An Outlook of the World Wheat Economy [1885-2010]

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Abstract:
Almost half the calories consumed globally today derive directly from grain. Of this, about a quarter comes from wheat. In some parts of the world wheat has long been even more significant than such global averages suggest, and its production and distribution 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. Although much less visible in the post-war years, the scale of wheat production, its efficiency, and its sites of production were transformed at historically unprecedented rates. The aim of this paper is to summarize the changes in the main variables related to wheat markets (production, acreage, yields, volume of trade and consumption per capita, among others) over the period 1960-2010. This will help to identify crucial issues for future analysis on food and agricultural policy.

Key Words: Wheat, Grain, Malenbaum, Green Revolution, Agricultural Policy.

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1. Introduction

Wheat has a number of features that makes its study important to 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. Out of all the grains, only rice has superior nutritive value. Hence, growing wheat for direct human consumption purposes is a relatively efficient way of producing calories, at least in terms of output per area harvested. That is probably the reason why historic cases of shifts towards wheat can particularly be found over periods 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) could be taken as examples of this behaviour (although, in the case of Britain, the promotion of wheat had more to do with the necessity of saving shipping space and substituting bulky imports with home production (Edgerton, 2012)). In fact, there is a growing awareness of how crucial food has been in determining the fortune of many wars. But wheat has other peculiarities of special importance. To a great extent due to some of its physical characteristics (e.g. it does not break easily and it can be preserved indefinitely as long as it is kept away from humidity and rodents (Maurette, 1922)) wheat is -and has always been- the most traded grain. As a consequence, it has played a key role in international relationships throughout history. It has also been a central part of major technological changes in agricultural methods and plant breeding (Perkins, 1997).

One interesting issue with agriculture is that its own modernisation leads to a decline in its relative importance in comparison to other sectors of the Economy (Simantov, 1967). There is no doubt that wheat used to be more important –for instance, in terms of its place in the political agenda– before the Second World War than it has been in post-war years. This partly explains the decreasing academic interest on wheat markets and the fact that one broad study such as Malembaum’s for the period 1885-1939 has not been continued after the War. Yet, wheat has never ceased to be a central part in the diet of many countries, nor has it stopped to be a crucial aspect of international relations. Moreover, recent developments in food markets, such as price spikes, massive land acquisitions in developing countries and food riots, have contributed to put wheat back into the public eye again.

2. Starting point:

The World wheat position prior to the War was thoroughly described in Malembaum’s work (1953). It dealt with one concern that would become a major issue –particularly for some
industrialised countries— over the second half of the twentieth century: agricultural oversupplies. His main thesis was that there was a growing disequilibrium in wheat markets over the period 1900-1939, and that it was largely due to three factors. First, lower production costs granted by improved methods of cultivation and new areas suitable for wheat production. Second, widespread governmental policies directed towards increasing production. Third, the fact that acreage expansions in the major exporters (USA, Canada, Australia, Argentina) did not seem to be conducted by market forces and could rather be considered as an automatic product of economic development (i.e. expected output price was not the main driver of acreage decisions).

Large surpluses in producing countries contributed to speeding up the downward trend in wheat prices, creating an uncertain situation among farmers and motivating the emergence of wide assistance programs which eventually tended to exacerbate the surplus problem. At the same time, large numbers of hungry people in the world were in need of those “oversupplies” but lacked the means to obtain them. This was particularly true in underdeveloped areas where wheat was not the main staple grain. Therefore, wheat shortages before the War reflected problems of food distribution rather than problems of food production (one major difficulty was that the transfer of wheat to underdeveloped areas would have involved a change in their pattern of consumption).

Wheat producing countries in the interwar period can be grouped according to their usual position in the net balance of international wheat shipments. Malembaum 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 and Poland), the ex-European exporters (India, Algeria, Morocco, Tunis, Chile and 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 and New Zealand). All the countries listed before represented roughly eighty percent of all wheat output. 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 this study. Graph 1 illustrates this interwar world map of wheat trade (green coloured countries are net exporters, while red coloured countries are net importers).
When it comes to demand patterns, typical preferences for wheat as bread grain suggested that the potential market for wheat was huge. However, it was possible to distinguish between different consumption trends among countries. On the one hand, there was a declining per capita trend in countries in which wheat had long been the main bread grain and which were advanced industrially (USA, Australia, Canada, United Kingdom, France). On the other hand, a rising per capita trend prevailed in economically advanced countries where other grains were abundant (Denmark, Finland, Germany, Netherlands), in less developed countries where wheat was of main importance in the grain diet (Argentina, Bulgaria, Romania, Yugoslavia, Italy) and in less developed countries where other grains were of great importance in the diet (Tunisia, Egypt, India). Overall, total demand for wheat was expected to increase –mainly because population was expected to rise as well– and this led to growing concerns that the world output could not keep pace with world population growth. Paradoxically, the challenge of what to do with wheat surpluses in exporting countries remained. In what has been described as a “break with history” (Morgan, 1979), grain would become “one of the foundations of the post war American Empire” (a “break with history”, because previous economic powers used to import, rather than export, food). All the conditions were set for wheat to become a chief element in the United States’ international affairs.
3. Main global trends after World War II

By the end of the War, only the United States were in the position to provide the food supplies required by the rest of the world. “American agronomists had been anxious since the beginning of hostilities that the end of the conflict would bring about a sudden stop in demand for food, which, with America’s food production at unprecedented levels, would trigger a return to the economic depression, unemployment and food surpluses of the 1930s” (Collingham, 2011, 477). In 1945 only the United States had a bumper harvest, and simultaneously there were plenty of countries in need for those oversupplies. The first conference of the Food and Agriculture Organization (FAO) was held in May 1945, and for a moment it seemed that a new way of international cooperation—a reconfiguration of the world’s political economy by “organising it scientifically, according to human need, not profit” (Vernon, 2007, 153) – would have been possible. The creation of a World Food Board was proposed by John Boyd Orr, director-general of the FAO. It was intended to work out the problem of surpluses, creating “a food pool from which food aid could be distributed to needy countries” (Matusow, 1967, 85; Collingham, 2011, 483). However, decision-making became quickly dominated by the political considerations of the Cold War, and Boyd Orr’s plan never became a reality. Far from solving the problem of surpluses and unfair food distribution, the post war food-cooperation system has been a major cause of social discomfort and the recipient of large criticism (Patel, 2008). Within the system, wheat has always played a crucial role (for instance, between 1956 and 1960 United States’s help represented more than a third of total world wheat trade). Nevertheless, since the end of World War Two there have been significant changes both in fundamentals and institutions shaping world wheat trade and in the relative positions occupied by many countries in regard to global wheat production, acreage and consumption.

3.1 Production

World wheat production has trebled since 1960. The largest part of this increase has occurred in some Asian countries (mainly India and China) but significant raises in production have taken place in most parts of the world. This is mainly because improvements in yields have also been widespread. However, wheat production has risen less than maize or soybeans production, thus becoming relatively less important. Graph 2 illustrates this evolution.
The growing significance of corn and soybeans may be linked to a global dietary shift towards meat products. It has been pointed out that some digestive troubles associated to wheat have motivated a preference for other grains and oilseeds when it comes to animal feeding (Malembaum, 1953). Roughly, only 15% of total wheat production is used for feeding purposes, and it has been little change in this percentage since the seventies (FAOSTAT, 2012). On the contrary, maize is widely utilized as feed (roughly 60% of total production) and the soybean meal is also broadly used as a high-protein feed for pigs, poultry and cattle (McMahon, 2013, 38). Therefore, there are reasons to expect a relative decline in wheat production as dietary transitions take place all over the world (although it is not obvious that there is an universal model of transition characterised by moving away from consumption of basic grains (Pujol and Nicolau, 2011), nor is it clear that demand is the main driver of production).

3.2 Acreage

Wheat acreage followed an upward trend over the period 1960-1980, and then started a downward trend until 2001. In the last ten years there has been a slight increase.
Among the key variables affecting acreage decisions are relative output prices and relative production costs (which in turn determine expected returns per unit of land). National policies and developments in technology are therefore of great importance. Why did global wheat acreage decline over the period 1980-2000 whereas corn, rice, and soybeans acreage significantly rose over the same period? Part of the answer, as it has been pointed out in the previous section, can be found in patterns of demand. However, there are factors regarding supply conditions that might have been of importance as well. For instance, it has recently been held that wheat has been losing its competitiveness because “it has not been a recipient of the new genetically modified (GM) technologies that have benefited corn, soybeans, canola and cotton” (Wilson, 2012).

The trend in total area harvested conceals substantial differences in tendencies between countries. For instance, while there have been significant increases in acreage in some developing countries such as India or Pakistan, since the eighties there has been a steady decline in the United States. In the latter case, the decrease in wheat acreage has had a lot to do with the surge of a new activity competing for arable land: biofuels production (McMahon, 2013).

### 3.3 Yields

There are a great number of factors affecting yields: the weather, the presence of pests, cultural practices such as fallow or rotations, procedures which minimize adverse conditions, mechanisation, the variety of wheat that has been sown and the amount of labour allocated to its production, among others. The extent to which yields have risen over the last seventy years...
years was, to some degree, unexpected before the War. Wheat yields started to rise significantly in developed countries after the Second World War and in developing countries from the sixties onwards. This process of change in agricultural technology during the 1960s and 1970s—which was possible thanks to a massive transfer of technological resources to developing countries— is commonly referred to as The Green Revolution. It involved the use of seeds of high-yielding varieties (HYV), and “the adoption of a package of improved agricultural practices involving fertilizers, pesticides, controlled water, credits, mechanical threshers, pumps and so forth” (Parayil, 1992, 737).

Graph 4. Land productivity: yields (1961=100), by type of grain, 1961-2010.

Source: own elaboration from FAO Database

Wheat yields—measured as unit of weight/area—have traditionally been lower than corn and rice yields. However, wheat has much greater calorie content per unit of weight than any other grain, and that should be taken into account when comparisons are made. To avoid those comparability problems, the evolution of yields over the period 1960-2010 has been plotted in Graph 4 using indexes (1960=100). As it is possible to see, wheat yields have risen even more than those of other major grains. Indeed, this astounding performance in yields represents a major alteration with respect to the dynamics before the War, when the vast majority of changes in output were the result of changes in acreage. Yet, this revolution

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2 Malembaum (1953) estimated that, from 1885-1886 through 1938-39, roughly 97% of the variation in the general movement of output was caused by changes in the acreage sown (corr. coeff = 0.983). However, in the last sixty years that correlation has weakened (R-squared= 79%, corr. Coeff = 0.89; own estimation from FAO Statistical Database).
came at a cost: a strong dependence on relatively scarce sources of energy (i.e. fossil fuels) and on several practices that compromise sustainable development.

A recent study by the International Institute for Applied System Analysis (IIASA) revealed that no country achieves the “maximum attainable yields” (IIASA, 2013), yet margins for improvement differ among countries. In fact, as a consequence of the Green Revolution, “yield gaps” are today larger than ever before. The most benefited countries have been those belonging to the European Importers group in the interwar period (for instance, France, Ireland or the UK) and several developing economies (India, China, Egypt). In contrast, no remarkable take off in yields took place in the United States.

### 3.4 Consumption

World wheat consumption chiefly depends on three variables: population growth, the percentage of population that consumes wheat, and the amount of wheat consumed per capita. It is often said that wheat demand is highly inelastic with respect to price: changes in price affects total demand only slightly (Lehfeldt, 1914). However, it has been noted that such inelasticity may have been overstated (Malembaum, 1953), probably due to the fact that expenditures are usually maintained for a while when prices rise. It has also been pointed out that price-elasticity is higher at lower levels of income (McMahon, 2013). Finally, it has been said that general computations of price-elasticity usually impede seeing a more elastic demand for wheat as feed (Malembaum, 1953).

In any case, the percent of total wheat production used for feeding is relatively small. Unlike what happens with corn or soybeans (see Graph 5), direct human consumption represents the largest part of wheat demand. Feed, seed and industrial usages are, therefore, of minor importance.

![Graph 5.Human consumption / production (%), 1961-2010.](image-url)
Income-elasticity of demand for wheat has also been a major concern throughout history. It has often been held that, as people earn more, they spend a smaller percentage of their income in wheat. This was first noticed –not specifically for wheat but for food in general– by the statistician Ernst Engel (1821-1896). This peculiarity of food demand (income-elasticity of demand between 0 and 1, or inelastic demand) was soon known as Engel’s Law, and lead to growing concerns about trends in prices. Raúl Prebisch –an influential economist born in one of the largest wheat exporting countries, Argentina– realised that the terms of trade had only deteriorated in underdeveloped commodity-exporting countries (Prebisch, 1952). The fact that there is a clear physiological maximum in per capita food demand was, therefore, seriously considered by the promoters of the Dependency Theory. But in the case of wheat, it has not only been said that its income elasticity of demand is less than 1, but that it is negative (i.e. as people earn more, they purchase less wheat because they shift to more expensive sources of calories). Actual data show a peak in global per capita wheat consumption in 1990 and a downward trend thereafter.

Graph 6. Food supply (kcal / per capita /day), 1961-2010.
There is also some empirical evidence supporting the idea of a declining per capita demand above a certain level of income.

Graph 7. Wheat consumption per capita and GDP per capita (cross-section observations in 1961 and 2008; each observation stands for one country).

However, further data examination suggests that there is not a universal trend in wheat consumption per capita. Income, though important, is only one of the explanatory variables. National trends show peculiar behaviours, and most of the cases do not show any correlation between the income level and the per capita consumption level.
3.5 Trade

The volume of wheat internationally traded has trebled since 1960. It is still the most traded grain, though, as happened in production and acreage, it has lost relative importance with respect to maize and soybeans.

Graph 8. Volume of trade (global exports, tonnes), 1961-2010

Source: own elaboration from FAO Database

The new map of world wheat trade is not only the consequence of changes in acreage and yields in different countries: trends in population growth and patterns of demand also matter. Considering this, it is hardly surprising that today’s wheat trade outlook is very different from how it was before the War. The United States no longer hold its indisputable lead among the exporting countries. Several countries belonging to the European Importers group in the Interwar period are no longer importers but significant exporters, France being the most powerful example. Populous Asian countries such as China and India have achieved a self sufficient position. On the other hand, countries like Egypt, Italy and Brazil have become heavily dependent upon imports.

4. Main objectives of my proposed thesis

Wheat markets are frequently held up as real-world examples of perfect competition in economics textbooks (for instance: Samuelson and Nordhaus (1985) or Mankiw (2012)). However, far from being a free market, wheat markets have traditionally been the target of systematic state intervention. There is no doubt that all the trends presented above are, to a great extent, the result of deliberate decisions and policies. Yet these policies are also
reflecting changing conditions in the material nature of grain markets and in the main
developments in economic thought. Success in Asian countries’ battle for self sufficiency can
be considered as a result of their government’s strategy (McMahon, 2013) but, at the same
time, self-sufficiency as a desirable goal has a lot to do with episodes of history when
dependency on imports caused negative consequences.

However, fundamentals supporting government intervention are not always conspicuous, and
most of the times it is difficult to evaluate the impact of state intervention on real variables.
There have been major changes both in general prescriptions (for instance, the role that
marketing boards are supposed to play) and in actual events and trends, but they have hardly
been studied in a global perspective. A large amount of research has been conducted into the
Green Revolution and the fundamental changes that took place in developing countries’
agriculture since the 1960s, but little attention has been paid to the richest countries. Yet there
is no doubt that developed countries’ policies have played a key role in configuring today’s
globalized world wheat economy. Addressing crucial issues such as the commonly claimed
“imbalance” in wheat markets (Farnsworth, 1958) necessarily requires focusing on the richest
countries. Therefore, my aim will be to study all the changes mentioned above—in production
techniques, geographical distribution of production and trade…—exploring the ways in which
production was and was not shaped by new political economies in the post-war years. I will
also look at the changing structure of world trade in wheat, and at the nature of wheat markets
(including futures markets) in shaping production and distribution. My work will draw on
statistical and archival sources, including where possible the papers of trading firms and
producers, and will rest on much important work that is currently being done by scholars in
CHoSTM⁴ and elsewhere on the history of agricultural production, plant breeding, and
agricultural policy.

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⁴ Centre for the History of Science, Technology and Medicine, King’s College (London).
http://www3.imperial.ac.uk/historyofscience


