to a great number of countries all over the world. Distance is, however, only one of the many variables that directly affect trade. Section 3.4 is aimed at identifying and quantifying the impact that other major variables – such as income and production – have had on the international wheat trade.

Figure 3.5 Wheat exports (tonnes) from the United States, average 2006-2010, by destination country



Source: author's elaboration from UN-COMTRADE (2016)

Figure 3.6 Wheat exports (tonnes) from Canada, average 2006-2010, by destination country



Source: author's elaboration from UN-COMTRADE (2016)

Figure 3.7 Wheat exports (tonnes) from Australia, average 2006-2010, by destination country

Figure 3.8 Wheat exports (tonnes) from Argentina, average 2006-2010, by destination country

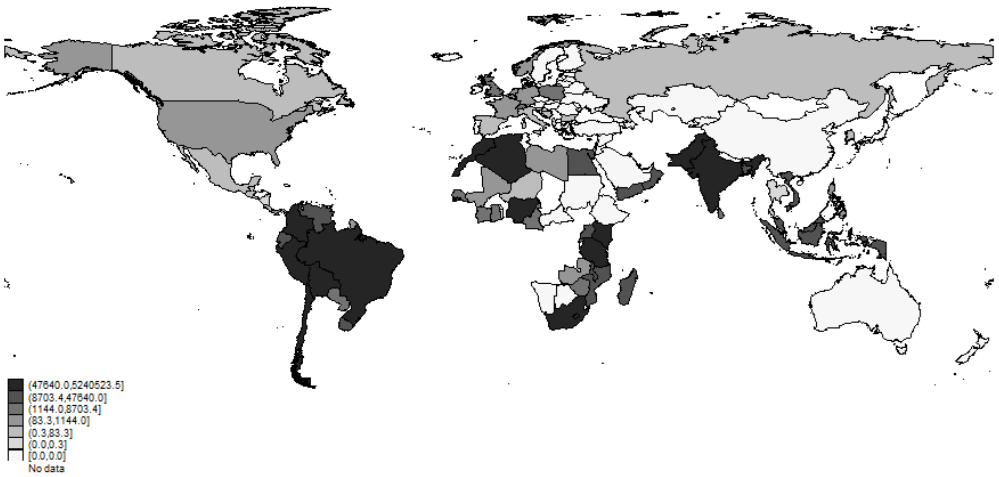
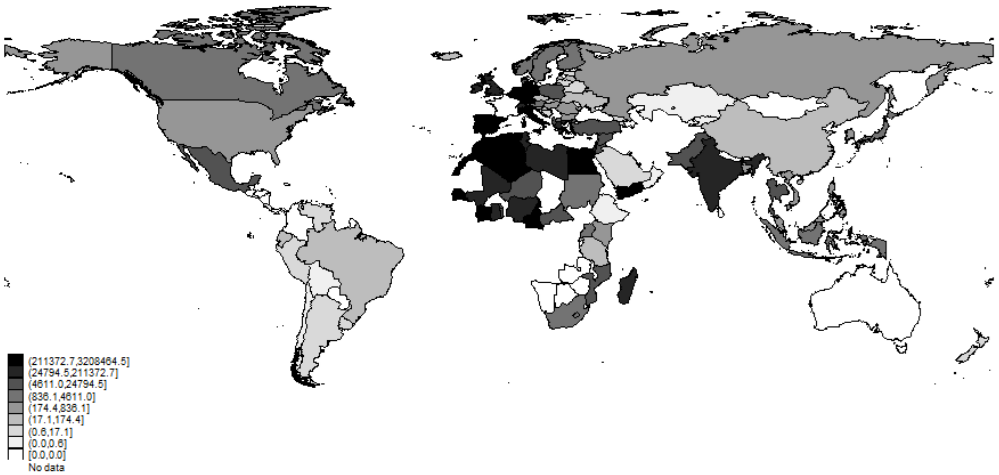


Figure 3.9 Wheat exports (tonnes) from France, average 2006-2010, by destination country



Source: author's elaboration from UN-COMTRADE (2016)

3.3 International Trade Theories and the Gravity Equation

The GE emerged in the 1960s as a purely empirical proposition to explain aggregate gross bilateral trade flows (Fratianni, 2006). The seminal work of Timbergen (1962) paved the way for other empirical works, such as Pöyhönen (1963a, 1963b), Pulliainen (1963) and Linneman (1966). These works had few theoretical underpinnings, yet the relatively good fit of coefficient estimates suggested that some underlying economic law must be at work (Anderson, 2011). The basic idea behind the GE was that countries trade in proportion to their respective GDPs, and proximity. Therefore, the inspiration for the gravity model came from physics: countries trade in a similar way that planets are mutually attracted in proportion to their size and closeness, according to the Newtonian theory of gravitation. The most basic GE for bilateral trade flows is frequently specified as follows:

$$X_{ij} = Y_i Y_j / d^2_{ij}$$

A mass of goods supplied at origin *i*, Y_i, is attracted to a mass of demand for goods at destination *j*, Y_j, but the potential flow is reduced by the distance between *i* and *j*, d_{ij}. The predicted movement of goods between both countries would be X_{ij}. It is noteworthy that the most prominent models of international trade in the 1960s paid little attention to the distance and to the size of the economies involved in trade (WTO, 2012). While the Ricardian model focused on differences in technology across countries to explain trade patterns, the Heckscher-Ohlin (HO) model emphasized the role of factor endowments (WTO, 2012). There was little room for distance and size in traditional explanations of trade, and it is for this reason that the GE was thought of as a mere representation of an empirically stable relationship, and was considered to be an "intellectual orphan, unconnected to the rich family of economic theory" (Anderson, 2011: 1).

Yet this would change in the late 1970s, when the gravity model was legitimized by a number of theoretical works demonstrating that the basic GE could be derived from a range of standard trade theories (Deardorff, 1998). The first important attempt to provide theoretical micro-foundations for the gravity model was Anderson (1979). His contribution was based on a model of complete specialization and identical consumer preferences, and it was criticized at the time because the cornerstone of the theory seemed to have been constructed *ad hoc* (Deardoff, 1984:503; Baldwin and Taglioni, 2006:1). Anderson's work was the first of many contributions that aimed to provide a theoretical basis

for the GE. For instance, Baldwing and Taglioni pointed out that the emergence of the 'new trade theory' in the late 1970s and early 1980s (e.g. Krugman 1979, 1980, 1981; Helpman 1981) "started a trend where the gravity model went from having too few theoretical foundations to having too many" (Baldwing and Taglioni, 2006: 2). In fact, as Fratianni (2006) has noted, the GE has been derived from models of complete specialization (Bergstrand 1985, Deardorff, 1998) but also from models of product differentiation with monopolistic competition (Helpman 1987), models of incomplete specialization and trading costs (Haveman and Hummels, 2004) and hybrid models of product differentiation and different factor proportions (Bergstrand 1989, Evenett and Keller 2002).

The GE has become the 'workhorse' of the applied international trade literature (Baldwing and Taglioni, 2006; Shepherd, 2013). Yet it is somewhat surprising that, despite its robust findings and empirical success, most economists and international trade theorists tended to ignore it until very recently. For instance, according to Anderson (2011), gravity first appeared in textbooks in 2004 (Feenstra, 2004). In 1995, Levinsohn and Leamer asserted that "textbooks continue to be written and courses designed without any explicit references to distance, but with the very strange implicit assumption that countries are both infinitely far apart and infinitely close, the former referring to factors and the latter to commodities" (Levinsohn and Leamer, 1995; Anderson, 2011: 1). Fortunately, recent research on the theoretical basis of GE has highlighted "the importance of deriving the specifications and variables used in the gravity model from economic theory in order to draw the proper inferences from estimations using the gravity equation" (WTO, 2012: 105). Hopefully, all those contributions will encourage the ongoing but difficult task of integrating empirics with theory. Our empirical case is, of course, very specific, since it is aimed at explaining trade in a particular commodity rather than analyzing aggregated trade flows.

We will make use of the GE in its simplest form in order to explain wheat trade flows between pairs of countries, in terms of the countries' incomes, distance, and a host of idiosyncratic factors such as common language and common border. Several models will be estimated in order to include a number of control variables such as wheat production (both absolute and *per capita*) of both the importing and the exporting country. We will also be sensitive to the most recent critiques and recommendations in the GE literature, in order to make the most adequate estimation possible. First, Anderson and van

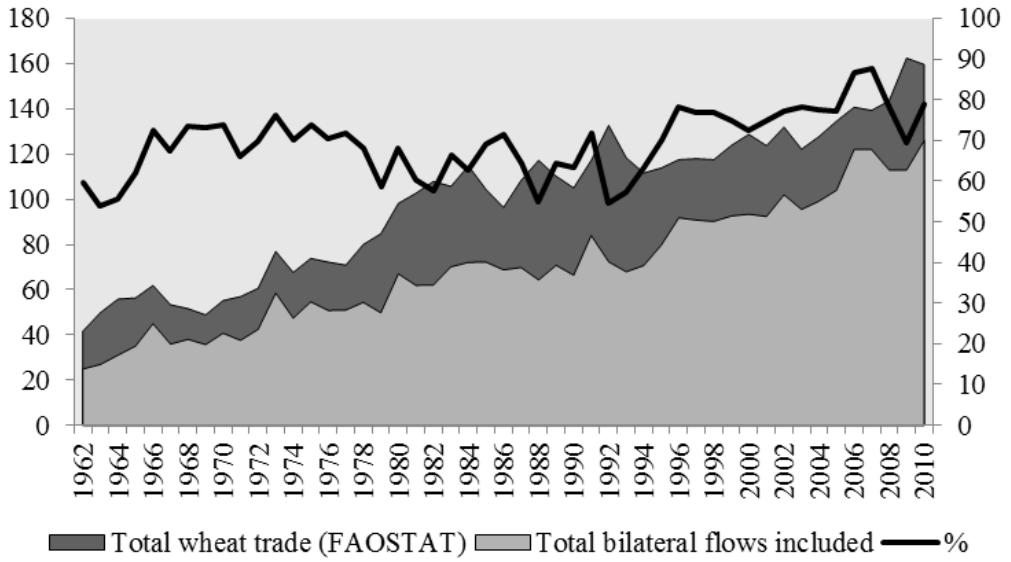
Wincoop (2003) show that controlling for relative trade costs is key for a well-specified gravity model. The main problem is that the so-called multilateral trade resistance terms (MTRs) are not directly observable. Many alternatives have been proposed to deal with this problem since the publication of Anderson and van Wincoop's work, one of them being the inclusion of a proxy variable for "remoteness". In our case, we have chosen the simplest – yet widely-used – solution: the inclusion of country fixed effects for importers and exporters. All estimated models include a set of dummy variables equal to unity each time a particular importer appears in the dataset. Following this approach, we aim to account for all sources of unobserved heterogeneity that are constant for a given importer across all exporters. By also including a set of dummy variables equal to unity each time a specific exporter appears in the dataset, we account for all sources of unobserved heterogeneity that are constant for a given exporter across all importers. As far as the estimation procedure is concerned, Santos Silva and Tenreyro (2006) provide solid arguments for preferring the Poisson quasi-maximum likelihood estimator (PPML) over the ordinary least squares estimation (OLS) and the log-linearization approach when estimating a gravity equation. We will use the PPML because, following these authors, it has at least three noticeable advantages over other methods. First, it is consistent with the presence of fixed effects. Second, this estimator allows for the inclusion of observations for which the observed dependent variable (in this case, wheat imports) is zero. And third, the coefficients of any independent variables entered in logarithms can be interpreted as elasticities (WTO, 2012). An additional reason for preferring PPML over other estimation methods is that it produces estimates in which, "summing across all partners, actual and estimated total trade flows are identical" (Arvis and Shepherd, 2011, 1). According to these authors, Poisson is the only quasi-maximum likelihood estimator that preserves total trade flows, thus solving the "adding up" problem faced by other gravity model estimators.

In addition, our estimation method produces standard errors that are robust to arbitrary patterns of heteroskedasticity in the data. Since errors are likely to be correlated by country pair, we allow for clustering by country pair by specifying a clustering variable that separately identifies each pair of countries, regardless of the direction of trade: distance. Here, we use the method of Santos Silva and Tenreyro (2010) to identify and drop regressors that may cause the non-existence of the (pseudo) maximum likelihood estimates.

3.4 Data description and estimation

Our dataset has been constructed to account for the maximum percentage of total wheat trade while minimizing the number of zero values. Since many countries do not export any wheat, they have been dropped – as exporters – from the database. A large number of small countries whose imports are consistently null have also been dropped. Data on wheat imports for other countries is sometimes available only from a certain year onwards, so years with no data have been excluded. The final result is a non-balanced panel with 111 importers, 61 exporters, and 199,980 observations. From those observations, 167,689 have non-missing values in every explanatory variable that has been incorporated into the econometric models: gross domestic product of the importing and the exporting countries (both absolute and *per capita*), wheat production of the importer and the exporter (both absolute and *per capita*), distance, common language, contiguity, regional trade agreements in force, and World Trade Organization (WTO) membership. The dataset accounts for an average of 70.31% of the total wheat trade between 1963 and 2010, and includes the most populous countries from every continent (see tables 1 and 2, in the appendix). As figure 3.10 illustrates, the coverage is slightly better from the 1990s onwards.

Figure 3.10 Total wheat trade (tonnes, area graphs, first axis) and total bilateral flows included (%, second axis), 1963-2010



Source: author's elaboration from FAOSTAT (2016) and UN-COMTRADE (2016). Wheat also includes wheat flour

The results from the estimation of seven different models are shown in figure 3.11. The following dummy variables are included in every model: *contiguity*, *common language*, *trade agreement in force*, *bothwtopre1994* and *bothwtopost1994*. Distance and the importing country GDP is also included in every regression. However, the seven different models find their reason to be on the decision to omit or include the remaining explanatory variables: *GDPexporter*, *GDPpcimporter*, *GDPpcexporter*, *ProductionIMP*, *ProductionEXP*, *ProductionpcIMP*, and *ProductionpcEXP*. Since some of the latter variables are indeed closely interrelated, the comparison of the seven models allow us to settle our conclusions on safer grounds. The seven proposed models fit the data relatively well: the R2 is always above 0.5, which means that the explanatory variables account for over half of the observed variation in trade[40].

[40] Data on bilateral trade flows come from UNITED NATIONS (2016). Wheat is measured in real terms (tonnes). Trade in wheat flour has been converted to its wheat equivalent by applying the corresponding coefficient (1kg of wheat flour → 1.39 kg of wheat). Data on *distance*, *contiguity*, and *common language* come from the CEPII gravity set. This dataset was originally developed by Keith Head, Thierry Meyer, and John Ries to be used in Head et.al. (2010). As usual, *contiguity* is a dummy variable that takes the value 1 if the importer and the exporter share a common border and zero otherwise. *Common language* is a dummy variable equal to 1 if both countries share a common language. Bilateral *distance* has also been taken from Geodist, the CEPII distance dataset (Head et. al. 2010; Head and Mayer, 2013). Information on the existence of bilateral relationships (*trade agreement in force*) has been taken from De Sousa (2012). This is a dummy variable that takes the value 1 if there was a bilateral trade agreement in force between the importing and the exporting country in a selected year, and zero otherwise. World Trade Organization (WTO) membership of different countries over time comes from the CEPII gravity set, which in turn is based on the information provided on the WTO official website. Since trade in wheat came to be under the WTO treatment only after the Uruguay Round of negotiations, two dummy variables have been included; *bothwtopre* takes the value 1 if both the importing and the exporting country were WTO members before 1994 and zero otherwise; *bothwtopost* takes the value 1 if both the importing and the exporting country were WTO members between 1995 and 2010, and zero otherwise. Data on GDPs is expressed in real terms (1990 Int. Geary–Khamis $) and has been obtained from the Maddison-Project database (http://www.ggdc.net/maddison/maddison-project/home.htm, 2013 version; see Bolt and van Zanden (2014) for more information on the underlying methodology). For certain years and countries, this information has been complemented with data on GDP growth from the World Development Indicators database (2016). Data on population also comes from WORLD BANK (2016). Finally, data on wheat production is measured in real terms (tonnes) and comes from FAO (2016).

Figure 3.11 Estimation results

	(1) imports	(2) imports	(3) imports	(4) imports	(5) imports	(6) imports	(7) imports
GDP importer	0.00713	1.163**	0.127	-0.104	1.143***	0.801*	1.100**
	(0.05)	(3.04)	(1.03)	(-0.64)	(3.96)	(2.31)	(2.95)
GDP exporter	0.536*	-1.971***		0.517*		0.310	-1.595***
	(2.38)	(-4.22)		(2.50)		(1.55)	(-3.65)
Contiguity	0.328*	0.362*	0.317*	0.332*	0.341*	0.350*	0.364*
	(2.07)	(2.28)	(1.98)	(2.10)	(2.14)	(2.21)	(2.30)
Distance	-1.041***	-1.072***	-1.051***	-1.054***	-1.062***	-1.065***	-1.083***
	(-10.66)	(-11.14)	(-10.69)	(-10.82)	(-10.93)	(-11.08)	(-11.37)
Common language	0.551**	0.568***	0.552**	0.557***	0.550**	0.555***	0.566***
	(3.20)	(3.37)	(3.25)	(3.29)	(3.28)	(3.33)	(3.43)
Trade Agreement	1.156***	1.074***	1.131***	1.101***	1.056***	1.042***	1.037***
	(9.10)	(7.80)	(9.11)	(8.85)	(8.91)	(8.68)	(7.96)
WTO pre1994	-0.187	-0.240	-0.192	-0.178	-0.227	-0.222	-0.242
	(-1.05)	(-1.40)	(-1.07)	(-1.08)	(-1.38)	(-1.40)	(-1.53)
WTOpost1994	-0.151	-0.173	-0.0531	-0.0806	-0.0914	-0.0968	-0.116
	(-0.82)	(-0.98)	(-0.28)	(-0.43)	(-0.51)	(-0.54)	(-0.64)
GDPpc importer		-1.309***			-1.440***	-1.156**	-1.417***
		(-3.33)			(-4.34)	(-3.18)	(-3.71)
GDPpc exporter		3.209***					2.674***
		(5.64)					(5.05)
Production importer			-0.289**		-0.349***		
			(-2.64)		(-3.39)		
Production exporter			0.775***		0.767***		
			(8.14)		(8.10)		
Production pc Importer				-0.366**		-0.358***	-0.359***
				(-3.11)		(-3.48)	(-3.47)
Production pc Exporter				0.869***		0.909***	0.783***
				(9.32)		(9.66)	(9.13)
_cons	3.043	32.82***	6.409	29.40***	-1.046	12.88**	42.90***
	(1.67)	(5.06)	(1.79)	(5.29)	(-0.24)	(2.83)	(6.29)
N	178810	178810	176025	167689	176025	167689	167689
R^2	0.51	0.51	0.52	0.52	0.52	0.52	0.52

t statistics in parentheses

* $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

Source: author's elaboration.

The first model is the most basic gravity equation possible. The main problem is that the coefficients of the two masses – i.e. *GDPimporter* and *GDPexporter* – are hardly interpretable because several relevant variables have been omitted (and these variables are strongly correlated to absolute GDPs). This is fixed in the second model, which also includes the GDP *per capita* of both the importer and the exporter. The positive and statistically significant coefficient in *GDPimporter* is now suggesting that the size of the

destination market acts as an attraction force for wheat imports. As countries grow, they tend to import more wheat. Despite that this result was expected, it confirms our belief that absolute economic growth in importing countries – which is, of course, strongly related to their population growth – is key to understanding the great progress in total wheat trade that occurred between 1963 and 2010. However, this observation should be nuanced by taking into account the strong, negative, and statistically-significant coefficient in *GDPpcimporter*. While larger (more populous) countries tend to import greater amounts of wheat, rising *per capita* income may actually reduce imports via lower wheat demand *per capita*. This result is consistent with studies showing that the income-elasticity of demand for wheat not only tends to be highly inelastic, but that it is usually negative above certain levels of income (Fabiosa, 2012; FAPRI, 2009; Seale et.al., 2003). With regard to the exporter GDP, the unexpected negative sign probably has much to do with the fact that applying the logic of the gravity equation to the study of trade in individual commodities is not entirely straightforward. More specifically, absolute GDPs are not necessarily good proxies for supply. That is the reason why models 3 to 7 have been estimated: all of them include some other indicator of supply for the exporting country, either absolute wheat production or *per capita* wheat production. When supply is measured by absolute wheat production in the exporting country – rather than by its absolute GDP – the estimated coefficient is always positive (above 0.7) and statistically significant. The same is true if supply is proxied by *per capita* wheat production (in this case, the coefficients are even higher than 0.7). These results confirm the idea that, as countries produce more, they tend to export more wheat (the size of the market matters) and the idea that countries that become more specialized/more efficient in wheat production also tend to export more. It is important to note that countries with higher *per capita* wheat production are more likely to have enough wheat to satisfy domestic demand, thus making wheat surpluses available for export. Models 3 to 7 also include some indicator of production in the importing country (absolute wheat production or *per capita* production). These variables are incorporated to control for the so-called 'home bias' effect (Anderson and Van Wincoop, 2003). As Dal Bianco et.al. (2016) do for the case of wine, we consider 'home bias' in the context of wheat trade as the resistance to importing foreign products due to the supply of national products. Since the estimated coefficients for wheat supply in the importing country are negative and statistically significant, we may conclude that a 'home bias' effect has existed in the world wheat trade. Finally, some other facts deserve special attention. As mentioned before, the exporter GDP is not a good proxy for wheat

supply. Yet, when controlling for *GDPpcexporter* (as in models 2 and 7), the estimated coefficient in the exporter GDP remains negative and statistically significant, and is therefore telling us something: the size of the export market affects wheat exports negatively. This result is consistent with the hypothesis that, as countries grow, they tend to hold back production. If absolute GDP growth is partially due to population growth, a larger domestic market indeed means a higher domestic demand for wheat (thus leaving less of a wheat surplus for export). When it comes to the *per capita* GDP of the exporter, the findings are quite clear: as countries become richer, they tend to export larger amounts of wheat. This could be due to several facts. First, as countries grow, they usually enjoy higher land and labor productivity rates in agriculture. However, the positive and statistically-significant coefficient in the GDP *per capita* of the exporter remains high, even when controlling for its *per capita* wheat production (see model 7). This means that the greater wheat exports associated with income growth may have something to do with the demand side: as countries become richer, their population begins to substitute wheat for the consumption of other products, thus leaving growing wheat surpluses for export. Another possible interpretation is related to policies and international trade negotiations. As mentioned in the first section of this paper, wheat policies in exporting countries have usually involved trade-distortive instruments, such as export subsidies. It is well-documented that the United States – the country with the highest GDP *per capita* after World War II according to Maddison (The Maddison Project, 2013) – was able to mold GATT rules to its advantage in order to allow its interventionist wheat programs (Hathaway, 1987, Johnson, 1987). On these grounds, it seems reasonable to argue that income growth may lead to greater bargaining power in international trade negotiations, resulting in a greater ability to impose export subsidies and dump wheat surpluses abroad.

With regard to distance and the other control variables, first it must be said that their coefficient estimates seem to be less sensitive to the omission and incorporation of other important variables. A first conclusion may be drawn from the observed estimation results: distance and proximity really matter. For geographical contiguity, we find that countries that share a common border trade significantly more than those that do not[41]. In addition, the coefficient on distance is negative and statistically significant in every single model. The seven different estimations reveal that a 1 per cent increase in distance tends

[41] The coefficients estimated for the discrete variables may be interpreted as semi-elasticities: $100*[\exp(\beta i)-1]$.

to reduce wheat trade by roughly 1 per cent. When it comes to cultural proximity – measured by the existence of a common language – we also find it to be a significant trade enhancer. Finally, with regard to the international trade organization, we find that the inclusion of wheat trade under the WTO umbrella – following the Uruguay round of negotiations – did not significantly alter the functioning of world wheat markets. On the contrary, it seems that the wheat trade has traditionally been fostered only by bilateral trade negotiations and agreements.

3.5 Conclusions

The history of the wheat trade over the second half of the 20th Century should not be considered as merely a history of successive international exchanges in a single commodity. Behind the observed trends in wheat trade flows, there are indeed countless national and international developments that constitute in themselves the very political and economic history of humanity, with all its complexity. There is no doubt that events such as the fall of the Berlin wall, and international dynamics such as Cold War politics, have deeply affected international wheat trade. In fact, the market for wheat has often been crucial for national economic policy and development strategies, and it has been so for notable reasons. First, wheat-based products are a staple in many parts of the world, thus making the functioning of wheat markets a key element as far as national food security strategies are concerned. In some cases, if the expenditure share in wheat products was sufficiently high, wheat prices could be considered as a key element in determining real wages. For instance, after WWII, this notion underlay certain development strategies based on promoting cheap wheat imports, with the aim of fostering industrialization. Second, wheat is not only extensively consumed, but also widely cultivated all around the world. This means that wheat prices not only significantly affect the economic welfare of consumers, but also, and sometimes very intensely, the revenues of a great number of primary producers. Since both consumers and producers vote – not to mention the usual ability of wheat growers to exert political pressure by other means – wheat policies have often been an extremely delicate matter of dispute, both within and between countries. Wheat policies – and especially commercial policies – in importing and exporting countries have commonly been designed to pursue a range of different goals, varying from assuring farm incomes to solving balance of payments problems, or achieving food security (or self-sufficiency). The observed trends in the volume and direction of wheat trade

flows have surely been affected by those national historical contexts and policies, which were sometimes rooted in the interwar period (or even before). All these considerations have been thoroughly analyzed in González Esteban (2017a), but are extremely difficult to quantify, let alone to incorporate into an econometric model. The major aim of this paper has been to show that a great percentage of the observed variation in wheat trade between 1963 and 2010 may actually be explained by certain standard economic variables, such as distance and GDP growth.

First, our estimation provides a confirmation for Anderson and van Wincoop's concept that "the death of distance is exaggerated" (Anderson and van Wincoop, 2004, 1). In the case of wheat, it is clear that countries tend to trade more if they are closer to each other. The same is true if the importing and the exporting countries share a common border and a common language. Therefore, in a world characterized by an apparently growing integration between economies, both geographical and cultural proximity have still been important in explaining the direction of wheat trade flows. This can be seen most clearly in figures 3.5 to 3.9, which illustrate how the top 5 exporters – the United States, Canada, Australia, Argentina, and France – sell much more wheat to countries that are closer to them. Second, our analysis shows that international wheat exchanges have depended much more on bilateral arrangements between countries than on the new multilateral organization of trade. The existence of good bilateral relationships between the importer and the exporter – measured by the existence of any kind of trade agreement between them – have shown positive results in terms of the total amount of traded wheat. However, it seems that the Uruguay Round of negotiations and the incorporation of the wheat trade under the WTO organization did not significantly modify the actual organization of the world wheat trade.

Finally, with regard to the effect of income growth on the wheat trade, we have found it useful to control for relevant variables, such as income *per capita* and both absolute and relative wheat production. Doing so has allowed us to distinguish between different processes. With regard to the exporting countries, we find two different forces in operation. First, as countries grow, they tend to retain production in order to satisfy the growing domestic demand for wheat. However, if the process of economic growth is intensive rather than extensive (i.e. if we are talking about *per capita* GDP growth, rather than absolute GDP growth), then an export-enhancing force comes into play. This may be due to the lower *per capita* demand for wheat (wheat demand tends to be negative

above certain levels of income), and/or to a greater ability to impose export-enhancing mechanisms such as export subsidies. With regard to the importing countries, we also find two different operating forces. Again, as countries grow, they require increasing quantities of wheat in order to satisfy domestic demand. Wheat imports can be reduced if population growth is accompanied by a growing domestic production (there is a "home bias" effect). And, if there is a process of intensive economic growth – i.e. per capita GDP growth – some import-limiting forces can also come into play, mostly the lower *per capita* wheat demand associated with dietary transitions and the substitution of wheat-based products for other sources of calories. However, *caeteris paribus*, population growth in importing countries act as a powerful import-enhancing force, and it surely is a crucial factor in explaining the tremendous growth in the wheat trade that occurred over the studied period.

Appendix

Figure 3.A.1 World wheat production (tonnes), average 2006-2010, by country

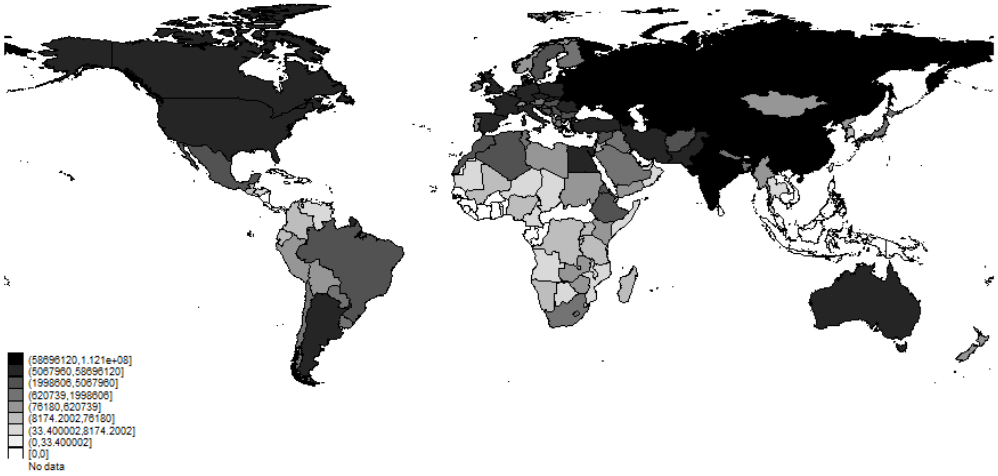


Figure 3.A.2 World wheat production *per capita* (tonnes / population), average 2006-2010, by country

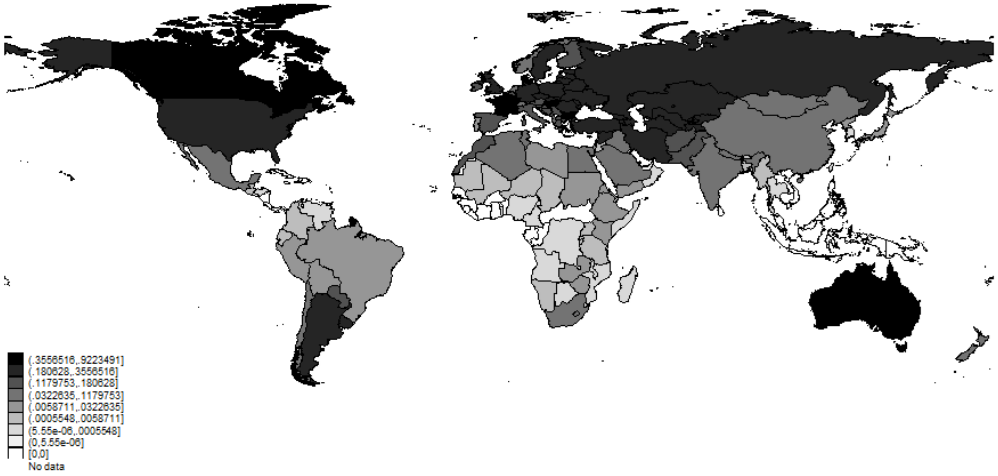
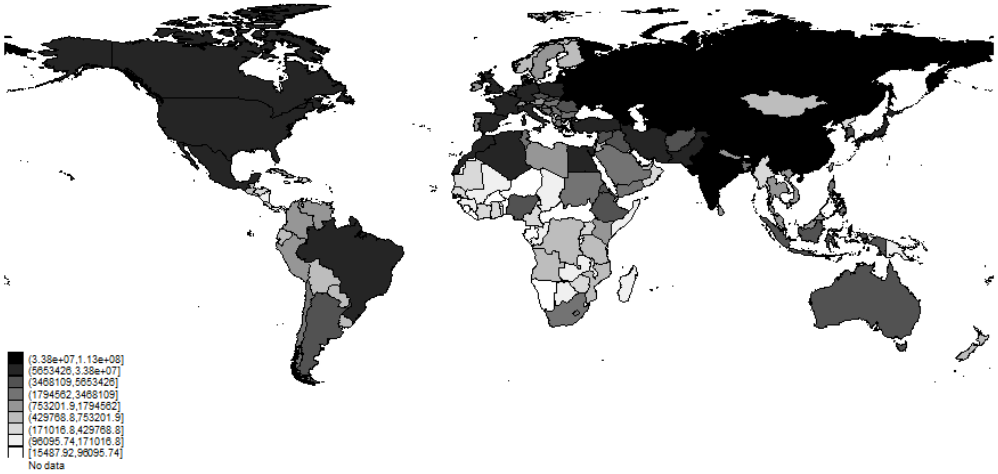


Figure 3.A.3 World wheat consumption (tonnes), average 2006-2010, by country



Source: author's elaboration from FAOSTAT (2016) and United Nations (2013

Figure 3.A.4 World wheat consumption *per capita* (tonnes/population), average 2006-2010, by country

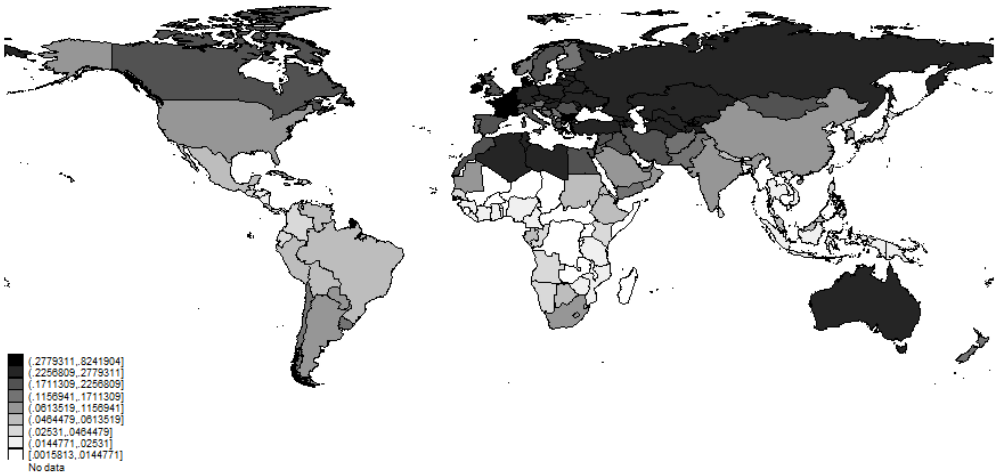


Figure 3.A.5 Wheat exports (tonnes), average 2006-2010, by country

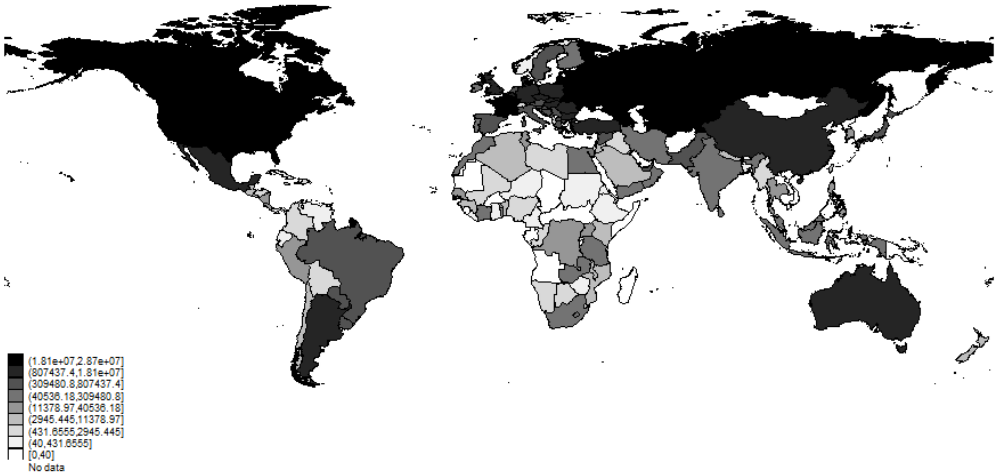
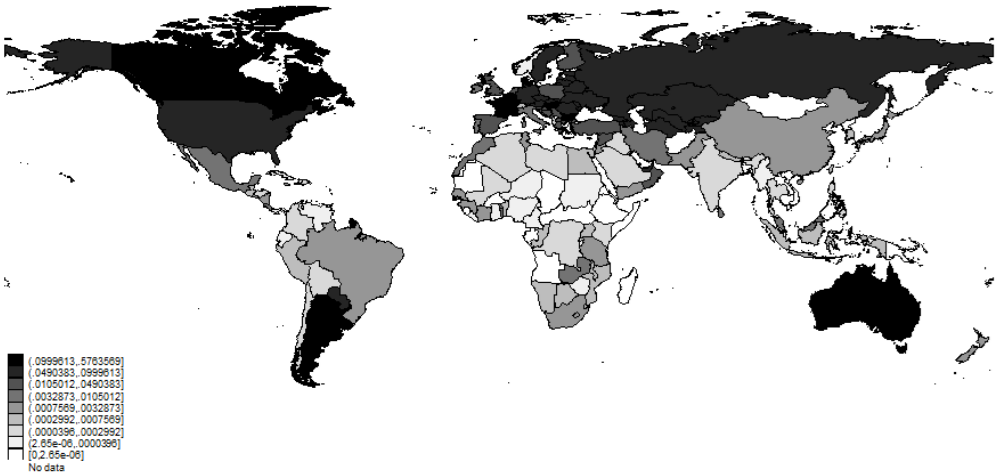
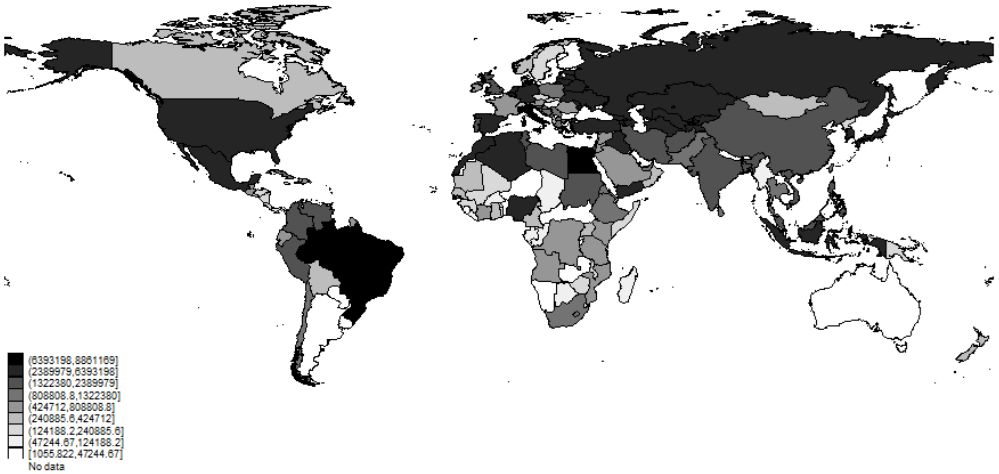


Figure 3.A.6 Wheat exports *per capita* (tonnes / population), average 2006-2010, by country



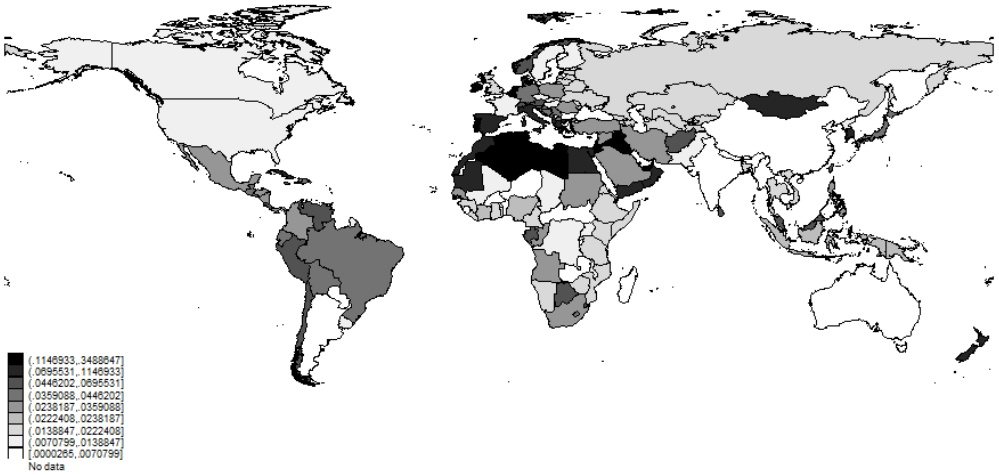
Source: author's elaboration from FAOSTAT (2016) and United Nations (2013)

Figure 3.A.7 Wheat imports (tonnes), average 2006-2010, by country



Source: author's elaboration from FAOSTAT (2016)

Figure 3.A.8 Wheat imports per capita (tonnes / population), average 2006-2010, by country



Source: author's elaboration from FAOSTAT (2016) and United Nations (2013)

Table 3.A.1 List of countries included in the dataset as importers, by continent

Europe	Africa	Asia	America	Pacific
Albania	Algeria	Armenia	Argentina	Australia
Austria	Burundi	Azerbaijan	Barbados	New Zealand
Belarus	Cameroon	Bahrain	Bolivia	
Belgium	Côte d'Ivoire	Bangladesh	Brazil	
Bosnia-Herce	Egypt	Hong-Kong	Canada	
Bulgaria	Ethiopia	SAR	Chile	
Croatia	Gambia	Georgia	Jamaica	
Cyprus	Ghana	India	Mexico	
Czech Rep.	Kenya	Indonesia	Nicaragua	
Denmark	Libya	Israel	Peru	
Estonia	Madagascar	Japan	Trinidad and Tobago	
Finland	Malawi	Jordan	USA	
Fmr USSR	Mali	Kazakhstan		
France	Morocco	Kuwait		
Germany	Mozambique	Kyrgyzstan		
Greece	Namibia	Lebanon		
Hungary	Niger	Malaysia		
Iceland	Nigeria	Oman		
Ireland	Rwanda	Pakistan		
Italy	Senegal	Philippines		
Latvia	South Africa	Qatar		
Lithuania	Sudan	Rep. Of Korea		
Luxembourg	Syria	Russian Federation		
Malta	Togo	Saudi Arabia		
Netherlands	Tunisia	Singapore		
Norway	Uganda	Sri Lanka		
Poland	Tanzania	Thailand		
Portugal	Zambia	Viet Nam		
Moldova	Zimbabwe	Yemen		
Romania				
Slovakia				
Slovenia				
Spain				
Sweden				
Switzerland				
TFYR of Macedonia				
Turkey				
Ukraine				
United Kingdom				

Source: author's elaboration

Table 3.A.2 List of countries included in the dataset as exporters, by continent

Europe	Africa	Asia	America	Pacific
Austria	Egypt	China	Argentina	Australia
Belgium	South-Africa	Hong-Kong	Brazil	New Zea-land
Bosnia-Herce	Syria	India	Canada	
Bulgaria		Israel	Mexico	
Croatia		Japan	USA	
Cyprus		Kazakhstan	Uruguay	
Czech Rep.		Lebanon		
Denmark		Malaysia		
Estonia		Pakistan		
Finland		Rep. of Korea		
Fmr USSR		Russian Federation		
France		Saudi Arabia		
Germany		Singapore		
Greece		Thailand		
Hungary		Viet Nam		
Ireland		United Arab Emirates		
Italy				
Latvia				
Lithuania				
Luxembourg				
Netherlands				
Norway				
Rep. of Moldova				
Romania				
Slovakia				
Slovenia				
Spain				
Sweden				
Switzerland				
Turkey				
Ukraine				
United Kingdom				

Source: author’s elaboration

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Conclusions

This thesis was begun when the experience of the global food-price crises of 2007, 2008, and 2011 was still very recent. Widespread riots in certain importing countries – mostly in countries in North Africa and the Middle East – were usually linked by the global media to food shortages and insufficient food availability. Soaring food prices raised new concerns about the ability of world agriculture to meet the rising calorie-intake requirements of a rapidly-growing population. International organizations, such as the FAO, were concerned that the surge in food prices would push millions of people into poverty and malnutrition, and the emphasis was soon put on national and international policies, and on their impact on price volatility. What were the causes of the price crises, and how could their effects be mitigated? Were trade-distortive policies, such as export taxes, actually causing or aggravating these international crises? Since wheat was indeed playing a protagonist's role in the crises – wheat had become a staple in many parts of the world and its price was skyrocketing worldwide – attempting to provide an informed historical perspective of the wheat sector and the changing national and international configuration of wheat policies seemed to be a good and timely idea. The thesis did not set out to explain the 21st Century food crises, yet the motivation for writing it came from the realization that the world wheat economy was far from being irrelevant in our time. It soon became apparent that both the debate on wheat price trends and the general concerns about availability of supply dated back to the 1930s, or even before.

The three chapters that compose this thesis are concerned with the world wheat economy between 1939 and 2010, focused on different aspects. The first chapter is broader in scope and extension than the other two, and provides both a descriptive and an explicative analysis of the major trends in world wheat production, consumption, and trade over the studied period. In doing so, special attention is given to the evolution of prices and certain institutional variables, such as trade policies and international agreements. While the world wheat market showed evident signs of disintegration during the late 1920s and 1930s, there was a dramatic increase in wheat trade over the 65 years that followed the end of the Second World War. The so-called 'wheat problem' in the 1930s was one of surpluses alongside needs: excess wheat supplies in the main producing/exporting countries found no international buyers, while millions in the deficit areas of the world went hungry. Chapter 1 deals with the institutional 'solution' that was given to this problem after WWII, taking into account the many variables that also affected wheat supply and demand trends over the studied period: population growth,

urbanization, changing consumption habits, new technologies and production techniques… The theoretical model brings together all those variables, thus helping to organize the explanatory section. For instance, this chapter clarifies why the Overseas Exporters have prevailed as key wheat exporting-nations, and why traditional European importers such as France, Germany, and the United Kingdom have ceased to be net importers of wheat. It also sheds light on some key changes in the former USSR republics, while helping to explain why more and more wheat has flown from Europe to Africa and Asia.

The second chapter is specifically concerned with one of the most significant of the trends in wheat trade identified in chapter one: the rapidly growing concentration of wheat imports in a large number of low-income countries that, for all practical purposes, did not consume wheat before WWII. The theoretical section of this paper offers a state-of-the-art description of the food regime literature and characterizes the so-called 'Second Food Regime'. It is generally argued that food regimes are stable sets of complementary state policies whose implicit coordination creates specific prices relative to other prices, a specific pattern of specialization, and resulting patterns of consumption and trade on a global scale. Since international wheat markets have been the cornerstone of this method of analysis, in the empirical section we make use of this approach to illustrate the long-standing impact of the postwar institutional organization of trade on the distribution of wheat imports, throughout the 20th Century. More specifically, we argue that increasing wheat dependence in poor and insecure countries over the last 40 years may be considered as an enduring effect of the 2nd food regime, since there have been path-dependence mechanisms influencing the evolution of the demand side (wheat consumption), the supply side (wheat production), and the institutional side (new international regulations under the WTO).

Finally, the third chapter is more focused on the 'economic' determinants of trade, thus paying more attention to variables such as market size and income growth. It makes use of an entirely different dataset, which in this case provides information on the bilateral structure of trade. The estimation of seven different gravity models shows that the wheat trade has been deeply affected by population and income growth. Indeed, it is clear that the extraordinary expansion of the world wheat trade over the last fifty years would not have been possible if not for the creation of new sources of demand in developing countries, and for the unprecedented demographic and economic growth attained by those

countries. The analysis also reveals that, in today's globalized world, the death of distance has probably been exaggerated: countries trade more when they are closer to each other, but they also trade more when they have a common border and a common language. Moreover, while the inclusion of the wheat sector under WTO procedures has not altered the functioning of international wheat markets, regional trade agreements have significantly affected the volume and direction of wheat trade flows, throughout the period.

The three papers presented in this dissertation by no means constitute an endpoint in the research into the determinants of the international wheat trade. There are many issues that remain to be expanded and developed. For instance, future research should attempt to unify the existing but disparate data on wheat aid to developing countries between 1945 and 1988. This will deepen our understanding of the causes of different rates of wheat consumption and production patterns across African, Asian, and South American countries over the studied period. Contrary to what has happened in most African and Asian countries, both wheat imports and wheat consumption *per capita* in South America have remained fairly stable over the 70-year period covered in this work, so any comparative study of South American countries and other developing countries in Asia and Africa could be of interest. Furthermore, there is a promising field of research into the theoretical and empirical links between food security and food import dependency. While it is clear that wheat import-dependence in low-income countries has increased throughout the period, the extent to which this has posed a problem for those countries is less clear. There is much to be said on the specific mechanisms through which high levels of import-dependency may translate into food insecurity, and we should try to identify the most important country-cases related to wheat. Finally, regarding the specification and estimation procedure of the model presented in chapter 3, there remains an ongoing debate over the best ways to capture the so-called multilateral trade resistance. We would also like to establish more sophisticated ways of taking into account tariffs and other types of trade-distortive policies. In addition, we are very interested in dividing our sample into sub-periods, since it remains to be seen whether or not the effects of the various explanatory factors have changed over time.

Several general conclusions may be extracted from this thesis. These are wide-ranging reflections related to fundamental economic questions. First, *history* matters. Understanding today's global wheat economy requires looking back to the historical

origins of the current trends. Patterns of wheat production, consumption, and trade have been shaped by constantly evolving institutional arrangements, yet some of those arrangements set in motion path-dependence mechanisms that have had persistent effects. Second, *power* must be taken into account. While Neo-Classical studies of trade have tended to ignore market power relationships between the agents involved – this practice being extensively criticized by authors such as J.K. Galbraith, A. Bhaduri, and others – the case of wheat clearly illustrates that asymmetric international market power has severely affected the institutional outcomes that have governed the world wheat trade. Third, *distribution* issues should be highlighted even more than general concerns about the availability of supply. When wheat prices skyrocketed in 2007, Krugman pointed out that commodity markets were simply telling us that we are living in a finite world. Recent price spikes were surely motivated by a succession of global harvest failures, and Krugman's assertion – among many others – reveals that Malthusian fears have never ceased to be an issue. And yet, these kinds of consideration have historically coexisted – somewhat paradoxically – with overproduction problems in many regions. The following words were written in the late 1930s:

> *Men who can graft the trees and make the seed fertile and big can find no way to let the hungry people eat their produce. Men who have created new fruits in the world cannot create a system whereby their fruits may be eaten. And the failure hangs over the State like a great sorrow*
>
> John Steinbeck, The Grapes of Wrath, 1939

Although Steinbeck's reflection was likely referring solely to the agricultural disarray within the United States, the 'failure' to which he refers could easily be extrapolated to the international level. This basic idea – surpluses alongside needs, but no way to connect them – has been the cornerstone of the political economy of wheat throughout the 20th Century. We have seen that attempts were made to redress this on a global scale, yet no universally satisfactory solution was ever found. Moreover, it seems that the price crises of the late 2000s did not put an end to the long-run trend of falling real prices. Therefore, despite the impressive growth that the wheat trade has experienced over the last 70 years, the underlying forces that originally motivated the 'wheat problem' have not completely disappeared. Finally, several reflections can be made on the role of the *state*. Traditional wheat exporters, such as Canada and the United States, resorted to export subsidies and other governmental surplus-disposal schemes to dump their wheat

abroad when they needed to. High-income countries that went from being major wheat importers to being significant wheat exporters – i.e. the United Kingdom, France, Germany – did so thanks to massive programs of state support and protectionist measures at the border. Developing countries that aimed to achieve self-sufficiency in wheat and succeeded in their task – for instance, China, India, and Pakistan – were only able to do so through extensive state intervention. In contrast, low-income countries whose governments did not intervene and welcomed cheap wheat from abroad, with the idea of fostering industrialization, failed in their primary task while originating a long-run trend of wheat import dependency. This means that, at the national level, there have been many good reasons for the state to intervene. It is well known, however, that trade-distortive policies of this sort have been responsible for large welfare losses at the aggregate level (this being the reason why most governments have an internationally-stated objective of trade liberalization). The case of wheat thus serves to explain the collapse of the Doha round of negotiations: crucial national aims, ranging from raising farm income to guaranteeing food security, have systematically over-ridden international trade considerations. Since no satisfactory mechanism has been found to put an end to this seemingly-rational behavior, the old puzzle on how to reconcile the pursuit of fundamental national goals with world trade liberalization remains largely unresolved.