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ABSTRACT

World population has increased six-fold in the last two centuries, and thus agricultural production must have grown as well. The last fifty years of this increase are covered by the Food and Agriculture Organization (FAO) production series. This article aims to push our quantitative knowledge back in time as far as possible. It reviews the scattered evidence on agricultural production in the first half of the 19th century, estimates a yearly series of output for the main countries since 1870, and puts forward some guesstimates on trends in the rest of the world. In the long run, agricultural production has increased more than population. Growth has affected all continents, even if it has been decidedly faster in both the countries of Western Settlement and in Eastern Europe, than in Asia or in Western Europe. It was faster before World War I, a veritable golden age for world agriculture, than in the inter-war years. The composition of production has changed as well, with an increase in the share of livestock products.

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1. INTRODUCTION: WHY SHOULD WE CARE ABOUT AGRICULTURE?

D. Gale Johnson reminded the audience in his 1999 Presidential Address to the American Economic Association that "people today have more adequate nutrition than ever before and have acquired that nutrition at the lowest cost in all human history, while the world has more people than ever before – not by a little but by a lot" (Johnson, 2000, p. 1). Nowadays, world population exceeds six billion people and, in theory, each of them could consume 2800 calories per day – a more than adequate intake.[1] This average conceals wide disparities among the continents and malnutrition is still widespread, especially in Sub-Saharan Africa, where the official average daily availability is about 2200 calories. However, true starvation is rare, and is almost always caused by wars and political events, which disrupt agriculture and trade in agricultural products, and make food relief efforts too dangerous.

Two hundred years ago, world population was a mere one billion, and its average caloric consumption was undoubtedly lower – possibly as low as 1800 calories in France or 2200 in the United Kingdom, the two most advanced countries in Europe.[2] Throughout the world, there was a real risk of starvation, especially for poor and destitute people, and terrible famines hit several countries in the 19th century (e.g. Ireland, Finland, India, and so on). Thus, there must have been a huge increase in world agricultural production. Indeed, according to the latest FAO estimates, world gross output increased by 60% from 1938 to the late 1950s, and more than doubled from then to 2001.[3]

Output must also have increased in the previous one hundred and fifty years, but the extent of this growth is still poorly known. Before 1870, the statistical evidence is scarce. Historians have tried to deduce the performance of agriculture from that of the overall economy: agricultural production is assumed to have grown fast in the early starters (notably, the U.K., but also the U.S.), and to have remained stagnant in the late-comers, such as Italy or Russia. The evidence on the period after 1870 is more abundant, but it does not seem to attract much attention among historians. For instance, agriculture is barely mentioned in popular textbooks on 19th and 20th century modern economic growth, such as those by Rosenberg-Birdzell (1986), Cameron (1989) and Landes (1998).

Agriculture does not directly feature in the recent literature on 19th century globalization (Williamson & O'Rourke, 1999) either. Their general framework, however with its strong stress on factor endowments and migration flows, implies different rates of growth in agricultural production comparing the New World (North America, South America and Oceania) with the Old World (Europe). The combination of abundant land and immigrant labor must have caused production to grow faster in the countries of Western Settlement than in Europe, where the

land endowment was roughly constant, and the labor force was not increasing fast. The fall in freight rates made it possible to feed Europeans with the production of Western Settlement countries. Agriculture regains a central (and negative) role in interpretations of economic trends after the Great War. In fact, overproduction in the 1920s and the fall in agricultural prices are routinely listed among the causes of the Great Crisis.[4]

One can sum up the conventional wisdom in five stylized facts: (1) agricultural production grew in the long run, at least as much as population and probably more; (2) this growth was slow in the first half of the 19th century, accelerated in the second half of the century and at the beginning of the 20th, only to slow down again after World War I; (3) the growth was faster in Western Settlement countries than in the long-settled areas of Europe and Asia, where it was faster in the "advanced" countries than in the "peripheries"; (4) before 1913, the integration of world markets caused prices to converge, so that prices rose in land-abundant exporting countries and fell in land-scarce European countries (when not artificially propped up by duties); (5) prices in the 1920s and 1930s were low and not profitable.

This article aims to test these statements, focusing on the first three.[5] After a brief methodological discussion in Section 2, Section 3 reviews the evidence on agricultural growth, mainly in Europe, during the first seventy years of the 19th century. Section 4 deals with the period from 1870 to 1938, on the basis of a new series of "world" production, which covers the whole of Europe (except for Norway and some Balkan countries), North America and Oceania, and substantial parts of Asia and South America.[6] Section 5 discusses the reliability of this series and the possible biases from errors in the country data or in the aggregation procedure. Section 6 presents the available evidence on production trends in other countries (including China), while Section 7 puts forward some guesstimates about total world output. Finally, Section 8 deals with the change in the composition of agricultural production. Section 9 concludes.

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2. SOURCES AND METHODS

Agricultural production can be measured either by gross saleable production or GSP (often referred to as "gross output" or "final product") or by Value Added (or GDP).[7] The former is defined as the total market value of all products, net of re-uses within agriculture itself of seed and feed, but inclusive of farmers' domestic consumption, while Value Added is the GSP net of the cost of inputs purchased from outside the sector. It is worthwhile computing both series, as they measure two different aspects of agricultural performance. The gross output measures the capability of agriculture to provide food, clothing, and heating, while

Value Added measures its capability to create income. Furthermore, the ratio of Value Added to Gross output is a simple proxy for the diffusion of "modern" agricultural techniques which require the purchase of industrial output (fertilizers, fuel, industrial feedstuffs, etc.). It is likely to have declined in the long run – a sixth stylized fact to test.

In recent years, economic historians have worked hard to estimate national accounts and series of agricultural production. It has been possible to find yearly series for twenty-five countries (at their 1913 boundaries). In some cases, the source provides both Gross Output and Value Added, in others only one series. Some of these series extend back in time to the first half of the 19th century (as early as 1800 for Sweden), while the majority start in the 1850s or 1860s, and five start after 1870. The series for some key European countries (Russia, Germany, France, etc.) do not cover the war-time years because during the period of hostilities these countries ceased to publish statistics. With some plausible guesswork, it has been possible to build twin series of Gross Output and Value Added for all twenty-five countries from 1870 to 1913 and from 1920 to 1938.[8] They refer to agriculture only, not to the primary sector as a whole, as the data on production in forestry, fishing and hunting are not available for some key countries, such as the United States, France, and the United Kingdom. However, the differences between agriculture and the primary sector are very small: the omitted activities account for more than a tenth of the production of the primary sector only in Sweden and Finland.[9]

"World" indices of Gross Output and Value Added are obtained by weighting the country series with their respective shares of production in 1913. This year has been chosen for sound historical reasons (it marks the end of a long period of expansion of the world economy) and for more mundane ones. It seems advisable to select a late date, because the accuracy of the data tends to increase through time, but the choice of any post-war date (e.g. 1938) would amplify the effect of any error in boundary adjustments. The value of production in 1913, measured by sources in national currencies, is converted into British pounds at the market exchange rates.[10]

3. THE GROWTH OF AGRICULTURAL PRODUCTION IN THE FIRST HALF OF THE 19TH CENTURY

The statistical evidence on agricultural production in the first half of the 19th century (Table 1) is incomplete and, in all likelihood, less accurate and reliable than for later periods.

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Table 1. Rate of Growth of Agricultural Production and Population Before 1870.

Country	Production		Population	
	Period	Rate	Period	Rate
Australia	1828–1870	8.42	1828–1870	7.97
Austria	1830–1870	0.57	1840–1870	0.63
Belgium	1812–1870	0.64	1816–1866	0.30
Denmark	1818–1870	1.31	1801–1870	0.95
France (a)	1803–1812/1870	0.90	1806–1866	0.41
France (b)	1821–1870	1.12	1821–1866	0.50
England (a)	1800–1870	1.10	1801–1871	1.34
England (b)	1800–1830	1.18	1801–1831	1.18
England (c)	1800–1850	1.00	1801–1851	1.40
England (d)	1800–1809/1870–1879	0.93	1801–1871	1.34
Egypt	1821/1872–1878	5.19	1821/1872–1878	1.54
Germany (a)	1800–1810/1866–1870	1.50	1817–1870	0.91
Germany (b)	1816–1849	2.61	1817–1850	1.02
Germany (c)	1800–1810/1846–1850	1.60	1817–1850	1.02
Germany (d)	1850–1870	1.49	1850–1870	0.72
Indonesia	1815–1817/1869–1871	1.43	1820–1870	0.96
Netherlands (a)	1808–1870	1.10	1808–1870	0.83
Netherlands (b)	1851–1870	1.40	1851–1870	0.75
Greece	1848–1870	2.72	1850–1870	2.00
Poland	1809–1870	2.65		NA
Portugal	1848–1870	–0.79	1841–1878	0.53
Spain (a)	1800–1870	0.57	1800–1870	0.62
Spain (b)	1850–1870	0.70	1857–1877	0.36
Sweden	1800–1870	1.44	1800–1870	0.82
United States	1800–1870	2.91	1800–1870	2.88

Note: All data computed as geometric interpolations between three-years moving averages (if not otherwise indicated).

Sources: Population data: Mitchell (1998a, b, c, Tables A1 and A5). Production data: *Australia*: Butlin-Sinclair (1986); *Austria*: Kausel (1979, Table 1a); *Belgium*: Goosens (1992, p.155); *Denmark*: Hansen (1974, Table 4); *Egypt*: O'Brien (1968, Table 7); *England* (and Wales) (a) Deane and Cole (1968 Table 38); (b) Crafts (1985, Table 2.10); (c) Allen (1999, p. 215); (d) Clark (2002, Table 5) England and Wales *France*: (a) Toutain (1961), (b) Levy-Leboyer (1968); *Germany*: (a) Helling (1965), (b) Tilly (1978), (c) Franz (1976, Tables 16 and 17); (d) Hoffmann (1965, ii Table 64); *Greece*: Petmezas (1999) and personal communication; *Indonesia* (Java): Van Zanden (2003) and personal communication; *Netherlands*: (a) Van Zanden (2000), (b) Knibbe (1994); *Poland* (Kingdom) Kostrowicka (1984, Table1); *Portugal*: Lains-Silveira Sousa (1998); *Spain*: (a) Gutierrez Brigas (2000, quadro VI.1), (b) Prados (2000); *Sweden*: Schon (1995, Table J1); *United States*: Weiss (1994, Table 1.6).

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The results tally only partially with the conventional wisdom. First, the performance is better than often assumed. Total production rose in all countries except Portugal, and, in nine cases out of fifteen, it grew substantially faster than population.[11] Second, the country ranking differs quite markedly from *a priori* expectations. The most striking result is the boom in Egypt, which, however, as warned by Hansen and Whattleworth (1978, p. 458), seems too good to be true. At the other end of the range, the fall in production per capita in England is also striking. It contrasts not only with the country's reputation as a beacon for technical progress (Deane, 1967; Overton, 1996), but also with the likely increase in consumption per capita during the Industrial revolution, when imports of agricultural products were negligible. There is no easy solution to this "food puzzle" (Clark, Huberman & Lindert, 1995) but the fact that production growth was not impressive seems now well-established (Allen, 1994; Clark, 2002).

As expected, production grew very fast in the countries of Western Settlement (a 3% increase over 70 years corresponds to an eight-fold growth). However, the achievement is less impressive than it might seem: the increase barely exceeded population growth, both in Australia and in the United States.[12] In contrast, according to these estimates, European performance was surprisingly good. Production per capita increased in all countries, except Austria and Portugal, and, in some cases, quite fast – up to 0.7% per year. Scattered evidence points to an increase in output also in other countries, such as Austria before 1830, Hungary, and Russia.[13] However, the relative prices of agricultural products rose quite substantially, especially during the "hungry Forties," and heights, which, *ceteris paribus* depend on food consumption, were falling or stagnant in the first half of the century in the United States and in several European countries.[14] These facts cast some doubt on the reliability of the figures in Table 1, which should be considered an upper bound on the true rate of growth.

The world outside the "Atlantic economy" (with the exception of Java) is, statistically speaking, *terra incognita*. Maddison opines that, in Togukawa Japan, agricultural production grew faster than the population – i.e. by 20% from 1820 to 1870.[15] In China, production may have grown slightly less than population, which rose from about 340 million in 1800, to 410 in 1840, to plunge to 360 million in 1870 because of the Tai'ping rebellion.[16] The total population of the Third World countries, including China, increased at about 0.3–0.4% yearly in the first half of the 19th century – i.e. by a quarter or by a third (the data are extremely uncertain).[17]

If production had been stagnant, consumption per capita would have fallen by the same amount. Such a fall is unlikely. Caloric consumption at the beginning of the century was quite low – perhaps less than 2000 calories per day per capita in Asian countries, such as Japan and Java (Van Zanden, 2003). Furthermore, in most countries, land was still quite abundant, and thus there was ample scope for

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production growth even without technical progress. In other words, the best, or least bad, guess, suggests that agricultural production in the LDCs must have risen, possibly as much as their population. As said previously, production per capita in "advanced" countries was rising. Thus, one can, very tentatively, conclude that, in the first seventy years of the 19th century, world output per capita did not fall and may have increased.

4. LONG-TERM GROWTH AND POLITICAL SHOCKS, 1870–1938

The yearly series confirm the conventional wisdom about long-term growth.[18] From 1870 to 1938, "world" gross output increased by 2.5 times (1.31% yearly) and "world" GDP by 2.2 times, at 1.18% per annum (Fig. 1). As expected, the growth was faster before 1913 than afterwards, and there is some (weak) evidence of a slowdown during the so-called Great Depression.[19]

The data also confirm the received wisdom about the effects of modernization of agriculture. Purchases outside the sector absorbed 8.5% of total GSP in the 1870s, 11% on the eve of World War I and, after a fall caused by the war itself, more than 15% in the late 1930s. Most of these sums were spent to purchase fertilizers, as the use of tractors and other machinery was to spread massively only

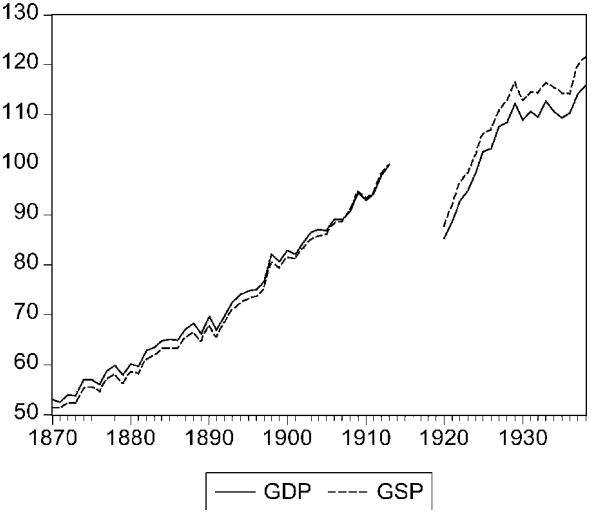

Fig. 1. Agricultural Production.

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Table 2. Growth in Agricultural Production, by Area and Period.

	Gross Output			Value Added		
	1870–1938	1870–1913	1913–1938	1870–1938	1870–1913	1913–1938
Europe	1.19	1.36	0.76[a]	1.05	1.30	−0.12[a]
North Western Europe	0.97	1.02	1.50	0.74	0.90	1.41
Southern Europe	0.88	0.97	0.96	0.84	0.96	0.73
Eastern Europe	1.67	2.13	0.36[a]	1.61	2.09	0.16[a]
Asia	0.97	1.11	0.58	0.96	1.18	0.56
South America	3.80	4.43	3.05	3.89	4.86	3.07
Western Settlement	1.37	2.20	0.74	1.22	1.92	0.62
World	1.31	1.56	0.67	1.18	1.48	0.38[a]

Source: Statistical Appendix Table A.1.
[a] Not significantly different from zero.

after World War II (Federico, forthcoming). Thus, this statistical reconstruction by and large buttresses the conventional wisdom. However, there are also substantial divergences in long-term trends by country/area performance (Table 2) and in short-term changes during the interwar period (Figs 2 and 3).

Before 1913, the growth in agricultural output was slower than expected in the countries of Western Settlement (with the remarkable exception of Argentina) and faster in Eastern Europe. Agricultural production in the rest of Europe and in

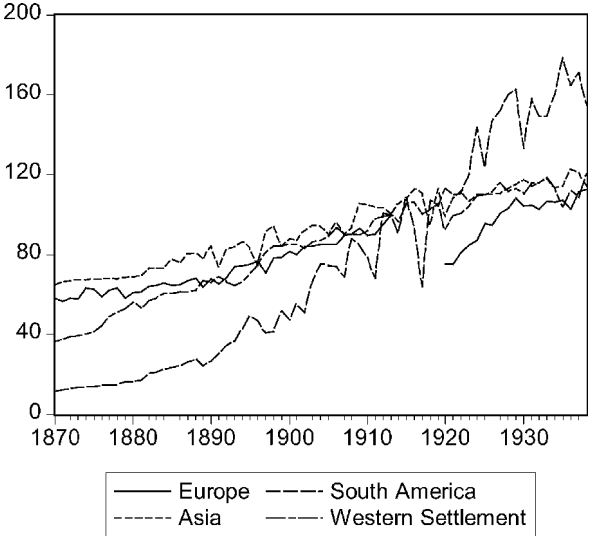

Fig. 2. Agricultural Output, by Continent.

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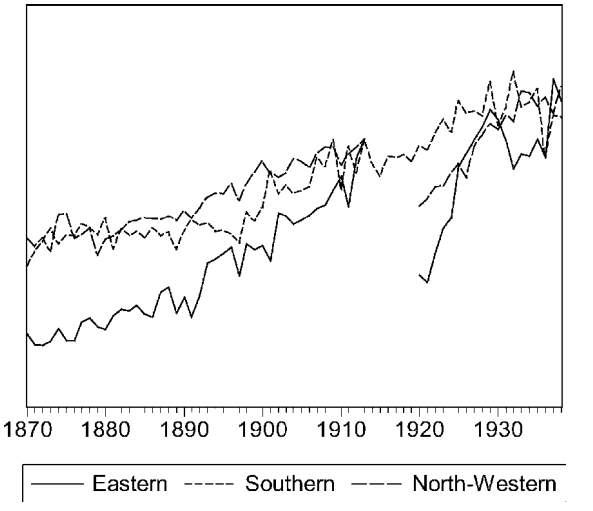

Fig. 3. Agricultural Output, Europe.

Asia grew as well, even though less than in the countries of Western Settlement or in Russia. However, performance widely differed between countries in the same area (Statistical Appendix Table D.2). India dragged down the Asian aggregate rate in spite of the high growth in Indonesia and Japan. In Northwestern Europe, the good performance of Germany and Denmark contrasts with the lackluster growth in France, the Netherlands and Belgium, and the stagnation in the United Kingdom. Greece outshone the two other Mediterranean countries, with a growth rate that was twice that of Italy and 4.5 times that of Spain.

These differences reflect different combinations of growth in inputs (extensive growth) and in their productivity (intensive growth). At one end of the range, Argentina was the prototype of extensive growth, featuring an exceedingly fast population growth, an almost infinite supply of land and, at least in the 1900s, declining productivity.[20] In some European countries, such as France, Ireland, and the United Kingdom, Total Factor Productivity grew more than output, and the quantity of inputs (especially labor) declined.[21] All other countries fall somewhere between these extremes. For instance, in the United States, from 1870 to 1900 inputs roughly doubled, while output increased by 135%: Total Factor Productivity thus accounted for about a fifth of production growth (Craig-Weiss, 2000).

The period to 1913 not only shows a growth in production, but also quite favorable price trends. At the very least, the real prices of agricultural products remained constant or rose, as in the United States, while the terms of trade (relative to manufacturers only) increased in almost all countries. As expected,

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there is some evidence of price convergence between the land-abundant New World and the land-scarce Old World, but it is quite weak. In fact, the range of country cases is quite wide. However, this combination of growing production and (probably) rising prices singles out the period to 1913 as a golden age for agriculture, at least in the Atlantic economy.

The outbreak of the war changed the situation. As already said, it is impossible to calculate the "world" indices during war-time years, but it is possible to compute series for some areas (Table 3), and there are independent estimates of production (especially of cereals) for almost all the missing countries. Assuming that these estimates are reliable enough, and that cereal output is a good proxy for the whole of agricultural production, it is possible to estimate that the "world" gross output in 1915–1918 was about 8% lower than in 1913.[22]

This overall decline is the outcome of widely different country trends. Asia was relatively unaffected by war, and, in fact, in 1915–1918, its production continued to rise exactly at the pre-war rate. Production stagnated in neutral European countries and in overseas countries. The increase in freights and the embargo on Germany disrupted their traditional exports flows, even though cereals were no longer subject to Russian and Romanian competition after the closure of the Dardanelles. In all the belligerent European countries production fell. The mobilization drained men and horses from the fields and the conversion of chemical plants to the production of explosives drastically curtailed the supply of fertilizers. This shortage may account for the poorer performance in "modern" countries, such as France or Germany, as compared with Italy or Russia.

Table 3. Gross Output 1915–1918 (1913 = 100).

	Indices	Other Sources	(a)	(b)	(c)	(e)
Asia	106.6	United Kingdom	114.5	96.8	99.2	
Southern America	96.4	France	68.1	66.8	80.5	
Western Settlement	102.8	Germany	67.3	67.5	62.2	
European Neutral countries[a]	99.6	Russia		79.0	74.9	81,1[b]
Italy	87.6	Hungary			79.8	
Austria	65.4[b]					

Sources: Indices: Statistical Appendix Table D.1; (a) League of Nations (1943) (cereals and potatoes); (b) Dessirer (1928) (cereals); (c) United Kingdom: estimate of the author (The figure is obtained by weighting the 1915–1918 average gross output of cereals, potatoes, milk and meat (Mitchell, 1988) with the shares of these products on gross output in 1911–1913 (Ojala, 1958, pp. 208–209), France Hautcoeur (forthcoming); Germany Holtfrerich (1986, Table 33) (cereals); Russia: Adamets (1997, Table 2) (cereals) and Hungary: Schultze (forthcoming) (cereals); (e) Harrison-Gattrell (1993, Table 12).

[a] Denmark, Greece, the Netherlands, Portugal, Spain, Sweden, Switzerland.

[b] 1915–1917 only.

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The post-war recovery was decidedly slow. In 1920–1922, "world" output was still about 8–9% below the pre-war level.[23] Actually, production exceeded the 1913 level in the majority of countries, including the United States, but "world" recovery was hampered by failure in three major countries, Austria-Hungary, Germany, and Russia, which accounted for about a quarter of "world" output in 1913. In the former Central Empires, production stagnated around its war-time level, while in Russia, where the civil war was raging, it collapsed to (perhaps) half the pre-war level in 1920–1921. As late as 1927–1929, "world" production was only 10% higher than in 1913, and European production was only 5% higher.

Thus, looking at aggregate production figures, there is little evidence of the alleged overproduction in the 1920s. In-fact, the growth in "world" production barely matched the increase in population (from 1913 to 1930, by 11% in the world, and by 13% in the 25 countries). Nor did trends in prices confirm the conventional wisdom. Indeed, prices fell in the early 1920s, but, in most countries, they returned quite quickly to their pre-war peaks (and, in a handful of countries, terms of trade actually exceeded the 1913 level). During the Great Depression, prices fell drastically (by 25–30% in most countries), while production remained constant. The three-year moving averages (a rough measure to smooth the effect of crop fluctuations) only decreased in 1931, by less than 1%, which was exclusively because of the collectivization disaster in the Soviet Union.[24] On the eve of World War II, "world" production was 3–5% higher than in 1927–1929. Gross output grew even more (by 8–9%) according to the estimates of the League of Nations.[25]

The combined effect of World War I, the Great Crisis and collectivization in the Soviet Union account for the difference in growth rates before and after the war. In the inter-war years, the growth rate of agricultural production matched or exceeded the pre-war rate only in Northwestern and Southern Europe. Elsewhere, it fell drastically, plummeting to zero in Eastern Europe. The slowdown can be measured by computing the level which production would have attained had it gone on growing as quickly as it had done in 1870–1913 (Table 4).

Table 4. Counterfactual Production Estimates in Interwar Years (Actual Production = 100).

	World GDP	GSP	GDP, by Area Europe	Northwestern Europe	Southern Europe	Eastern Europe	Asia	South America	Regions of Western Settlement
1920	130	127	145	133	108	198	109	128	125
1929	112	109	114	110	98	132	103	143	124
1938	125	121	124	108	117	158	115	242	140

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The 1920 "counterfactual" production would have been 30% higher in the "world", and almost two times higher in Eastern Europe. The recovery of the 1920s was "sufficient" to return to the steady state growth path only in Asia and Southern Europe, while the gap between actual and potential output was still about 10% for "world" production (and 30% for Eastern Europe). It widened again as a consequence of the stagnation during the Great Crisis. In no area was the 1938 "counterfactual" output close to the actual one.[26]

Clearly, the "counterfactual" output is a purely statistical artifact. Even without wars, the pre-1913 growth rate could not have been sustained. The supply of new land to be settled was dwindling in most Western Settlement countries and the workforce started to fall in all "advanced" countries. In fact, the growth rate of Total Factor Productivity and its contribution to output growth were decidedly higher after World War I than before it. It is impossible to know whether technical progress could have been faster, even without the adverse shocks of wars and economic crisis.

5. CAVEATS: SHALL WE BELIEVE THESE NUMBERS?

The reconstruction of historical national accounts is not an exact science. Its results are always uncertain and, at times, are positively controversial. In the 1960s, Nakamura argued that the data available then grossly overestimated the growth of Japanese agricultural production before 1913. After a very lively controversy, his views were accepted and the quasi-official series were revised downwards, although less than he had advocated.[27] In other cases, such as the Soviet Union, the issue is still open. The official production figures have been revised many times, and most Western scholars suspect that they have been "cooked" to extol the successes of Stalinist planning.[28] Consequently, they have suggested alternative estimates: Fig. 4 reproduces two series by Wheatcroft and Allen and compares them to the Soviet figures in their latest version.[29] According to the official data, gross output exceeded the pre-war peak already in 1924 and never fell below it afterwards. According to Wheatcroft, production barely recovered the pre-war level in 1929, before plunging to three quarters of the 1913 level during the collectivization crisis. The series by Allen, which has been used to compute the overall index, is midway between these two extremes. Table 5 compares the base-line estimates (those used to compute the index) with all the alternative ones that the author is aware of.

In about half the cases, the difference is so small as to be negligible, while, in the others, the alternative series grows faster than the base-line one. India is

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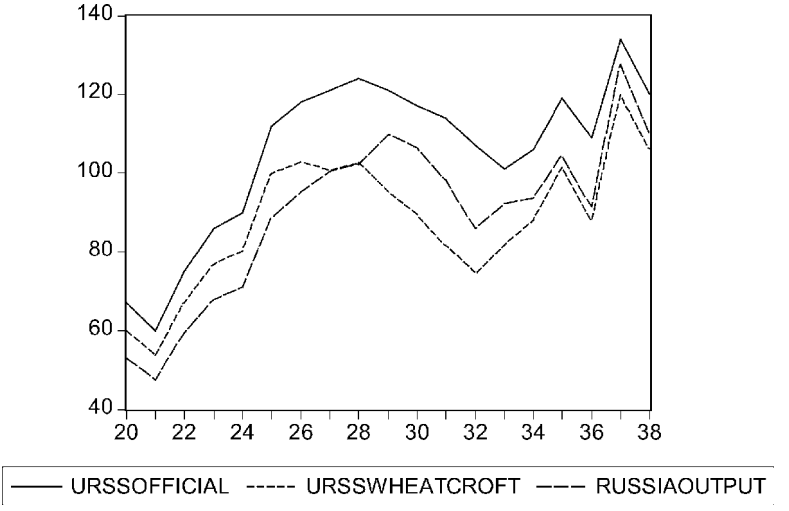

Fig. 4. Alternative Estimates of Soviet Gross Output (1913 = 100).

arguably the most important case, because of the size of the difference and the importance of the country, the second largest among the twenty-five (Table 6). According to the official statistics, in the first half of the 20th century, yields of main food-crops fell, acreage grew slowly, and per capita consumption declined.

Table 5. Alternative Estimates of Production Growth by Country.

Country	Period	Base	Alternative (a)	Alternative (b)
Argentina	1900–1938	3.15	2.94[a]	
Austria	1871–1913	1.44	1.39[a]	
Canada	1971–1927	2.77	2.74[a]	
France	1820–1913	0.72	0.93[**]	
India	1900–1938	0.45	0.90[**]	0.77[**]
Italy	1870–1913	1.14	0.85[*]	
Netherlands	1851–1913	0.60	0.90[**]	
Sweden	1861–1931	1.07	1.25[a]	

Sources: "Base" series: Appendix B; "alternative" Austria: Kausel (1979, Table 1a), Canada: McInnis (1986, Table 14 A.2), France: Levy-Leboyer (1968); Netherlands: Knibbe (1994); India (a) Heston (1984) (b) Maddison (1985, Table 4); Sweden: Lindhal (1937, Table 1); Italy: Ercolani (1969, Table XIII.1.1.4).

[a] Not significant; different from the "base."

[*] Significantly different from the "base" series at 10%.

[**] Significantly different from the "base" series at 1%.

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Table 6. Shares in "World" Agricultural Production.

	(a)	(b)	(c)	(d)	(e)	(f)
Argentina	2.3	2.3	2.0	2.4	3.3	2.3
Australia	2.2	2.4	2.2	2.4	2.2	1.6
Austria	3.1	2.9	3.1	2.6	3.0	3.7
Hungary	3.7	3.5	3.7	3.2	3.7	5.3
Belgium	0.6	0.8	0.6	0.7	0.5	0.6
Canada	1.9	1.9	1.7	2.0	2.2	1.5
Chile	0.3	0.3	0.2	0.3	0.4	
Denmark	0.6	2.0	0.6	0.7	0.4	0.6
Finland	0.3	0.3	0.3	0.3	0.3	0.4
France	9.2	9.1	9.3	7.9	6.4	8.7
Germany	9.3	8.9	9.1	8.0	12.6	10.4
Greece	0.3	0.3	0.3	0.3	0.2	0.5
India	15.1	13.8	16.6	16.2	14.5	
Indonesia	1.9	1.7	1.9	2.0	3.0	
Japan	2.9	2.9	2.9	3.1	2.3	6.6
Italy	5.8	5.5	5.6	5.0	4.3	7.2
Netherlands	0.5	0.9	0.6	0.6	1.5	0.7
Portugal	0.5	0.4	0.6	0.5	0.3	0.7
Russia	12.9	11.9	11.5	13.9	14.3	26.9
Spain	2.4	2.3	2.5	2.1	2.0	3.0
Sweden	0.6	0.7	0.7	0.6	0.9	0.7
Switzerland	0.6	0.5	0.6	0.5	0.5	
U.K.	2.4	3.1	2.5	2.6	3.7	2.3
USA	20.6	21.5	20.7	22.1	16.9	16.4
Uruguay	0.2	0.2	0.2	0.2	0.5	
Correlation		0.995	0.997	0.995	0.969	0.865

Sources: See text.

This fall is controversial. Sivasubramonian (2000), in his base-line estimate, endorses the official production statistics, while other scholars deem a decline in consumption implausible. Heston, in his own estimate of Indian GDP (alternative a), revises the production data under the assumption that yields had remained constant from the beginning of the century to the early 1950s.[30]

The two series thus imply quite different assessments of the performance of Indian agriculture, with far-reaching implications for the economic history of the country during the last period of British domination. But the choice of one of them would not substantially affect the analysis of "world" and area trends. Substituting the Sivasubramonian series for Heston's in 1900–1938 would increase the Asian growth rate from 0.74 to 0.94% per year (causing production in 1938 to be 8%

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higher) and the "world" rate by 0.02 points. Errors in country series must be huge to affect the "world" index. For instance, a 100% mistake in the American series leads to only 0.2 mistake in the "world" series in 1870–1913, and the error would be proportionally greater for area series, but the "world" indices could be seriously biased only if several country series were in error, and all in the same direction. This coincidence cannot be ruled out, but it seems quite implausible.

Mistakes in the weighting procedure are potentially more serious than those in the country series. A wrong set of country shares might bias the index upwards (downward) if fast-growing countries are given a too high (low) weight. This can happen either because 1913 production in those countries was unusually high (low) or because 1913 market exchange rates overvalued (undervalued) the real purchasing power of the country's currency. Although agricultural products are highly tradable, duties, quotas, and other trade barriers hampered trade. O'Brien and Prados estimate that, in 1911, the market exchange rate overvalued the "agricultural" Italian lira by 16% and the German mark by 10%.[31] The effect of these potential biases can be explored by computing the "world" indices with different weights (Table 6).

The two first columns on the left reproduce the "basic" country shares (column a for "world" value added and column b for gross output). Column c takes the short-term fluctuations into account by replacing gross output in 1913 with an estimate for 1909–1913.[32] The three other columns use different methods for converting the 1913 output into a common monetary unit. The shares in column d are computed by simply reducing the value of the output of the "protectionist" countries (Austria-Hungary, Italy, France, Germany, Spain, Portugal and Sweden) by a fifth. Column e uses the author's estimate of the agricultural gross output for some 50 countries in 1913, which uses a standard set of international prices.[33] Column f is calculated with the exchange rate implicit in Prados's recent estimates of national income in purchasing power parity in 1913.[34]

As shown in the bottom row, in three cases out of four, the coefficients of correlation between the basic set of weights (column a) and the alternative ones are extremely high and thus the long-run growth rates are almost identical.[35] The last set of weights (column f) differs from the basic ones: as expected, the value of output is higher in "underdeveloped" countries, such as Russia. However, the long-term growth rate of "world" output comes out to be very close to the basic one (1.28%, instead of 1.33% for the same countries) and also the short term differences are relatively small (cf. Fig. 5).

In short, this section shows that one can trust the overall reliability of the "world" (and area) indices in spite of errors in some country series and possibly in the weighting procedure.

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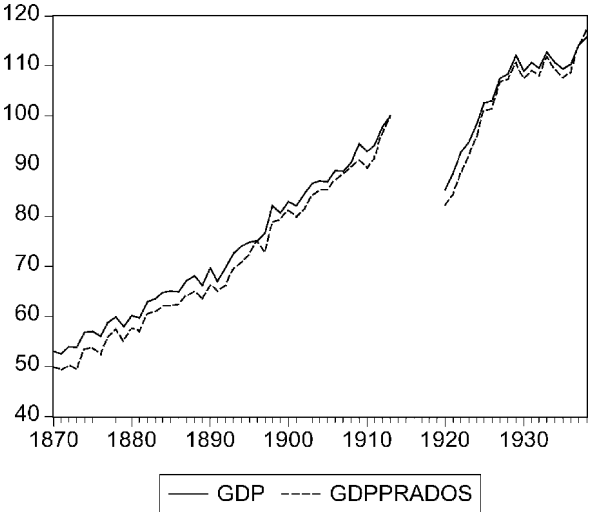

Fig. 5. Indexes of Output, with Alternative Weighting Schemes.

6. EXTENSIONS: THE "OTHER" COUNTRIES

What happened in the rest of the world? Did agricultural production increase as much as in the twenty five "core" countries? Table 7 provides a partial answer. It reports the evidence on the growth of agricultural production in a dozen other countries, which have been omitted from the base series, because they do not cover the whole period 1870–1938 and/or refer only to benchmark years.

By and large, these additional data confirm the previous results: production increased in the long-run in almost all countries, and it grew faster before rather than after World War I. Unfortunately, none of these countries was really important from a worldwide perspective. Their cumulated gross output in 1913 was about 6–7% of the "world" total.[36] It would be much more important to know something about China, which in 1913 accounted for a quarter of world population and produced about 20% more than the United States. Indeed, there are several estimates, but, unfortunately, there is no consensus.[37] Perkins, in his classic book on Chinese agriculture, surmises that agricultural output increased more or less as much as the population from 1850 to 1957 (i.e. at about 0.5% per year). Feuerwerker, in his authoritative survey of Chinese economic history, endorses Perkins' view, which is deemed too optimistic by Chao, who implicitly suggests a growth of around 0.4% from 1882 to 1950.

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Table 7. Rate of Growth in Agricultural Production, "Other" Countries.

	1870–1913	1913–1938
Bulgaria	1.14	
Montenegro	2.12	
Serbia	1.18	
Egypt (a)	2.19	0.94
Egypt (b)	2.23	1.15
Palestine		7.39
Taiwan	−0.91	2.85
Korea		2.76
Philippines	7.7	1.11
Thailand	1.32	2.20
Burma	0.14	−0.16
Mexico (a)	2.92	−0.27
Mexico (b)	3.35	2.02
Brazil	2.31	3.15
South Africa		2.55
New Zealand	3.94	1.61

Sources: *Bulgaria* (1865–1873 to 1911–1914), *Montenegro* (1873 to 1911–1912) and *Serbia* (1873–1875 to 1911–1912): Palairet (1997, Tables 7.1, 8.2 and 10.2) (total output); *Egypt*: (a) (1872–1878 to 1910–1914 and 1910–1914 to 1935–1939) O'Brien (1968, Table 10) (gross output for eight major crops), (b) (1887 to 1911–1913 and 1911–1913 to 1936–1938): Hansen-Whattleworth (1978) (production); *Palestine* (1921–1923 to 1936–1939): Metzler (1998, Table A.11) (gross output); *Taiwan*: (1887 to 1911–1913 and 1911–1913 to 1936–1938) and *Korea* (1911–1913 to 1936–1939): Mizoguchi-Umemura (1988, Tables 5 and 7) (NDP at factor costs), *Philippines*: (1902–1918 and 1918–1938): Crisostomo-Barker (1979, Table 5.1); *Thailand* (1870–1913 and 1913–1938): Manarungsan (1989, Table c.3) (GDP at market prices); *Burma* (1901–1902 to 1911–1912 and 1911–1912 to 1938–1939): Saito-Kin (1999, Table IX-2) (NDP at factor costs); *Mexico* (a) (1900–1902 to 1911–1913) Carr (1973, Table 1) ("total output"), (b) (1900–1910 and 1910–1940): Reynolds (1970, Table 3.2) ("production"); *Brazil* (1901–1911 and 1911–1941): Merrick-Graham (1979, Table II.3); *South Africa* (1911–1913 to 1936–1938): Union of South Africa (1960, Table I-27) ("physical output"); *New Zealand* (1900–1910; 1910 to 1936–1938): Bloomfield (1984) (gross output Table v.3 deflated with wholesale prices IX.13 and IX.14).

Rawski disagrees. He argues that labor productivity must have grown as much as real wages. If this were the case, agricultural output must have grown much faster than Perkins assumed – by 1.4–1.7% per year, from 1914/18 to the early 1930s. Rawski's argument has not convinced prominent Western scholars, such as Wiens and A. Maddison, who, in his latest book, reinstates Perkins' view. Output grew slightly slower than population from 1890 to 1913, and slightly faster from 1913 to 1933. On the other hand, some years before, the Chinese scholar Wang Yu-ru, apparently oblivious to the Western debate, had put forward a figure (a growth

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rate of 1.2% from 1887 to 1928) which is only marginally lower than Rawski's "preferred" estimate. The end of the debate is not in sight, but there is no doubt that total production grew substantially, as the population increased from about 360 million in 1870 to about 500 in 1933 – i.e. by 40% (Maddison, 1998, Table D.1).

As far as the author knows, there are no data, even tentative ones, on agricultural production in all the other countries, including large areas of Asia and almost the whole of Africa.[38] Trends in agricultural production can be inferred from the available, very tentative, estimates of change in GDP per capita. Reynolds (1985) argued that, by 1870, "intensive growth" (i.e. the increase in GDP per capita) had already started or was about to start all over the world. His statement is buttressed by some recent guesstimates by Maddison. He surmises that, from 1870 to 1950, the average GDP per capita in the "rest of the world" (including China) grew by a half.[39] Such an increase must have augmented the demand for food, which had to be satisfied by local production, as imports from the twenty-five "core" countries were very small or negligible. A (conservative) back-of-the-envelope estimate suggests that per capita production of foodstuffs may have risen by a quarter.[40] On top of this, exports of agricultural products from most Third World countries grew quite substantially. Thus, if Maddison is right, per capita agricultural production in the "rest of the world" must have grown by at least by 25% from 1870 to 1938.

7. EXTENSIONS: AN ESTIMATE OF TOTAL WORLD OUTPUT

The rate of change in total world output can be estimated as an average of the growth rates for the "core" twenty-five countries and for the "rest of the world," weighted with their respective share of output in 1913. Unfortunately, the latter are not available. One can proxy them with the proportion of output in 1970, or with the share of acreage (arable and tree-crops) in the late 1940s, or with the percentage of the population in 1913. The "rest of the world" accounted for about a third, two fifths and 45% of the total respectively.[41] Clearly, none of these figures is an exact proxy for their share of gross output, and it is difficult to assess *a priori* whether they underestimate or overestimate the actual share. Thus, Table 8 assumes that the "rest of the world" accounted for 45% (column a) or 35% (column b) of world gross output. It also assumes (conservatively) that its production per capita remained constant.[42]

Needless to say, the estimate is highly tentative. However, it confirms that the growth in total production was substantial, and that it was decidedly faster before 1913 than after. The growth in production per capita was not spectacular, nor was it negligible, either, especially in the period before the war. Furthermore, if

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Table 8. Growth in World Gross Output.

	25 Countries	Rest of The World	Total Gross Output	
			(a)	(b)
Total				
1870–1913	1.54	0.58	1.06	1.17
1913–1938	0.71	0.73	0.72	0.72
1870–1938	1.24	0.64	0.94	1.01
Per capita				
1870–1913	0.55	0.00	0.26	0.38
1913–1938	−0.08	0.00	−0.05	−0.05
1870–1938	0.32	0.00	0.15	0.22

Source: Statistical Appendix Table D.1.

Reynolds and Maddison are right, the estimate of Table 8 should be considered as a lower bound, with an upper bound around 0.20 –0.30% per year. If this latter figure were true, there would be very little difference between the performance before and after World War II. Even in the lower, more conservative, version, the period would mark a clear discontinuity from the previous historical experience. Maddison surmises that world GDP per capita (and thus also agricultural output) grew at about 0.05% per year from 1000 to 1820 – i.e. by a half.[43] This estimate seems too optimistic. In fact, according to Allen (2000, Table 7) agricultural production per capita decreased in all the major European countries from 1400 to 1800. It is unlikely that it had increased in Europe before 1400, or in the rest of the world, sufficiently to compensate for this loss and to achieve the long-run growth rate suggested by Maddison. It seems more likely that agricultural production per capita had remained roughly constant in pre-industrial times, albeit with wide fluctuations.

8. EXTENSION: THE CHANGES IN COMPOSITION

It is likely that the demand for agricultural products changed in the long run for at least two reasons. First, industrialization must have increased the demand for raw materials, and thus their share of total agricultural production, because artificial substitutes were not available before the 1920s (and their production boomed only after World War II). Second, the rise in income per capita must have increased the demand, and thus the share, of high income-elastic goods. However, the definition of the latter varied a lot by area: meat and dairy products were “luxury” goods in

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Table 9. Share of Raw Materials on Total Gross Output.

	1800	Ca 1850	Ca1880	1910	Ca 1938
Australia			58.6	53.7	47.8
Belgium		14.5	22.4	28.3	
USA	6.1	15.8	14.0	16.6	14.4
France		10.1	11.6	7.5	7.4
Italy			10.1	10.5	8.5
Russia			12.0	9.6	
Japan			9.8	8.9	10.9
U.K.			7.8	6.5	3.9
Spain			2.3	3.3	3.7

Sources: *Australia* ("pastoral" 1879–1881, 1911–1913 and 1936–1938): Butlin (1962); *Belgium*: Blomme (1993, Table 1); *France* (textile materials, tobacco and timber in 1845–1854, 1875–1884, 1905–1914 and 1935–1938): Toutain (1961, Tables 76, 76 bis and 77); *Italy* (1891, 1911 and 1938): Federico (2000); *Russia* (1879–1881 and 1911–1913, "industrial crops"): author's estimate (cf. Appendix B); *Japan* (cocoons, 1879–1881, 1911–1913 and 1936–1938): Okhawa-Shinohara (1979, Table A16); *Spain* (raw materials, circa 1890, 1909–1913 and 1929–1933): Prados (1993, Table 1); *United Kingdom* (1879–1881, 1911–1913): Afton-Turner (2000, Table 38.8) and (1935–1939): Ojala (1952, pp. 208–209); *United States* (textile raw materials and tobacco) 1800 and 1850: Towne-Rasmussen (1960, Table 6), 1879–1881, 1911–1913 and 1935–1937: Strauss-Bean (1940, Tables 10 and 27).

Asia and Southern Europe, while they were almost the staple diet in North-Western Europe, where the real luxuries were fruit and vegetables. Unfortunately, testing these hypotheses is very difficult. Only a few sources provide data by product, even if they estimate total production. Table 9 shows the available data on the share of raw materials.

These data are not accurate. The Australian data refer to "pastoral" production, inclusive of mutton, and thus overvalue the share of raw materials. Other country data omit some products (notably wood from tree crops), and thus undervalue the share, even if the bias is not likely to exceed a few percentage points. In spite of these biases, the story is clear: the share of raw materials was low in all countries except Australia and, contrary to expectations, it did not increase over time – either decreasing (as in France or the U.K.) or fluctuating without a clear trend (as in the U.S.). In most countries, one or two goods (wool in Australia and the U.K., cotton in the U.S., cocoons in Japan and Italy) accounted for most of the aggregate "raw materials."

The output of these "core" products was deeply affected by the state of the world market, especially by competition from other countries, which was almost never fettered by protection. For instance, the production of British wool remained constant (and thus fell as a share of total output) because of Australian competition.

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Table 10. Share of Livestock Products in Gross Output.

	(a)	(b)	(c)	(d)	(e)
1870–1872	38.3	54.5	32.6	38.3	37.3
1889–1891	41.6	51.7	36.6	40.1	40.9
1911–1913	43.4	48.7	40.0	42.1	44.2
1920–1922	44.1	49.2	40.9	41.9	43.2
1936–1938	44.7	49.8	41.2	43.4	45.0

Note: (a) Share of livestock products in total gross output; (b) Share of livestock products in the gross output of land abundant countries (Australia, Argentina, Canada, Russia, Uruguay and USA); (c) Share of livestock products in the gross output of other countries; (d) Counterfactual estimate assuming constant share of livestock by country at its 1870–1872 level; (e) Share of land-abundant countries in total "world" gross output of livestock products.

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Unfortunately, the data are too scarce to draw any meaningful inference on world trends.

It is possible to be somewhat more precise about the distribution of gross output between crops and livestock products (Table 10).[44] As column a shows, the share of livestock products in gross output of the twenty-five "core" countries grew substantially, especially before World War I. The share of these countries in world totals was rising (Table 8), and livestock products accounted for a lower share in the "rest of the world" than in the "core" countries. In 1913, they accounted for about a quarter of gross output in a group of twenty-five other countries, including China, Mexico and Turkey (Appendix Table A.6). Extending (somewhat arbitrarily) this figure to the whole "rest of the world" for all years, it is possible to estimate that the share of livestock products in world gross output grew from about 30% in 1870 to about 35% in 1913, and remained almost stable thereafter. Relative prices of livestock products increased substantially before 1913 and remained roughly constant in interwar years, albeit with substantial fluctuations.[45] A contemporary increase in prices and production strongly suggests a growing demand, not matched by an increase in (relative) productivity.

How was the growing demand for livestock products satisfied? Traditional livestock-raising was quite a land-intensive activity, and thus one would expect that it accounted for a greater share in land-abundant countries (column b) than in the others (column c). Indeed, this was the case at the beginning of the period: in 1870–1872, livestock products accounted for 96% of Argentinian gross output and for a mere 17% of Indian output. Since then, their share declined in all land-abundant countries except the United States, and rose in 15 out of the 19 land-scarce countries (the main exception being Indonesia).

This convergence is by no means surprising, given the underlying change in factor endowment. However, this change in the country composition of output only accounts for a fifth of the increase in the "world" share of livestock products, as shown by a comparison of columns d and a. The rest is accounted for by the growth in the share of land abundant countries on the "world" output of livestock products (column e). The population and incomes in these countries was growing faster than in the rest of the "world" and these countries also supplied increasing quantities of livestock products to (land-scarce) Europe.

9. CONCLUSIONS

The results of this paper can be summed up in five statements:

- agricultural output increased from the beginning of the nineteenth century, and the growth accelerated over the century, peaking on the eve of World War I. It was a veritable "golden age" for world agriculture, as relative prices were rising or constant.
- the War and the Great Crisis hit agriculture quite hard, and growth in the interwar years never reached the pre-war pace. However, prices did not rise, even if they did not fall as catastrophically as has sometimes been argued.
- The growth affected all areas, even if rates of increase were decidedly greater in the countries of Western Settlement and in Eastern Europe than in Asia and Western Europe.
- in the long run, the increase in output exceeded that of population by a substantial margin especially in the Atlantic economy – but probably throughout the world.
- the production of livestock products increased more than the total, probably as a result of changes from the demand side.

These results answer, at least to some extent, the questions raised at the beginning of this paper. But there is much work to be done. The main priority is to add further countries to the sample, and to extend the existing series back in time. Even imprecise estimates are better than total ignorance. It would also be useful to revise several country estimates, even if, as argued in section 5, none of them would affect the world total that much. In fact, accurate country series are essential in assessing country performance. Last but surely not least, all this statistical ground-work is only preliminary for tackling the real big issues: how was this growth achieved? What was the contribution of productivity growth and technical progress? How much did agricultural performance foster or hamper modern economic growth?

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NOTES

1. Population from Maddison (2001), calories from FAO (http://www.fao.org).
2. Fogel (1997, p. 450). The long-run growth in caloric availability is shown also by the rise in heights.
3. The first figure is estimated from FAO, Yearbook, various years. It excludes the Communist countries, and thus may overvalue actual growth. The data for 1961–2000 are taken from the FAO website (http://www.fao.org).
4. The role of agricultural crisis was first highlighted by Arndt (1963, p. 10). Cf. for instance Feinstein et al. (1997, pp. 78–80) or James (2001, pp. 112–113).
5. Price trends will be dealt with succinctly, on the basis of the discussion in Federico, forthcoming, ch. 3.3
6. In the following, the word "world" is written between brackets when it refers to the 25 countries covered in the index and without brackets when it refers to all countries.
7. Cf., Rao (1993, pp. 12–14). In the following, the words "output" and "gross output" will be used for GDP and GSP respectively, while "production" refers to both.
8. For a detailed description of the data, sources, and methods, see Appendix B. The missing (and interpolated) years are 1870–1873 for Japan, 1870–1874 for Argentina, 1870–1879 for Belgium and Indonesia, 1870–1871 and 1873–1881 and 1883 for India, 1920–1924 for Germany and the Soviet Union. When necessary, gross output (value added) is estimated starting from value added (gross output) with information provided by the source itself or with VA/GSP ratios for similar countries. Some series adopt slightly different concepts (e.g. the net instead of gross domestic products), and these differences are taken into account whenever possible. Boundaries are adjusted to those existing in 1913 with data on output or, when the latter are not available, on agricultural acreage. In this case, it is implicitly assumed that the production per acre was similar throughout the whole country.
9. The omission of forestry, fishing, and hunting reduces the bias in the series for countries of Western Settlement arising from the omission of the output by native population. Their contribution to agriculture was minimal, while they accounted for a sizeable, even if fast shrinking, share of the total primary output in the USA (Mancall-Weiss, 1999) and Australia (Butlin-Sinclair, 1986) in the 18th and early 19th century.
10. Exchange rates from League of Nations 1913–1925. The effect of alternative methods of conversion (wheat units and PPP-adjusted exchange rates etc.) is explored in section five.
11. The extent of the fall in Portuguese production depends a lot on the starting point. Omitting 1848 (an exceptionally good year) the rate of decline would halve to –0.36% per year.
12. At least for the United States, the coincidence is not entirely casual: before 1840 the output of most goods is calculated by assuming constant per capita consumption at the 1840 level, and adding net exports (Towne & Rasmussen, 1960, p. 264).
13. For Austria, Good (1984, Tables 11 and 22) reports growth rates for crops (1789–1841) of 1% per year and for livestock (1818–1850) of 0.6% per year. Komlos (1983, pp. 52–89) argues that in Hungary, production grew in the whole period from the 1830s to the 1860s (with no noticeable effect of the emancipation of serfs in 1848), and that the output of grain rose faster than the population. According to Khromov (quoted by Mitchell (1998c, p. 315), the output of grain in European Russia increased by 40% between 1800–1813 and 1857–1861. Cf., also, on Spain in the first half of the 19th century,

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the debate between Prados de la Escosura (1989) and Simpson (1989a, b), who suggests a 0.65% yearly growth for the whole century.

14. Cf., on prices, the analysis in Federico, forthcoming, chap. 3.3; for the fall in heights (or "early industrialization puzzle") Steckel (1995, 1998), Komlos (1998), Steckel and Floud (1997), Baten (2000).

15. Maddison (2001, Table B-17) and also Yamamura-Hanley (1977, pp. 70–74).

16. Richardson (1999, p. 20) and population data from Maddison (1998, Table D-1).

17. From 1800 to 1850, the population of Asia, Africa, and South America rose from 750 to 925 million people according to Biraben (1979), or from 700 to 880 million according to McEvedy-Jones (1978) – corresponding to growth rates of 0.42% and 0. 46% respectively. According to Maddison (2001, Table B-10), from 1820 to 1870, the population of the overseas LDCs increased from 805 to 895 millions – i.e. at 0.21% yearly only (for the consequences of the Chinese disaster). In the same years, the population of Eastern Europe increased from 95 to 145 millions (0.85% yearly). Needless to say, all these figures are highly tentative and give us only a rough order of magnitude.

18. Statistical Appendix Table 1. Unless otherwise specified, the growth rates are calculated with a linear regression (adjusted to take into account the autocorrelation of residuals if necessary).

19. A dummy for 1879–1896 is negative and significant in the time trend regressions for the whole world, North-Western and Southern Europe, while it is not significant in Eastern Europe, South America and countries of Western settlement.

20. From 1900–1904 to 1910–1914 the agricultural workforce increased by 40%, land by almost 50% and Total Factor Productivity fell by almost 20% (Diaz Alejandro, 1970, Table C.3.2). The total population of the country soared from 1.8 million in 1870 to 7.6 in 1913 (Mitchell, 1998b).

21. Cf., for France, Grantham (1996, Tables 5 and 6), for Ireland O'Grada (1993, Table 30), and for the United Kingdom, Turner (2000, Table 3.33). Cf., for further cases and a more detailed analysis, Federico, forthcoming.

22. It is assumed that the gross output was three quarters of the 1913 level in Finland and two thirds in Belgium. Production of meat and livestock products may have fallen more than cereal output and animal stock (League of Nations, 1943).

23. This slow recovery contrasts with the experience after World War II. In 1948–1952, output exceeded pre-war levels by 7% in Europe, 41% in North America, 11% in Oceania, 26% in Latin America, 5% in the "Far East" (i.e. Asia) and by 20% in the "world", which includes Africa and the Near East, but not the Socialist countries. Factoring them in would probably reduce the overall increase. In fact, according to Davies (1998, pp. 64–69), the Soviet production returned to pre-war levels only after 1950, and probably the Chinese even later.

24. If Soviet output had remained constant at the 1929 level, "world" output would have risen until 1933, and then it would have fluctuated until 1939.

25. League of Nations (various years). The estimate takes into account the most important commodities only, but covers more countries. The same source reports an index for crops only, starting in 1920, which can be compared with the implicit "world" index for crops only. In 1920–1922, the two indices are very similar (92.8 for the League of Nations instead of 91.5) while the Leagues of Nations index grows decidedly more in the 1920s (in 1927–1929, it reaches 121.4 instead of 111.4) and in the 1930s (136.5 instead of 116.3).

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26. It is possible to calculate the "losses" from the Great Crisis under the assumption that production had been growing as fast as in the 1920s. The counterfactual "world" 1938 production would have been about a quarter greater than the actual one.

27. Cf., Nakamura (1966) and the short survey by MacPherson (1987, p. 53).

28. Wheatcroft-Davies (1994a, b). Allen (2002) is less critical. He remarks that the archival sources, recently made available, do not prove the allegations. The lack of "corrections" by the Moscow statistical offices, however, does not rule out the "cooking" of the figures by farm or district managers at the local level, in order to fulfill their plan targets and to please their Moscow bosses.

29. Cf. Clarke-Matko (1984, Table 5). In all three cases, the rate of change in 1920–1938 is not significantly different from zero.

30. Heston's skepticism is fully supported by Pray (1984), who remarks that official figures imply a 40% fall in per capita consumption in Bengal. Maddison (1985) and McAlpin (1983) admit that the official statistics may be wrong, but do not fully endorse Heston's alternative hypothesis. In contrast, Blyn (1966, pp. 150 ff) and Mishra (1983) trust the official figures. Cf., for the whole debate, Roy (2000, pp. 52–55).

31. Cf., O'Brien-Prados (1992, Table 2). The rates for French Francs and the Spanish peseta coincide almost perfectly with the PPP.

32. The latter is obtained for each country as the 1913 value times the ratio of output in that year to the 1909–1913 average. The result would be unbiased if relative prices of agricultural products had not changed.

33. Cf. Appendix A.

34. Prados (2000). The shares are not exactly comparable to those of the other columns of Table 6 because he omits four countries (Chile, India, Indonesia and Switzerland).

35. The long-run growth rate is 1.18% for the basic series (column a), 1.15% for adjusted 1909–1913 output (column c), 1.21% for "protectionist" (column d) and 1.24% for "agricultural" PPPs (columne). None of these differences is significant even at the 10% level.

36. Cf., Appendix A. The missing Brazilian output is crudely estimated according to its agricultural workforce (Mitchell, 1998b).

37. Cf., Perkins (1969, Table D.32 – he puts forward a range from 0.24 to 0.64% – and 0.5% is his "preferred" estimate), Feuerwerker (1980, p. 6 and 1983, p. 63), Chao (1986, p. 216) (multiplying his estimates of consumption for the population estimates by Maddison (1998, Table D1), Rawski (1989, pp. 322–328 and Table 6.11), Wiens (1997, pp. 65–71), Maddison (1998, Tables C.1 and D.1) and Wang (1992, Table 4.1). Cf., also, on the "optimist" side, Brandt (1989, pp.132–133 and 1997, pp. 289–292) and the survey by Richardson (1999, pp. 31–39).

38. Production is said to have increased in Syria from the 1830s to World War I (Schilcher, 1991 p. 173), and in East Africa in the interwar years (Mosley, 1983, p. 121) but not in Macedonia (Akarli, 2000, pp.127–129).

39. Calculation by the author from data in Maddison (2001, Tables A-2, A-3, B-10 and B-18). According to his estimates, the Chinese GDP per capita declined by almost a fifth. Thus, the GDP of the "rest of the world" excluding China increased by 120%. The "rest of the world" includes all Africa, Asia (without India, Indonesia and Japan) and Latin America (without Argentina, Chile, and Uruguay). Unfortunately, Maddison does not provide enough data to compute the GDP per capita of Balkan countries.

40. It is assumed that prices increased by 20% from 1870 to 1938 – i.e. by 0.30% per year (cf., Federico, forthcoming), that income elasticity was 0.6 and price elasticity was –0.2.

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41. Cf., Rao (1993, Table 5.4) for the output, FAO (1952) for the acreage (55% for meadows and pasture) and Appendix C for the population. The acreage of the twenty-five countries at their 1913 borders is proxied by that of the "corresponding" countries in the 1940s. For instance, it includes Yugoslavia, which included a sizeable part of the defunct Austro-Hungarian Empire, net of pre-1913 Serbia (from Institute Internationale d'Agriculture, 1909a, 1921).

42. The rates for the 25 countries differ from those of Table 2 because they are calculated as geometric interpolation.

43. Cf., Maddison (2001, Table B-22) and Maddison's estimates are discussed by Federico (2002), while Bairoch (1999, pp.130–134) provides additional references and discussion on the growth in the very long run, from pre-history to 1800.

44. Cf., Statistical Appendix Table I and Appendix B for the sources and methods. Some of the shares have been obtained as a linear interpolation from benchmark years, and thus they are bound to be less volatile than in reality.

45. Cf., Federico (forthcoming, Table 3.7). The data refer to a dozen "advanced" countries.

46. The exact figures are 72% for Italy in 1911 (Federico, 1992), 69% for Belgium in 1913 (Blomme, 1992a, b), 69% in the United States in 1900 (Towne & Rasmussen, 1960) and 72% in China in 1914–1918 (Perkins, 1969) – the last figure being an upper bound because the gross output omits some minor products.

47. Most of the data are from Mitchell, while the production of textile fibres (flax, hemp and cotton) and tobacco is the 1909–1913 average from Institute Internationale d'Agriculture (1909a, 1921). The production of cocoons is estimated from that of silk (Federico, 1997, Table A VI) assuming a 12:1 yield. The information from these sources are supplemented or substituted with figures from Sandgruber (1978, Table 135) for Austria, Blomme (1992a, b) for Belgium, Petmezas (1999) for Greece, Lains-Silveira Sousa (1998) for Portugal, Federico (1992), adjusted to 1913 for Italy, U.S. Bureau of the Census (1975) for the United States, Perkins (1969, Appendix D) for China, McCarthy (1982, sections 14 and 15) for the Ottoman Empire and Manarungsan (1989, Tables A.3, A.5 and 3.2) for Thailand.

48. Mitchell reports figures for the 1913 gross production of livestock products in Finland, Canada, Australia (milk and wool only) and Japan (meat only). Additional data are taken from country sources for the United States (U.S. Bureau of the Census, 1975), Italy (Federico, 1992), Germany (Hoffmann, 1965), Belgium (Blomme, 1992a, b), the Netherlands (Knibbe, 1994), India (Sivasubramonian, 2000), Denmark (Jensen, 1937), Austria (Sandgruber, 1978), Portugal (Lains and Silveira Sousa, 1998), the United Kingdom (Mitchell, 1988) and China (Perkins, 1969, Appendix D), assuming a dead weight of 150 kg. for cattle, 80 for pigs and 10 for sheep). The Hungarian productivity is assumed to have been equal to the Austrian one for meat and four fifths its level for milk. The data for the 1930s and 1950s are taken from Mitchell (1998 a, b and c; Institute Internationale d'Agriculture (1939–1940), and FAO Yearbook (1956, Tables 72A and 77).

49. The series omits the output of Western Australia (Butlin-Sinclair, 1986, Table 6), which is, however, included in the total GDP of Table 1 (p. 129). On the other hand, it includes mining, other than gold mining in South Australia (p. 137). The first omission is corrected by adding 70% of the Western Australian GDP. After 1900/01, the data are calculated as a simple average of two consecutive fiscal years.

50. Butlin's definition of GSP differs from the standard one. Thus, the figures are calculated *ex-novo* as the value of "gross output" less the expenditure for seed (Tables 49

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and 50) and for fodder (Tables 53 and 54 for "agriculture," 68 and 69 for "dairying" and 40 for "pastoral." There are no data for the fodder expenses in the "pastoral" sector before 1900 (i.e. in Table 39). The omission is not corrected, as it seems more likely that Butlin reckoned them to be negligible than that he simply forgot to estimate the item altogether. Finally, the aggregate GSP at current prices have been deflated with the price indices of Table 267 in order to get a series at constant (1910–1911) prices. The data for VA at constant (1910–1911) prices are taken from Table 269, those at current prices from Tables 41 ("pastoral") 53 and 54 ("agriculture"), and 68 and 69 ("dairying, forestry, fisheries"). The VA of forestry and fishing is deducted from the total of Tables 68 and 69 by assuming that its share on VA was the same on the GSP.

51. The missing Hungarian output in 1921–1923 is interpolated with an average of the Austrian and Czechoslovak figures for the same years. Output in Austria and Hungary in 1938 is crudely estimated by extrapolating the 1937 production with wheat output (Mitchell, 1998a). Finally, the agricultural VA in Yugoslavia is computed as the total one (Table XIII) times a linear interpolation of the share of agriculture in total GDP in 1910, 1931 and 1953 from tab. XVIII.

52. McInnis' index is preferred to the original constructed by Urquhart (1993, p. 24, Table 1.6), which also includes non-agricultural sectors.

53. Population figures for Java and Madura have been provided by Van der Eng, while, following his method (1996, p. 271), the population of the Other Islands is assumed to have grown at 1.5% per year.

54. In both cases, the differences between the ISTAT estimate and the new one at benchmark years is minimal. In 1911, the new estimate is 1.4% lower than the ISTAT one, while the share of livestock products is 69.2% instead of 68.8% according to the ISTAT.

55. The use of the value of stock as a proxy for output may undervalue the growth in production if the increase in productivity has not been fully translated in the price of animals. On the other hand, Wheatcroft (1990, pp. 90–91) argues that Gregory's figures overstate the growth of stock – and these two biases might compensate.

56. It is assumed that 60% of the meat was produced from cattle, 25% from pigs and 15% from sheep and that the cow milk accounted for 85% of the total (Falkus, 1968, Table 7). It is also assumed that there was no increase in productivity per head from 1870 to 1885.

57. Wheatcroft-Davies (1994b) report somewhat different data on production in 1913. Using their estimates would not change the long-term growth rate of gross output, but it would yield an implausibly high share of livestock (up to 80% in 1891).

58. Allen's index refers to the Soviet Union at 1939 boundaries. Its use for Russia at 1913 boundaries is bound to bias the overall trend as the lost areas (mainly Poland) did not experience the dramatic fall and recovery in the 1930s.

59. The 1920 estimate (54) is substantially lower than the official Fig. (64), reported by Clarke-Matko (1984, Table 5). As Adamets (1997) points out, data are extremely uncertain, and estimates range from 25 to 75% of pre-war level.

60. Lewis has computed his index by splicing the annual production index by Drescher (1955) upon Ojala's (1952) multi-year averages (Lewis, p. 259) and by extrapolating back to 1852 with assumptions on per capita consumption. The Drescher series (called "economic index of production") is a weighted average of twelve product series, including feedstuffs such as turnips and mangolds. In a comment, Fletcher (1955) argues that Drescher does not follow the standard definition of GSP and the index rises more than an (apparently comparable) index from Ojala, because of the fast rise in livestock output.

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61. The figure is obtained by comparing Feinstein's Tables 8 and 54 (column1), which refers to Great Britain at 1913 boundaries. In 1911, Eire accounted for 18% of the ploughland, 31.5% of the meadows and for 28% of the whole agricultural acreage of the United Kingdom (Institute Internationale d'agriculture (1909 à 1921) Table 4).

62. The shares are from O'Grada (1991); the underlying data from Mitchell (1998c, Tables C2 C6 C7 C8).

63. These series might include some purchases of imported stuff and of feed of industrial origin, and this could cause a small undervaluation of GDP. The shares of livestock on gross output is obtained first dividing the "home consumption" between crops and livestock products according to the respective shares of the sum of the two categories, and then deducting "seed" from the value of crops and feed and livestock from the value of livestock products.

64. The two latter items are simply omitted. Rents belong to the dwellings, while subsidies are negative taxation – i.e. impinge on the difference between figures at market price and at factor costs.

65. Maddison (1998, Table D-1) for China, Visaria and Visaria (1983, Table 5.7) (Davis & Gujaral estimates) and Sivasubramonian (2000, Table 6.9) for India, Institute Internationale d'Agriculture 1909/13 and 1925 for the Soviet Union in 1920, Wheatcroft-Davies (1994a), Table 1 for the Soviet Union in 1938 and 1938 and from personal communications by S. Petmezas for Greece and P. Van der Eng for Indonesia.

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APPENDIX A

The Estimate of "PPP-adjusted" Agricultural Production in 1913

The PPP-adjusted production in 1913 is computed for forty-nine countries, the twenty-five of the sample and twenty-four others, including China (cf. the full list in Table A.6). The computation follows the three-step usual procedure: (1) estimate total production; (2) deduct seed and feed; (3) multiply by "world" prices to obtain gross output; and (4) deduct expenditures on purchased materials to get Value Added.

(1) Production is computed taking twenty-three products into account: wheat, rye, barley, maize, rice, cassava, sugar-beet, cane sugar, potatoes, sweet potatoes, tobacco, cotton, wine, olive oil, citrus fruit, flax, hemp, tea, rubber, meat, milk, wool and cocoons. This list seems fairly complete for temperate agriculture. The main omissions are pulses, vegetables, wood, fruit, and poultry. In all cases where a comparison is possible, the included products accounted for about 70% of the total gross output.[46] In contrast, the coverage of tropical agriculture is decidedly poor, as the list omits vegetable oils, coffee, cocoa, sorghum, etc. In any event the distortion is relatively small, because (unfortunately), the sample includes only one tropical country, Indonesia.

The production data are taken from Mitchell's well-known statistical compilations (Mitchell, 1998a, b, c), supplemented by the yearbooks of the *Institute*

Table A.1. Percentage Change in Output Per Animal, 1910–1913 to 1936–1939.

	Beef	Pork	Mutton	Milk	Wool
Italy	20.6	5.6	13.2	49.6	
USA	−1.6	34.7	23.2	38.3	25.6
Belgium	11.4	−13.8		20.8	
Germany	19.5	22.9	−11.6	1.9	5.0
Netherlands	1.1	2.9		25.6	
U.K.				−35.9	
Australia					16.6
New Zealand					9.0
India				5.1	

Sources: Italy: ISTAT (1958, pp. 114 and 116–117), Belgium: Blomme (1992a, b, Statistical Appendix, Tables 7, 14–15, 29, 36–37; Netherlands output: Knibbe (1994, Table III), stock: Mitchell (1998c, Table C5); Germany output: from Hoffmann (1965, ii Tables 54 and 55), stock: Mitchell (1998c, Table C5); the United States stock: U.S. Bureau of the Census (1975, series K564, K566 and K568), output: (U.S. Bureau of the Census, series K584, K587, K590, K593 and K597), and output of wool: Strauss and Bean (1940, Table 47); United Kingdom cattle stock: Mitchell (1998c, Table C5), output of milk: Mitchell (1988, Agriculture Table 9); New Zealand and Australia: Mitchell (1998a, Tables C11, C 13 and C15); India (milk cows) Sivasubramonian (2000, Table 3.8 and Appendix Table 3(h)).

Internationale d'agriculture and country sources whenever available. The coverage is almost complete for crops, but rather poor for livestock products.[47] In most countries, yearly series for livestock products are available only from the late 1930s, if not from the 1940s or 1950s.[48] Yet animal products are too important to be neglected. Thus, the production of "missing" countries is estimated multiplying the number of animals (from Mitchell) around 1910 for an estimate of the output of meat, milk and wool per animal. This latter is obtained extrapolating backwards the earliest productivity figures available – usually for the 1930s, and sometimes for the 1950s. The available evidence on productivity growth is reported in Table A.1. It is assumed that, from 1913 to the 1930s, the productivity per head of stock rose by 10% for meat and by 15% for milk and wool in the "advanced" countries (Western Europe, Canada, Argentina, South Africa and Japan), and that it remained constant elsewhere.

(2) The use of cereals and potatoes for seed and feed is estimated as a fixed proportion of gross output. The available data on this proportion are reported in Table A.2.

The figures reflect differences in agricultural technology (sowing by hand uses more seed), in diet, levels of income and factor endowment. For instance, potatoes, as a labor-intensive and land-saving crop, were not used for animal feed in the United States. In the more advanced countries, the seed/crop ratio was lower, but a

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Table A.2. Percentage of Total Output Used for Seed and Feed, Various Countries ca. 1910.

	U.K.	France	Italy	Russia	Ireland	Spain	Belgium	USA
Wheat	20		14	13	6	14	7	14
Barley	16		67	10	8	66	72	49
Rye			21	15		23	24	73
Maize			43			57		83
Potatoes	30	43	37	20	42	24	41	20
Rice			3					
All cereals		36						

Sources: U.K. (1904–10): Ojala (1952, Table I, II and V); Italy (1911): Federico (1992); Russia: Gregory (1982, Table D.1); Ireland (1912): Turner (1996, pp.98–99); Belgium (1919–22): Blomme (1992a, b, Tables 3–4, Statistical Appendix); USA (1913): Strauss-Bean (1940, pp. 34–41); Spain ("until 1929"): Prados (1993, Table A.1); France (1905–14): Toutain (1961, Tables 79 and 82).

higher proportion of available cereals (especially of maize) was given to animals. The assumed percentages vary according to the area and the level of development (Table A.3).

(3) The concept of "world" price is quite elusive. No single market place can claim to be really representative of the world, even if London is a strong candidate, and, moreover, no source provides quotations for all the twenty-three commodities in the same market. Thus, the set of "world" prices in 1913 has to be pieced together from different sources, notably the yearbook of the *Institute Internationale*

Table A.3. Percentage of Total Output Used for Seed and Feed, Estimates.

	WS	W. Europe	S. Europe	E. Europe	Asia	S.Amer.	Africa
Wheat	15	10	15	15	15	15	15
Rye	25	20	20	15	15	15	15
Barley	50	20	70	15	15	15	15
Maize	15	50	50	35	10	10	10
Potatoes	20	50	30	20	20	20	20
Rice	4	4	4	4	4	4	4

Note: WS (Western Settlement): Australia, Canada, Uruguay, South Africa, New Zealand; W Europe: Austria, Denmark, France, Germany, Netherlands Sweden, Norway and Switzerland; Southern Europe: Greece, Portugal, Algeria, Tunisia, Morocco, Egypt, and Cyprus. E Europe: Hungary, Russia, Finland, Serbia, Bulgaria and Romania. Asia: India, Indonesia Japan, China, Indochina, Korea, Philippines Taiwan and Thailand. S.Amer. (South America): Argentina, Chile and Mexico. Africa: Madagascar, Sierra Leone, and Zimbabwe.

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Table A.4. Relative Prices, by Country.

	Free Trade Countries																		Protectionist Countries.				
	U.K. (a)	U.K. (b)	Ireland	USA (a)	USA (b)	USA (c)	Indonesia	Neth. (a)	Neth. (b)	Russia	Canada (a)	Canada (b)	Denmark	Belg. (a)	Belg. (b)	Argentina	Australia	India	Italy	Germany	Austria (a)	Austria (b)	France
Wheat	1	1	1	1	1	1		1	1	1	1		1	1	1	1	1	1	1	1	1	1	1
Rye		0.87		0.98	0.95	0.71		0.82	0.70	0.77	0.77		0.89	0.86	0.85				0.77	0.81	0.80	0.84	0.70
Barley	0.86	1.03	0.99	0.71		0.91		0.99	0.79	0.69	0.65	0.53	0.96	1.00	0.98		0.97		0.76	0.85	0.72	0.75	0.79
Maize	0.74	0.76		0.90	0.73		0.48			0.62	0.81					0.64			0.62	0.55	0.70	0.82	
Potatoes	0.61			0.87	0.77			0.34					0.35	0.36					0.38			0.23	
Sugarbeet				0.19				0.14						0.12					0.09			0.23	
Sugar	1.70				2.40		0.98		1.11										4.81	0.88			1.11
Rice	1.29			0.87	0.77		1.00												0.82				
Cassava							0.14												1.72			2.22	
Sweet potatoes				1.15	1.09		0.14															6.04	
Tobacco				9.82	8.98									12.68					3.38			4.60	
Flax								10.32						6.44					5.41	5.57			
Hemp														6.44					1.03				
Cotton	10.25	9.82		9.59		8.04											9.29	8.32	5.07				
wine (hl)																			0.52				
Olive oil	7.76																		31.03				
Citrus fruit																			5.87	8.25	7.33		
Tea	13.25						6.07												5.80	7.00			
Rubber	61.44						30.06												8.40	8.71	5.41		
Beef[b]	8.96		8.37	6.78				10.75		9.75	7.68	9.05	9.24		8.01	2.74	7.08		7.79	10.20	10.31		
Pork[b]	10.06	10.08	8.53	6.41				7.62		6.96	7.82	7.60	8.07				7.91		0.55				
Mutton[b]	10.24	10.02	9.44	5.91		4.02		7.88		5.40	6.20	6.78				2.19	7.04		7.74				
Veal[b]											7.24						6.95		11.00				
Milk				1.24	1.00			0.67						0.73									
Greasy Wool[a]	13.90																						
Cocoon	16.09																						

Sources: U.K. (a) Paish (1913–1914, pp. 556–570) except rubber from Stillson (1971, Table 1); USA a) U.S. Bureau of the Census (1975, series K 504, 508, 516, 528, 534, 537, 540, 556, 560, 563, 585, 591, 594 and 605) (b) Strauss-Bean (1940, Tables 13, 15, 18, 19, 21, 22, 25, 27, 28, 30, 36, 43, 47, 48, and 54); Italy: ISTAT (1958, pp. 173–181); Indonesia: personal communication by P. Van der Eng; Belgium a) Blomme (1992a, b, Statistical Appendix, Table 26); Netherlands (a) Knibbe (1994, Tables I.2 and I.3); Austria: (b) Waizner (1928, Table I); Canada b) Historical Statistics (1983, series M 228–233). All other data from *Institute Internationale d'agriculture* (1913–1914, Tables 619–736).

[a] Greasy wool.

[b] Dressed weight.

Table A.5. Relative Prices, Averages.

	(a)	(b)	(c)	(d)	Van Zanden	Coeff.
Wheat		1	1	1	1	1
Rye	0.83	0.78	0.82	0.89	0.80	0.9
Barley	0.89	0.77	0.86	0.92	0.80	0.9
Maize	0.71	0.67	0.70	0.76		0.75
Potatoes	0.55	0.31	0.49	0.51	0.35	0.50
Sugarbeet	0.15	0.16	0.16	0.18		0.15
Sugar	1.55	2.27	1.86	2.15		2
Rice	0.98	0.82	0.95	1.00	0.84	1
Cassava	0.14		0.14	0.14		0.15
Sweet potatoes	0.79		0.79	0.79		0.5
Tobacco	10.49	1.97	7.08	7.32		10
Flax	8.38		7.60	8.20	7.00	8
Hemp	6.44	3.99	4.81	5.60		5
Cotton	9.22	5.49	8.29	8.70		9
Wine (hl)		1.03	1.03	1.34	1.30	1.3
Olive oil	7.76	5.07	6.41	7.17	4.60	7
Citrus fruit		0.52	0.52	0.67		0.7
Tea	9.66		9.66	9.66		6
Rubber	45.75	31.03	40.85	43.95		40
Beef[b]	7.15	9.29	7.85	8.31	6	9
Pork[b]	6.40	8.32	7.82	8.14	5.5	8
Mutton[b]	7.51	9.76	7.26	7.74		8
Veal[b]	9.43	12.26	8.50	10.19		9
Milk	0.91	0.55	0.84	0.87	0.50	1
Wool[a]	13.90	7.74	7.74	11.98	10	13
Cocoons	16.09	14.30	13.55	15.20		14

Source: See text.
[a] Greasy wool.
[b] Dressed weight.

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d'Agriculture. They provide twenty-three sets of prices for sixteen countries, which in Table A.4 are normalized to the price of wheat (rice in Indonesia).

Table A.5 sums up the data of the previous table in a compact form. The column "Van Zanden" shows the set of prices used by the author in his estimate of productivity growth in Europe (Van Zanden, 1988, Table 1). Columns a and b show averages for free-trade and protectionist countries respectively (Table A.4 (i) and (ii)). Column c is the average of all the sixteen countries, while column d takes into account, quite crudely, the effect of protection on wheat by increasing all prices by 30% in the protectionist countries.

Table A.6. Estimates of Gross Output and Value Added, in 1913 in Wheat Units.

	Gross Output	Value Added		Gross Output	Value Added
Argentina	22805	19689	Serbia	1745	1658
Australia	16518	13502	Bulgaria	3183	3024
Austria	19869	18372	Norway	1772	1684
Hungary	23878	22079	Romania	6265	5952
Belgium	5151	3265	Cyprus	297	282
Canada	15721	13573	China	183410	174240
Chile	2752	2615	Indochina	6896	6551
Denmark	7978	4825	Korea	2971	2822
Finland	2153	1790	Burma	7842	7450
France	44063	38775	Philippines	2583	2453
Germany	82962	75923	Thailand	3375	3207
Greece	1562	1437	Taiwan	1665	1582
India	92144	87863	Turkey	15320	14554
Indonesia	18212	18032	Algeria	6721	6385
Japan	16040	13834	Egypt	5919	5623
Italy	28123	26076	Madagascar	1622	1541
Netherlands	17169	9270	Morocco	1113	1057
Portugal	1724	1586	Sierra Leone	152	144
Russia	90877	86333	South Africa	3412	3241
Spain	12628	11875	Tunisia	2559	2431
Sweden	6604	6604	Zimbabwe	135	128
Switzerland	3468	3295	Fiji	230	219
U.K.	25506	17152	New Zealand	3757	3569
USA	151743	127031	Mexico	4785	4545
Uruguay	3885	3691	Cuba	5612	5331
Total	713535	604669	Total	273339	259672

Source: See text.

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The prices used to calculate the value of output ("coefficients") are, in most case, those of column d suitably rounded. There are exceptions, such as tea and beef. The former is inspired by the relative price in Indonesia, while the coefficient for beef is higher than the country averages because this latter is affected by very low prices in Argentina and because the total output includes veal, which cost more than beef.

(iv) Finally, the Value Added in wheat units for each country is computed by multiplying the gross output by the VA/GSP ratio in 1913 according to the national estimates.

APPENDIX B

THE COUNTRY SERIES: SOURCES AND METHODS

Argentina

The main source is Cortes-Conde (1997, quadro A.1), who provides yearly data from 1875 to 1935 on the GDP of crops and livestock (including fisheries). The two series are combined in an index of agricultural output by weighting with the livestock/crops shares in 1913 from Diaz Alejandro (1970, Table 19). The total VA series is extrapolated forward to 1939 with the estimates from the Banco Central de Argentina (Diaz Alejandro, 1970, Table 17) and backwards to 1870–1875 according to the rate of growth of the cattle stock from 1875 to 1882 (Mitchell, 1998b, Table c5). Livestock products accounted for more than 90% of output in 1875. The 1913 GDP at current prices is estimated by deflating the figure by Diaz-Alejandro with the index of agricultural prices from IEERAL (1986, Table 10). The gross output is computed by dividing the GDP by the VA/GSP series for Canada. The share of livestock for 1875–1935 is obtained as a by-product of the estimation of production. The share is assumed constant in 1870–1874, while the share in 1935–1938 is calculated by extrapolating the 1920–1935 downward trend.

Australia

The series for GDP are obtained by joining together the series by Butlin-Sinclair (1986, Table 1) and Haig (2001). The former provide figures at current prices for 1828–1860, the latter at constant prices for 1861–1938. The Butlin-Sinclair figures are converted into constant prices with the implicit GDP deflator from Butlin (1986, Table 8).[49] The two series are linked together by assuming that, from 1860 to 1861, prices fell by 1% as much as in the United Kingdom. The gross output is then computed multiplying Haig's data by the GDP/GSP ratio from Butlin (1962).[50] Finally, the estimates for 1913 are converted into current price using the price series from Butlin (1962, Table 267). The share of livestock products is taken from Butlin, as a sum of "dairying" and "pastoral."

Austria-Hungary

All the data for pre-1913 Austria-Hungary are taken from the recent estimates of a new set of national accounts by M. S. Schultze (2000). The series for "Austria" and

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"Hungary" (at 1913 boundaries) after the war are obtained as a weighted average of indices of VA of four successor states, Austria, Hungary, Yugoslavia and Czechoslovakia at their 1919 boundaries. The yearly data are taken from Kausel et al. (1965, p. 37) for Austria, Pryor et al. (1971, Table 3) for Czechoslovakia, Eckstein (1955, Tables 1 and 2) for Hungary and Vinsky (1961) for Yugoslavia.[51] The weights for Austria are taken from Waizner (1928, Table III): in 1911–1913 (post-1919) Austria accounted for 20.4% of (pre-1913) Austrian agricultural VA, Czechoslovakia for 47.5%, and the territories then transferred to Yugoslavia, Poland, Italy and Romania for 5.2, 19.5, 5.2, and 2.6% respectively. As no regional series for the last three countries are available, the index is calculated as a weighted average of the series for Austria (weight 0.281), Czechoslovakia (weight 0.647) and Yugoslavia (weight 0.071) only. There is no comparable source on regional output for (pre-1913) Hungary. However, (post-1919) Hungary accounted for 45.8% of the combined output of Yugoslavia and Hungary in 1935–1939 (Moore, 1945, Table 5) and for 47% of total agricultural land (arable and tree-crops) in 1925–1926 (Institute International d'Agriculture, 1925–26). The index for (pre-1913) Hungary is thus calculated as a weighted average of the indices for Hungary (weight 0.45) and Yugoslavia (weight 0.55).

All the estimates quoted so far data refer to Value Added. The gross output has to be calculated by multiplying the VA by the inverse of the VA/GSP ratio. According to Waizner (1928, Table III), the VA accounted for 97.5% of GSP in Austria in 1913, while Komlos (1983, Table D7), suggests a constant 93% ratio for Hungary for the whole period 1885–1913. Neither figure is really plausible. The figure for Austria seems too high, while Komlos' assumption of a constant ratio contrasts with the downward trend in all other European countries. It is thus assumed that the VA/GSP ratio fell from 0.95 in the 1850s to 0.90 in the 1950s. These are the Portuguese figures, and are quite close to the Italian ones, a country with a similar level of development.

Finally, the figures on the composition of gross output before 1913 have been kindly provided by M. Schultze. The shares of livestock products for the inter-war period are assumed to have remained constant at the 1904–1913 level.

Belgium

The main source is the very detailed reconstruction by Blomme (1992a, b). He provides a series for "agricultural output" (i.e. gross output, as explained on p. 22) and Value Added since 1877 (with a break in 1914–1918). The former are both at current (Tables 22 and 42) and at constant prices ("volume indices" of Tables 57 and 58), and are divided also by major categories of products (arable farming

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livestock and horticulture). In contrast, the data for Value Added are available only at current prices, and the series at constant prices is calculated by double deflating the gross output data with the indices of prices of output (Tables 46 and 47) and inputs (Tables 55 and 56). The 1880–1913 and 1919–1939 series are then linked together by taking the changes in gross output (a 32% fall from 1913 to 1919) and in the VA/GSP (an increase from 0.634 to 0.842 in the same years). The Blomme series are then extrapolated backwards to 1866 superimposing the yearly fluctuations of the old index of agricultural production by Gadisseur (1973, Table 5) to the revised estimates of the growth rate from 1846 to 1878 by Goosens (1992, Table 35).

Canada

Urquhart (1993) provides a series of agricultural output ("farm revenue," Table 1.9) and GNP of agriculture at current prices for the period 1870–1926 (Table 1.1), which are deflated with the implicit price index of agricultural output from McInnis (1986, Table 14.A.2).[52] The Value Added from 1926 to 1938 is estimated by extrapolating Urquhart's figures with an index computed with the data from Historical Statistics of Canada (deflating the GDP at current prices of Table F56–F58 with the index of wholesale price index of Table F49). The source does not report data for the gross output, which is estimated assuming that the ratio VA/GSP had been declining after 1926 at the same rate as before. The share of livestock in gross output is taken from McInnis (1986, Table 14.A.1) until 1926, and from Canada Handbook (Tables 21 and 22) thereafter.

Chile

All the data are from the reconstruction of Chilean national accounts of the working group in the Pontificia Universidad of Santiago (Braun et al., 2000). The share of livestock and the GSP are from personal communication by I. Briones.

Denmark

The agricultural GDP (from 1818) is taken from Hansen (1974, Table 4). The gross output is estimated by dividing by the Dutch VA/GSP ratio from Knibbe (1994 Erratum). The share of livestock on gross output at current prices is taken from Johansen (1985, Table 2.11).

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Finland

The source for all the data is the book by Hjerrpe (1989). The GDP of agriculture at current prices is from Table 4 and at constant prices ("index volume") from Table 6. The gross output is calculated assuming that the VA/GSP ratio moved as the Swedish one. The share of livestock is taken from the same source, Table 8.

France

All the data are from Toutain (1997). He reports a yearly index from 1815 onwards for the GSP (series V1), series at current prices for both the GDP (series V6) and the GSP (series V10) and an index of agricultural prices (series V5). The figures for inter-war years are reduced by 1.5%, the additional acreage gained by France with the acquisition of Alsace-Lorraine. The data for the share of livestock are from Toutain (1961, Tables 76, 76 bis and 77).

Germany

The main source is Hoffmann (1965), who provides series of gross output (ii Table 58) and VA (ii Table 64) both at current and constant (1913) prices. The series need two adjustments. First, the data for 1920–1924 are missing, and thus they are estimated by extrapolating the 1925 production backwards with a production index. The latter is obtained as a weighted average of indices of the gross output of crops, meat and "other livestock products" (i.e. milk), using the shares of GSP in 1925–1927 as weights. The index for crops is computed by multiplying the gross output of wheat, rye, and potatoes (divided by half) from Mitchell (1998c, Table C2) by the price ratios in Italy in the same years (ISTA, 1958), normalized to wheat. The indices for meat and "other livestock products" are calculated as the number of animals in 1920–1924 (Mitchell, 1998c, Table C5) times their average productivity in 1925–1927 (production from Hoffmann, 1965, ii Table 55, stock from Mitchell, 1998c, Table C5). Second, the Hoffman data are at current borders, and thus they omit the production of the areas lost to Poland after World War I – some 15% of its pre-war acreage in arable and tree-crops (Institute Internationale d'Agriculture, 1909 à 1921, Table 4). The Hoffman figures for 1925–1938 are thus increased by the same amount. It is thus implicitly assumed that the production of the lost areas moved in parallel to that of the rest of the country.

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Greece

Greek agricultural production has recently been re-estimated by Petmezas (1999 and personal communication). He provides a series of the gross output of agriculture from 1848 and on the share of livestock (Table 7). The estimate of GDP is obtained by assuming the same trend in the VA/GSP ratio as in Portugal. Greece changed its boundaries many times in the period under consideration: the agricultural production is adjusted to 1913 boundaries, according to the total acreage of the country from Petmezas (1999, Table 7).

India

The series is obtained by linking the estimates by Heston (1983, Table 4.3.A) for the period to 1899 and by Sivasubramonian (2000, Table 6.10) for the years 1900–1938. Some missing years in the 1870s have been interpolated according to the population (Heston, 1983, Table 4.1). Sivasubramoninan data refer to the Value Added: the gross output is computed adding the figures for "repairs and maintenance" and "marketing costs" (which includes expenditure in fertilizers) from Table 3.7. Both Heston and Sivasubramonian report the production of crops and livestock separately, so it is possible to calculate the relative share of gross output. The implicit level of the two series, when overlapping, differs quite substantially and they cannot be spliced. Thus, for production data, the estimates by Sivasubramonian have been extrapolated backwards to 1870 with the trend from Heston.

Indonesia

Van der Eng (1996, Table A.4) provides figures of total GDP at constant (1960) prices, also divided by major items ("food crops", "animal husbandry", "cash crops", "estate crops") for the period 1880–1939. The author has kindly communicated his estimate of GDP in 1913 at current prices, which is raised by 5% to take some missing items such as fruit, vegetables and poultry into account (Van der Eng, 1996, p. 361). Gross output in 1913 is assumed to have been 1% higher than Value Added, as the expenditures outside the agricultural sector were minimal (Van der Eng, 1996, pp. 256–257). Finally, the two series have been extrapolated backwards to 1870 with the population growth.[53]

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Italy

The standard reconstruction of Italy's national accounts by sector of origin at constant (1938) prices is Ercolani (1969, Table 13.1.1). He builds on the previous work by the Italian Central Statistical Bureau (ISTA, 1957), which estimated GDP and GSP at current and constant prices. The series for the period to 1913 has long been controversial, and Federico (2003) provides an alternative estimate of gross output at current borders. It is possible to calculate a series of gross output and VA at 1911 boundaries by interpolating and extrapolating the benchmark estimates for 1891 and 1911 of the VA/GSP ratios (Federico, 2000) and of the ratio current/1951 borders (ISTA, 1957).

The VA series after 1913 are obtained from Ercolani, by deducting forestry and fishing according to the proportion of the original ISTAT (1957, Tables 8 and 9) estimates. The gross output is calculated dividing this Ercolani series by the VA/GSP ratio from ISTAT. The original ISTAT publication is also the source of the data on the monetary value of GSP and of VA in 1913, and of the yearly figures of the share of livestock products in gross output.[54]

Japan

All the data are taken from Okhawa-Shinohara (1979, Tables A16 and A17). It reproduces the estimates of the LTES (Long Term Economic statistics) project. The missing data for 1870–1873 are computed by extrapolating backwards the 1874 production according to population growth (Maddison, 1995, Table A-3a).

Netherlands

All series for the Netherlands (GSP, VA and share of livestock on output) are a combination of two estimates by Van Zanden (2000) for the period 1807–1913 and Knibbe (1994, Erratum) for the period 1914–1938.

Portugal

The source of the data is an article by Lains – Silveira Sousa (1998), supplemented by personal communication from the authors on the period 1913–1939. They estimate a Laspeyres index of agricultural GSP with the nine most important products

(Table A.2). The corresponding series of GDP is obtained by assuming that the VA/GSP ratio fell linearly from 0.95 in 1848 to 0.90 in 1960 (1998 fn. 40). The final step is the calculation of the value of gross output and GDP in 1913 by extrapolating the figures for 1900–1909 (Table 4) and by adding 13.4%, the share of omitted products in the same years (p. 956). The share of livestock products is calculated interpolating Lains' estimates for 1861–1870, 1900–1909 and 1935–1936.

Russia

No single GDP or GSP series is available for the whole period. Thus, a new series has to be estimated, with different procedures for Russia (to 1913) and the Soviet Union. The literature on agricultural production is quite abundant, but sometimes confusing, if not positively misleading.

The standard work on Imperial Russian national accounts is the book by Gregory (1982). Unfortunately, he does not report data on Value Added by sector, even if Table 3.6 proves that he has estimated them, at least for some years. Thus, following Gregory's suggestions (1982, p. 73), agricultural GSP is computed as a weighted average of three series, the index of the production of food crops by Gregory (1982, Table D.1, series G2), the series of the production of technical crops by Goldsmith (1961, Table 3) and the value of livestock herds by Gregory (1982, Table H.1 B).[55] Then, the GSP figures are extrapolated backward to 1870 separately for crops, industrial crops and livestock – respectively, with the index of the production of "major grain and potatoes" and of "technical crops" from Goldsmith (1960, Table 1) and with the number of animals from Mitchell (1998c, Table C5).[56] The weights are calculated from the data on the value of GSP in 1913 by type (food crops, industrial crops and livestock) from Falkus (1968).[57]

As stated in the text, the estimation of trends in production during the Soviet period is a very difficult and sensitive issue. Here, we use the most recent work by Allen (2002 and personal communication), who provides a series of gross output from 1924 to 1939 at interwar borders linked to 1913.[58] The Allen series is extrapolated back to 1920 with the official figures, the only available data for 1920–1923.[59] The gross output series are then converted into VA by assuming that the VA/GSP ratio has declined from 0.97 to 0.95 in 1913 and in 1920, to 0.94 in 1932 and to 0.90 to 1939.

Finally, the share of livestock from 1870 to 1913 is obtained by extrapolating the 1913 shares backwards to 1870 with the Gregory/Goldsmith index and forward to 1938 with an index of livestock production obtained splicing together the official data for 1920–1927 and the figures for 1928–1938 by Wheatcroft-Davies (1994b).

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Spain

L. Prados has been working on the reconstruction of national accounts for many years. He has provided his most recent estimates at constant and current prices for GDP and gross output (Prados, 2004). The share of livestock is estimated interpolating the shares from Prados (1993, Table 1).

Sweden

The figures are taken from Schon (1995) – the gross output from Table J6 and the value added from Table J1. The share of livestock until 1931 is from Lindahl et al. (1937, Table 2), and thereafter it is assumed as constant.

Switzerland

The data are taken from Ritzmann-Blickenstorfer and David (undated) and personal communication. The GDP is the sum of agriculture and horticulture. The gross output is computed assuming that the VA/GSP ratio fell as much as in France.

The United Kingdom

The standard reconstruction of British historical national accounts, by Feinstein (1972) provides an index number (1913 = 100) of GDP for agriculture, forestry and fishing at constant prices at current boundaries (1972, Table 8.1). For the years 1855–1913, Feinstein quotes as his source *a mimeo* by Lewis, who later published a series of GDP at 1907 prices (Lewis, 1979, Table A.3).[60] Quite strangely, the two series are perfectly identical from 1855 to 1912, and then diverge sharply in the last year: according to Lewis, agricultural production fell by 5% from 1912 to 1913, while, according to Feinstein, it remained constant. This latter trend seems more plausible – as the production of cereals and potatoes increased by 10–20%, that of milk remained stable and only the production of meat fell, albeit by a mere 3.6%. Thus, the index will use Feinstein's figures. After 1920, Feinstein uses "official statistics," and the series excludes Eire, which became independent in 1921. In 1920, Southern Ireland accounted for about 23% of all-U.K. agricultural output.[61] An index of the United Kingdom at 1913 boundaries is obtained as a weighted average of Feinstein's data for Great Britain (at 1921 boundaries) and Drescher's (1955) ones for Eire. The latter series stops in 1930: the figures for 1931–1938

are estimated by extrapolating the 1930 level with indices of the physical output of crops (an average of wheat, barley, oats and potatoes) and livestock (butter), assuming that livestock accounted for 78% of total output.[62]

The GSP at constant prices is then obtained by dividing the GDP series by the VA/GSP ratio from Ojala (1952, pp. 208–209). The figures for 1913 are calculated adjusting the Ojala (1952) estimate of gross output and GDP for 1911–1913. The share of livestock is also taken (with interpolation) from Ojala. The alternative series by Turner (2000, Table 38.8), which stops in 1914, yields a somewhat lower share, but the trend is very similar.

United States

The official data of national accounts, published in *Historical Statistics of the United States*, start in 1910 (U.S. Bureau of the Census, 1975). The gross output for crops and livestock is the sum of cash receipts (series K266 and K267) and home consumption (K269), net of the intra-sectoral expenditures for feed (K273), livestock (K274) and seed (K275).[63] The total revenues (and hence the implicit GSP) thus differ from the "realized gross farm income" (K264), which includes subsidies after 1931 (K268) and rent of farm dwellings (K270).[64] Then, the series of GDP is computed by deducting from the gross output the expenditures for fertilizers (K276), repairs (K277) and miscellaneous items (K280). Both gross output and GDP are transformed into constant (1913) prices by double deflating the indices of prices received (separate for crops and livestock K345-K346) and paid by farmers (K348).

Both series are then extrapolated backwards to 1869. Gross output is extrapolated according to the Fisher index of total output by Strauss-Bean (1940, Table 61). The GDP is computed by multiplying the result by a series of the VA/GSP ratio obtained interpolating the benchmark figures from Towne-Rasmussen (1960) for 1860, 1880, 1890 and 1900 and from U.S. Bureau of the Census (1975) for 1910. The share of livestock products from 1869 to 1909 is also obtained with linear interpolation, using the same sources.

Uruguay

All the data are taken from Bértola (1998). The GSP is a weighted average of the two indices of "*volumen fisico*" for crops and livestock, using the current-price value of gross output from Tables 3 and 4 as weights. The VA/GSP ratio is

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assumed, as for Argentina, equal to that of Canada. The data for 1937 and 1938 are interpolated with the Value Added for the whole economy.

APPENDIX C

World Population

The population data for the twenty-five countries in the sample (at current boundaries) are taken from Mitchell (1998a, b and c), McEvedy-Jones (1978), United Nations (1952) for 1920 and 1938, Institute Internationale d'agriculture 1939–1940 for 1937, Maddison (1991, Tables B2 and B3), Maddison (1995, Table A.3) and some additional country sources.[65] When necessary, figures have been obtained by linear interpolation.

There are several estimates of the world population at different dates, which are reported for the reader's ease in Table C.1. As one can see, they broadly agree, even if many figures are pure guesstimates. The population data (Table C.2) are thus taken from Maddison for 1870 and 1913, the United Nations for 1920 and the Institute Internationale d'Agriculture for 1938 (the 1937 figure is increased by 1.5% to take account of the natural increase of population).

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Table C.1. Estimates of World Population (Millions).

	1850		1870	1875	1900			1913	1920	
	Biraben	Mc Evedy	Maddison	Mc Evedy	Biraben	Clark	Mc Evedy	Maddison	Clark	UN
Europe	288	279		324	422	411	415		487	485
North America	25	34		57	90	81	95		117	117
South Central America	34	25	40	34	75	63	50	81	91	92
Africa	102	81	91	93	138	122	110	125	140	141
Asia	790	781	765	817	903	985	946	978	1.072	971
Oceania	2	1		2	6	6	7		9	9
Europe and Western Offshoots			375					608		
Total: World	1.241	1.201	1.270	1.326	1.634	1.668	1.622	1.791	1.916	1.813

	1925	1930		1937	1940		1950			
	Mc Evedy	UN	Clark	IIA	UN	Clark	Biraben	UN	Mc Evedy	Maddison
Europe	513	531	532	557	551	573	575	547	576	
North America	140	135	135	159	146	146	166	172	191	
South Central America	81	109	109	104	131	131	164	167	134	166
Africa	140	155	157	168	172	176	219	221	205	228
Asia	1.107	1.047	1.141	1.138	1.202	1.233	1.393	1.402	1.389	1.382
Oceania	10	10	10	11	11	11	13	13	14	
Europe and Western Offshoots										749
Total: World	1.990	1.987	2.084	2.137	2.214	2.270	2.530	2.522	2.509	2.525

Sources: Biraben (1979), McEvedy-Jones (1978), Clark (1977), United Nations 1920–1940 (1952, Table 1A) (average of maximum and minimum estimates), 1950 UN demographic yearbook 1999; Maddison (2001, Table A-c).

Table C.2. Population Estimates (Millions).

	Sample	World	%
1870	643	1270	50.6
1913	985	1791	55.0
1920	986	1813	54.4
1930	1111	1987	55.9
1938	1202	2169	55.4

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STATISTICAL APPENDIX

Table D.1. Series (1913 = 100).

	GDP	Output	Output Livestock	Crops	GDP, 1913 = 100 Europe	Northwestern Europe	Southern Europe	Eastern Europe	Asia	South America	Regions of Western Settlement
1870	53.0	51.5	44.8	55.3	58.4	70.3	62.9	41.7	64.9	13.4	34.1
1871	52.2	50.9	44.9	54.7	56.0	67.9	62.7	38.4	65.8	14.2	34.8
1872	53.6	52.1	46.3	56.0	57.6	70.3	66.0	38.3	66.8	15.0	36.3
1873	53.2	51.8	46.4	55.4	56.5	66.5	67.2	39.3	67.0	16.1	36.9
1874	56.8	55.1	48.6	58.8	62.9	77.5	67.0	43.3	67.1	15.6	37.4
1875	56.6	55.1	50.4	58.9	61.8	77.8	67.1	39.7	67.5	15.4	38.8
1876	55.6	54.2	50.2	57.5	58.4	70.6	66.5	39.8	67.4	16.3	41.8
1877	58.4	56.7	51.4	60.1	61.6	71.6	70.4	45.2	67.7	16.6	45.6
1878	59.7	57.9	52.6	61.0	63.0	73.6	71.4	46.3	67.4	16.9	47.6
1879	57.6	56.0	51.1	59.1	57.9	65.5	68.4	43.8	68.5	18.1	49.3
1880	59.8	58.2	53.4	61.3	60.4	70.3	72.2	42.9	68.7	18.8	52.3
1881	60.2	58.6	53.0	61.9	62.4	71.2	72.4	47.0	69.1	19.2	49.5
1882	62.9	61.1	54.7	64.6	64.1	73.0	73.1	49.1	73.0	22.3	53.2
1883	63.7	62.1	57.1	65.2	65.1	75.5	73.6	48.6	72.9	23.8	54.4
1884	64.9	63.1	58.5	66.1	65.9	76.2	72.6	50.2	73.0	24.8	57.0
1885	65.4	63.6	58.7	66.9	65.2	77.0	72.1	47.7	77.5	26.0	57.1
1886	65.1	63.4	59.4	66.5	65.0	76.7	74.2	46.6	75.5	26.8	57.7
1887	67.5	65.7	60.0	69.1	67.8	76.5	74.6	54.0	80.2	28.0	58.0
1888	68.6	66.7	61.8	70.0	69.0	77.4	75.6	55.6	80.8	30.0	59.1
1889	66.7	65.1	62.6	68.0	64.7	75.8	72.4	47.8	77.5	27.1	63.1
1890	69.8	68.0	63.5	71.4	68.1	79.0	73.4	52.5	84.3	28.5	62.7
1891	66.9	65.6	64.0	68.3	65.2	76.3	76.0	46.7	74.0	32.5	65.4
1892	70.3	68.9	64.4	72.0	69.6	79.8	79.3	52.8	82.2	36.5	63.0

1893	72.9	71.2	65.9	74.2	74.5	82.9	77.7	62.8	83.9	39.0	61.9
1894	74.7	72.9	68.1	75.9	75.7	83.9	79.1	64.0	86.4	45.9	64.2
1895	75.5	73.9	70.1	76.3	76.2	83.6	79.7	65.7	83.5	51.5	68.2
1896	75.6	74.2	72.9	75.4	77.8	86.8	76.5	67.5	74.6	49.1	72.3
1897	77.7	76.0	73.5	78.5	72.9	81.9	79.6	58.9	91.2	43.7	77.3
1898	82.5	80.7	76.4	83.3	79.3	87.0	82.2	68.6	94.2	44.0	80.3
1899	81.1	79.6	78.2	81.3	79.8	90.1	80.4	67.0	84.3	52.8	81.5
1900	83.3	81.8	79.0	83.7	82.4	94.2	82.3	68.2	87.8	48.6	81.8
1901	81.8	80.8	80.3	82.6	79.7	89.7	88.1	63.6	86.9	56.3	82.3
1902	84.7	83.6	80.6	85.6	84.4	88.8	87.1	77.8	91.9	53.6	80.2
1903	86.5	85.0	81.1	86.8	84.5	89.9	86.8	76.9	94.6	67.7	84.7
1904	87.4	86.1	83.3	87.4	85.8	94.2	87.9	74.6	93.9	75.9	85.9
1905	87.1	86.2	85.2	87.3	85.9	93.3	88.6	75.7	89.9	73.9	87.9
1906	89.7	88.7	87.6	90.4	86.3	91.6	92.1	77.1	96.2	74.3	91.9
1907	88.9	88.4	87.6	89.6	89.2	95.6	93.8	79.4	90.1	70.2	87.6
1908	91.1	91.1	90.0	91.8	90.9	98.0	95.4	80.2	93.4	88.5	90.0
1909	94.3	94.3	91.7	96.0	92.8	97.7	97.3	84.7	105.3	85.2	89.4
1910	93.5	93.7	93.0	94.9	90.7	92.3	90.7	88.8	104.6	80.2	90.8
1911	94.1	94.4	95.0	95.9	89.9	95.5	97.0	79.9	103.6	69.8	95.3
1912	98.1	98.6	96.8	99.0	95.7	97.8	92.8	94.4	103.2	101.9	99.1
1913	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0
1914							92.4		105.2	90.1	95.6
1915							88.9		107.7	106.0	105.8
1916							94.7		112.4	93.5	104.9
1917							94.2		110.7	66.9	97.0
1918							95.4		94.5	108.5	103.1
1919							92.9		112.8	105.5	105.5
1920	85.3	87.8	88.2	88.6	75.5	80.4	97.9	59.3	98.9	111.3	94.3
1921	88.7	92.1	93.5	92.8	75.3	82.3	96.1	57.1	108.2	111.6	100.3
1922	93.0	96.9	97.4	97.6	81.4	86.4	101.8	66.0	111.9	112.7	101.4
1923	94.9	98.5	100.8	98.7	84.9	86.4	105.9	73.4	106.7	120.1	105.6

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Table D.1. (*Continued*)

	GDP	Output	Output Livestock	Crops	GDP, 1913 = 100 Europe	Northwestern Europe	Southern Europe	Eastern Europe	Asia	South America	Regions of Western Settlement
1924	98.6	102.5	105.2	101.8	87.0	90.1	102.2	76.4	109.9	144.1	112.5
1925	102.7	106.4	108.4	106.4	95.7	93.0	111.5	91.8	109.6	125.1	111.0
1926	103.3	107.1	112.2	106.4	94.6	88.8	108.0	95.7	110.1	146.7	114.7
1927	107.8	110.8	114.9	109.8	100.6	98.2	108.5	99.8	110.7	153.1	119.1
1928	108.8	113.1	117.3	111.6	103.3	101.6	107.0	103.5	113.0	163.2	115.5
1929	112.4	116.9	121.5	115.9	108.4	104.9	117.2	108.8	115.1	162.6	117.5
1930	109.2	113.4	119.6	112.6	104.1	102.8	104.2	105.7	117.3	141.0	112.2
1931	110.8	114.9	120.3	113.4	104.8	107.5	109.5	99.3	114.3	159.7	119.5
1932	109.9	115.1	117.7	114.0	102.6	105.6	120.2	90.9	115.8	155.5	118.8
1933	112.8	116.9	117.9	115.7	106.5	114.3	109.5	95.5	118.0	148.1	121.0
1934	111.1	116.2	117.7	114.5	106.5	114.4	111.0	94.8	113.3	167.1	117.0
1935	109.8	115.0	117.1	113.2	107.3	110.4	115.1	100.0	114.2	179.2	110.4
1936	110.6	114.8	118.8	113.4	102.7	112.5	94.2	94.5	122.4	169.7	116.2
1937	114.9	121.0	121.2	118.8	111.6	108.1	107.2	117.9	121.1	191.3	114.1
1938	116.6	122.9	129.3	120.4	112.6	116.0	106.4	111.2	114.3	178.4	123.3

Sources: See text and Appendix B.

North-Western Europe the United Kingdom, France, Sweden, Denmark, Belgium, the Netherlands, Germany, Finland, Switzerland; *Southern Europe* Italy, Greece, Spain, Portugal; *Eastern Europe* Austria, Hungary and Russia; *Asia* Japan, India, Indonesia; *Western Settlement* Canada, Australia and USA; *South America*: Argentina, Uruguay and Chile.

Table D.2. Rates of Change in GDP, by Country.

	1870–1938	1870–1913	1913–1938	Column Difference
Argentina	4.41	6.07	2.89	***
Australia	2.83	3.36	2.31	***
Austria	1.09	1.44	1.52	*
Hungary	1.46	2.26	0.07	***
Belgium	0.62	0.76	0.02	***
Canada	2.00	2.86	−1.06	***
Chile	1.86	1.56	1.88	a
Denmark	1.87	1.62	3.24	*
Finland	1.26	1.56	1.89	a
France	0.58	0.62	0.90	a
Germany	0.91	1.56	0.02	***
Greece	1.53	2.12	3.56	***
India	0.73	0.96	0.31	***
Indonesia	1.97	1.79	1.92	a
Italy	0.86	1.14	0.58	***
Japan	1.60	1.73	0.75	**
Netherlands	1.31	0.65	2.47	***
Portugal	0.87	0.54	3.17	***
Russia	1.79	2.24	0.02	***
Spain	0.69	0.46	−0.06	***
Sweden	1.03	0.96	1.49	a
Switzerland	0.72	0.70	0.83	a
U.K.	0.58	0.00	1.52	**
USA	1.12	1.70	0.56	**
Uruguay	3.16	2.91	5.25	***

Note: Column Difference: test of the difference between the growth rates in 1870–1913 and 1913–1938.
[a] Not significant.
* Significantly different from zero at 10%.
** Significantly different from zero at 5%.
*** Significantly different from zero at 1%.

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