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LAND, LABOR AND THE WAGE-RENTAL
RATIO: FACTOR PRICE CONVERGENCE
IN THE LATE NINETEENTH CENTURY

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ABSTRACT

This paper augments the new historical literature on factor price convergence. The focus is on the late nineteenth century, when economic convergence among the current OECD countries was dramatic; and the focus is on the convergence between Old World and New, by far the biggest participants in the global convergence during the period; and the focus is on land and labor, the two most important factors of production in the nineteenth century. Wage-rental ratios boomed in the Old World and collapsed in the New, moving the resource-rich and labor scarce New World closer to the resource-scarce and labor-abundant Old World. The paper uses both computable general equilibrium models and econometrics to identify the forces causing the convergence. These include: commodity price convergence and the Heckscher-Ohlin Theorem of factor price equalization; migration, capital-deepening and frontier disappearance, factors stressed by Malthus, Ricardo, Wicksell and Viner; and factor-saving biases associated with induced-innovational theory, an endogenous response to relative factor scarcities.

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I. FACTOR PRICE CONVERGENCE IN THE LATE 19th CENTURY

Today's journalists fill the media with references to the global economic village, politicians talk in terms of world competitiveness, and Americans fear the loss of productivity and living-standard leadership. We often forget that this process of global economic integration and factor-price convergence has a very long history. While the literature on post-World War II economic convergence has reached enormous proportions, it was initiated, after all, by economic historians like Alexander Gerschenkron (1952) and Moses Abramovitz (1986). Under the leadership of William Baumol (Baumol et al., 1989), Robert Barro (1991; Barro and Sala-i-Martin, 1991) and many others, an empirically-based "new growth theory" has emerged in which human capital accumulation and endogenous technical progress play a richer role, but few of these economists pay serious attention to history. Furthermore, few of these economists pay much attention to the role which international commodity, labor and capital market integration has played in the process. In contrast, economic historians of the late 19th century pay considerable attention to trade, capital flows and migration, but pay little attention to their impact on convergence. This paper tries to bridge this gap.

When measured by GNP per capita or labor productivity per worker-hour, currently industrialized nations have converged on one another, at least since 1870 (Maddison, 1982; Abramovitz, 1986; Baumol et al., 1989; DeLong, 1988). However, the convergence did not take place without interruption (Williamson, 1992): dramatic convergence took place from 1870 to 1913 as international trade boomed, capital flows became enormous, and international migrations rose to levels large enough to be called "mass"; the long run convergence ceased

during and between the World Wars while world commodity trade and capital markets collapsed and international migrations slowed to a trickle in the face of quotas and a Great Depression; and the convergence resumed in the post-World War II period while international trade and capital flows gradually regained pre-World War I levels of integration, and "guest worker" and illegal migrations rose to significant levels. Nor was the convergence uniform across countries: unusual divergent examples included Argentina, whose decline after World War I from a rich-country status has fueled so much debate (Taylor, 1992).

The central question underlying this convergence experience is: What role did international migrations, capital flows and commodity trade play? True, all of the currently industrialized countries underwent different experience with human capital accumulation and technical progress, but most shared something in common -- the integration of factor and commodity markets. To understand the contribution of factor and commodity-market integration to the convergence process, we need far better evidence than simply GNP per capita and labor productivity per worker-hour. In addition, we need evidence on the wages of common labor, the rents on land, the returns to capital, and the premia on skills. That is, we need evidence to better document experience with factor-price convergence.

This paper augments the new historical literature on factor-price convergence (e.g., Williamson, 1992; O'Rourke and Williamson, 1992; DeLong and Williamson, ongoing). The focus is on the late 19th century, when economic convergence was dramatic; and the focus is on convergence between Old World and New, by far the biggest participants in the global convergence during the period; and the focus is on land and labor, the two most important factors of

production in the 19th century. Section II establishes the facts: wage-rental ratios boomed in the Old World and collapsed in the New, moving the resource-rich and labor-scarce New World closer to the resource-scarce and labor-abundant Old World. Section III confronts theory: What did Ricardo, Malthus and the frontier-staple histories have to say about the contribution of labor and capital transfers to wage-rental convergence? What did Heckscher and Ohlin have to say about the contribution of commodity-price equalization to the wage-rental convergence? Section IV surveys what contemporaries and historians thought about wage-rental convergence; it turns out that they had very little to say about convergence; indeed, they rarely had much to say about the wage-rental trends in their own country; but they usually had a great deal to say about land rents and prices by themselves. The remainder of the paper brings evidence to bear on theory: Section V attacks the problem with applied computable general equilibrium models and Section VI attacks it with econometrics. We conclude with an assessment and a research agenda.

II. THE WAGE-RENTAL RATIO CONVERGENCE FACTS

We have constructed a late 19th century panel data-set documenting wage-rental convergence among eleven countries: four New World countries plotted in Figure 1 -- Argentina (1883-1913), Australia (1872-1913), Canada (1901-1911) and the United States (1870-1915); four "free trade" Old World countries plotted in Figure 2 -- Denmark (1870-1913), Great Britain (1870-1915), Ireland (1870-1913) and Sweden (1870-1914); and three "protectionist" Old World countries plotted in Figure 3 -- France (1870-1915), Germany (1870-1915) and Spain (1870-1910).

We all know that farm land was abundant and cheap in the New World while scarce and expensive in the Old World. And we all know that labor was scarce and expensive in the New World while abundant and cheap in the Old World. Thus, we know that the wage-rental ratio was high in the New World and low in the Old. What we don't know is how big the gap was between the two at any point in time and how the gap evolved over time. The latter is resolved by the evidence in Figures 1-3. The former is unlikely ever to be resolved. While we can say something about wages for comparable work and comparable workers across countries (Williamson, 1992), we cannot say much about rent on comparable land since the latter varied so much in quality (a point of which Heckscher was well aware: Flam and Flanders, 1991, p. 48).

As Appendix 1 points out, we also have no choice but to use land values as a proxy for land rents for the late 19th century. While we are hardly the first to do so, the underlying assumptions linking the two should be made explicit. If land is an economic asset with infinite life, and if the land markets of that time simply projected current rents into the future, and if global financial markets were well enough integrated so that interest rates were pretty much the same everywhere across our eleven countries, then land values should serve as an effective proxy for land rents. However, there are reasons to suspect that these assumptions may not hold for the late 19th century. First, Avner Offer (1991) has recently argued that land was a "positional" asset in Britain, offering social status independent of economic value. If so, land values would have been higher than that based simply on rents. More important to the issue of factor-price convergence, Offer asserts that the positional value of British farm land probably declined in the late 19th century. If so, the fall in British land values would have been steeper

than the fall in land rents, in which case the rise in Britain's wage-rental ratio in Figure 2 is exaggerated. There is no evidence available to test Offer's plausible assertion, and, more importantly, we do not know whether positional value had greater or lesser influence in Britain than elsewhere. Second, naive projections of current rents into the future were unlikely to have characterized land markets in the late 19th century, but we have no evidence documenting the impact of speculative behavior on relative trends in wage-rental ratios. Third, while global financial markets linking northwest Europe to the New World were well integrated by the 1890s (Zevin, 1992), they may have been less so vis a vis the periphery (like Spain). Furthermore, global financial markets became better integrated as the late 19th century progressed, lowering interest rates among New World capital-importers relative to Old World capital-exporters. This implies that the wage-rental ratio convergence is exaggerated by our use of land values.

Our assumptions therefore serve to overstate the case for wage-rental ratio convergence, but we have no way of knowing how much. Our intuition is that the spectacular late 19th century wage-rental ratio convergence documented in Figures 1-3 would persist if properly measured by land rents.

Finally, a word about the Old World labels on Figures 2 and 3 -- "free trade" and "protectionist". The impact of the invasion of New World grains on Old World wage-rental ratios must have been muted where tariffs were raised in defense. As Charles Kindleberger (1951) pointed out long ago, the response was especially strong on the continent. But comparative measures of late 19th century protection are hard to construct. Ideally, we'd like effective rates of protection -- especially to distinguish their impact on grain producers and feedgrain-using livestock producers, but these are only available for a few

years and for a few countries. Alternatively, tariff rates disaggregated by sector would be helpful, but even the classic study by Liepmann (1938) suffers serious flaws (Tracy, 1982, p. 25) and, in any case, excludes six of our eleven countries. We have no choice, therefore, but to fall back on the crude measures of protection offered by Paul Bairoch (1989). Based on his evidence for 1913, reproduced in Table 1, the "protectionist" label applied to France, Germany and Spain, and the "free trade" label applied to Britain, Denmark and Ireland. Sweden lay somewhere in between, but since protectionist policy was implemented there relatively late in the period, we throw Sweden into the "free trade" group.

Relative factor-price convergence certainly characterized these four decades (Figures 1-3, Table 2). In the New World, the wage-rental ratio plunged. By 1913, the Australian ratio had fallen to one-quarter of its 1870 level, the Argentine ratio had fallen to one-fifth of its mid-1880 level, and the USA ratio had fallen to less than half of its 1870 level. In the Old World, the wage-rental ratio surged. According to the trend values in Table 2, the British ratio in 1910 had increased by a factor of 2.7 over its 1870 level, while the Irish ratio had increased even more, by a factor of 5.5. The Swedish and Danish ratios had both increased by a factor of 2.3. The surge was less pronounced in the "protectionist" than in the "free trade" group. The ratio had increased by a factor of 1.8 in France, 1.4 in Germany, and not at all in Spain. The last two lines of Table 2 summarize wage-rental trends in the New World relative to the Old 1870-1910. They must, however, be treated with caution: they are both based on indices 1900=100, but we are not sure that the underlying wage-rental ratios refer to quality-comparable units of land in the denominator. Subject to that word of caution, one index drops by a

factor of ten, from about 6 to about 0.6; and the other drops by a factor of four, from about 2.5 to about 0.6.

What explains this impressive relative factor-price convergence?

III. THEORY: FROM MALTHUS, MILL AND RICARDO TO HECKSCHER AND OHLIN

As Peter Lindert (1988, pp. 1-26) has eloquently reminded us, classical theories of pre-industrial performance argued that population growth would cause the relative price of land to rise as long as land scarcity did not choke off that growth. Certainly Malthus saw it that way: demographic events pushed up man-land ratios, lowered real wages, raised land rents, and caused the wage-rental ratio to fall to a new long run equilibrium where zero population growth was reattained. Ricardo's theory of rent told a similar, but more explicit, story.

This theoretical tradition of European pre-industrial pessimism was carried into the late 19th century by the writings of John Stuart Mill, Alfred Marshall, and, certainly, Henry George. It has also influenced late 20th century mathematical models of growth (Nichols, 1970), debates over sustainable growth provoked in the 1970s by the Club of Rome, and concern about the deteriorating natural resource environment in the Third World. Indeed, it is implied by Sir Arthur Lewis' (1954) famous paper on economic development with unlimited labor supplies, and Latin American scholars have used it to explain the late 19th century fall in wage-rental ratios there.

Carlos Diaz-Alejandro (1970) wrote that the labor supply in Argentina was highly elastic (p. 23): he thought that the labor supply before 1930 was "perfectly elastic at the going wage rate (plus some differential) in the

industrial centers of Italy and Spain, the main sources of emigration to Argentina" (pp. 21-22), and, as a result, elastic labor supplies have crept in to the language of Latin American economic history (e.g., Reynolds, 1985, p. 87). Given a long-run boom in the relative price of export staples, elastic immigrant-augmented labor supplies combined with less elastic land supplies in the Pampas is certainly consistent with falling wage-rental ratios in Argentina (along lines suggested by Harley, 1986). Nathaniel Leff believes the same was true of Brazil and that elastic labor supplies accounted for falling wage-rental ratios in the Sao Paulo and Santos area from the 1880s onwards: "The similarities between Brazil's historical experience in the nineteenth century and W. A. Lewis' celebrated model ... are evident" (Leff, 1992, p. 6).

The Argentine Pampas offer just one canonical example of the settler New World economy. Another is Australia with its outback, a New World economy for which Sinclair -- after Noel Butlin (1964) -- sketches a Mill-Ricardo model based explicitly on relative resource abundance and international factor transfer between, in Ragnar Nurkse's (1954) words, "core" and "periphery". This Mill-Ricardo staple theory views late 19th century economic development as a disequilibrium shock followed by a convergence response back towards equilibrium:

the discovery of productive land in the new region has the effect of upsetting an existing equilibrium in the supply of factors of production. The new land has a higher productivity than that in the older country but, at the point of discovery, other factors of production are not available to exploit it ... This generates a flow of capital and labour until their marginal productivity in both countries is the same. The process ... may thus be regarded as the correction of a disequilibrium in world markets (Sinclair, 1976, p. 5).

This language sounds very much like John Stuart Mill, who, in 1848, anticipates the Old versus New World factor-price convergence debate by stressing the contribution of factor migration while, as we shall see more

explicitly below, ignoring the impact of commodity-price convergence:

If to carry consumable goods from the places where they are superabundant to those where they are scarce is a good pecuniary speculation, is it not an equally good speculation to do the same with regard to labour and instruments? The exportation of labourers and capital from old to new countries, from a place where their productive power is less to a place where it is greater, increases by so much the aggregate produce of wealth of the old and the new country ... Colonization, in the present state of the world, is the best affair of business, in which the capital of an old and wealthy country can engage. (Mill, [1848], 1929, p. 970).

Much of existing Australian literature follows in this Mill-Ricardo tradition. While Ian McLean (1990, p. 8) offers a veiled reference to commodity trade by acknowledging the impact of the decline in long-distance freight rates, commodity-price convergence and the terms of trade generally receive little emphasis by Australian historians.

The Mill-Ricardo staple model has, of course, been applied to other New World examples. Harold Innis (1930) used it effectively for Canada, and it has found a welcome home in writings on other settler economies (Green and Urquhart, 1976; Schedvin, 1990), most recently on South Carolina in the late 17th and 18th centuries (Nash, 1992).

The Gordian knot tying increasing man-land ratios to falling wage-rental ratios in Europe could have been cut any number of ways in the late 19th century: the issue facing us in this paper is which cut was most important. The first cut, of course, was the discovery and exploitation of New World land, following Mill's insight. Abundant New World land supplies served to raise the wage-rental ratio everywhere, both in the New World and the Old. But since European emigrants moved to New World land in massive numbers in the late 19th century, wage-rental ratios should have increased more in Europe than in the New World, a Mill-Ricardo argument that should help account for the opposing factor-price trends in these two parts of the world.

The second cut involves the industrial revolution. Industrial revolutions typically embody productivity growth which favors industry, even when one takes account of the fact that such unbalanced productivity advance tends to lower the relative price of industrial goods. Since industrial output makes little use of farmland, industrialization tends to be land-saving, raising instead the relative demands for labor and capital. Such industrial revolutionary events should, therefore, tend to raise the wage-rental ratio. According to this prediction, more rapid industrialization in Europe compared with Argentina or Australia should also have served to raise the wage-rental ratio by more in Europe. Such events should have contributed to factor-price convergence, including the rise of real wages in the labor-abundant Old World relative to the labor-scarce New World. This prediction would be reinforced if productivity advance in the late 19th century New World was labor-saving and land-using, as the induced-innovation hypothesis would suggest (Hayami and Ruttan, 1971) and as economic historians generally believe (Habakkuk, 1962; David, 1974; Williamson and Lindert, 1980; di Tella, 1982). The prediction would be further reinforced if productivity advance in the Old World was land-saving and labor-using, as we also generally believe.

The third cut involves accumulation. To the extent that physical and human capital (skills) are used more intensively in industry than agriculture, rapid accumulation (also associated with the industrial revolution) should favor the relative expansion of industry and the relative demand for labor, thus raising the wage-rental ratio.

Finally, what about relative output prices and the terms of trade? The supply-side forces listed above tended (on net) to favor the relative expansion of industry, and, thus, to lower its price relative to agriculture.

Demand-side forces are likely to have muted those effects. That certainly seems to be the implication of Engel effects, demand-side forces which appeal to the relatively high income elasticity of demand for industrial goods compared with agricultural goods. Such demand-side forces should, by themselves, have tended to lower the relative price of agricultural goods world-wide. Things get a bit more complex, however, when Engel effects within the foodstuffs group are considered: the income elasticity of demand was much higher for meat and dairy products, and to the extent that these were relatively non-traded compared with grains (Tracy, 1982), it may have served to raise rents in some parts of Europe, like Denmark. More important for our purposes, however, is the role of global commodity market integration. At this point, we leave Malthus, Mill and Ricardo, turning instead to Heckscher and Ohlin.

The factor-price-equalization theorem has been a durable tool in trade theory for seventy years.¹ The Heckscher-Ohlin paradigm has it that countries tend to export commodities using intensively the factors with which they are well endowed while they tend to import commodities using intensively the factors with which they are poorly endowed. Thus, commodity trade acts as if to equalize factor endowments among trading partners. Furthermore, it can be shown under (very) restrictive assumptions that a move from no trade to free trade can in fact equalize factor prices where wide differences existed before. The example that matters most for us here is this: Let falling transport costs (unimpeded by any protective reaction from importing countries) tend to equalize prices of traded commodities. Countries will now

¹The remainder of this section draws on Hatton and Williamson (1992), pp. 45-50, which summarizes the results of O'Rourke and Williamson (1992).

export more of the goods which exploit their favorable factor endowment. The demand for the abundant and cheap factor booms while that for the scarce and expensive factor slumps. Thus, commodity-price convergence tends to produce factor-price convergence, although theory is ambiguous about how much.

When Eli Heckscher was writing in 1919 and Bertil Ohlin in 1924, they were motivated by the commodity-price equalization trends which they thought had taken place between the Old World and the New in the late 19th century. Their economic metaphor was driven by foodstuffs: what economic historians now call the invasion of grains from the New World, an inflow driven by the sharp decline in transport costs, and which served to raise the relative price of grains in the New World relative to the Old. What occurred in the late 19th century was exactly the kind of exogenous relative price shock which is supposed to set factor-price equalization in motion. According to the theorem, the invasion of grains should have raised the wage-rental ratio in the Old World while lowering it in the New World, ceteris paribus. In Ohlin's words, "trade increase[d] the price of land in Australia and lowere[d] it in Europe, while tending to keep wages down in Australia and up in Europe" (Flam and Flanders, 1991, pp. 91-92). Did it?

Actually, there are three questions here, not just one. First, were factor endowments really the key determinants of trade in the late 19th century? Second, was there pronounced commodity-price convergence in the late 19th century? Third, if the first two propositions hold, did commodity-price convergence also make a significant contribution to the observed wage-rental convergence?

Consider the first question. Two recent papers have analyzed the determinants of comparative advantage in British and American manufacturing in

the late 19th century. Nick Crafts and Mark Thomas (1986) found that endowments explain well the pattern of trade in British manufacturing between 1910 and 1935, as well as the United States in 1909. Gavin Wright (1990) found the same in accounting for the evolution of US trade patterns between 1879 and 1940, a result reinforced more recently by Richard Nelson and Wright (1992). Antoni Esteveordal (1992) has found more support based on a large sample of 18 countries around 1913. Indeed, the 1913 evidence is far more supportive of the hypothesis than Edward Leamer (1984) was able to report using post World War II data. Finally, it seems relevant to note that William Whitney (1968) found no evidence of a Leontief Paradox in the United States 1899 data.²

Consider the second question. Economic historians have long been aware of the revolutionary decline in transport costs underlying overseas trade in the late 19th century. Douglass North (1958, p. 537) called the decline "radical" both for railroads and ocean shipping. Since Europe imported foodstuffs and raw materials, and since these bulk commodities "were fundamental beneficiaries of the cheapening transport costs" (p. 544), North thought it was clear that it contributed in Europe to "lower priced foodstuffs and therefore rising real wages, and to lowering in the cost of industrial raw materials" (p. 545) and therefore, we take it, rising rates of industrialization. Although North didn't say so, symmetry suggests that the wage-rental ratio must have been lowered in the US while industrialization must have been suppressed, ceteris paribus. When deflated by a general price index, North's two freight rate indices dropped by from 41 to 53 percent between 1870 and 1910. Similar evidence has been offered more recently by

²Leamer (1980) has argued, of course, that there was never a paradox even in Leontief's data.

Knick Harley (1988).

In assessing the radical decline in overseas freight rates and the cost reductions along the rails, what mattered, of course, was its impact on the price convergence of tradables. A recent paper by two of the present authors has shown that while Liverpool grain prices exceeded Chicago prices by 60.2 percent in 1870, the spread was only 14.2 percent in 1912 (O'Rourke and Williamson, 1992). The price gap for meat and animal fats declined from 93 percent to 18 percent over the same period. The price gap for iron products fell from 80 to 20 percent, cotton textiles from 14 to 1 percent, and so on. Clearly there was dramatic price convergence in global commodity markets between 1870 and World War I, especially among those Old World countries who chose not to raise tariffs on New World farm products.

The answers to the first two questions are in the affirmative. What remains is the third question. How much of the late 19th century wage-rental convergence documented in Figures 1-3 can be accounted for by these Heckscher-Ohlin factor-price equalization effects? In contrast, how much of the convergence can be explained by trends in man/land ratios, and how much by industrialization forces?

IV. WHAT DID CONTEMPORARIES AND HISTORIANS HAVE TO SAY?

Contemporaries and an older generation of historians had little to say about wage-rental convergence since they focused primarily on factor-price trends at home. In fact, they had little to say about wage-rental trends even at home: some had plenty to say about land price and land rent trends, no doubt because at that time history was being written by the rich landed class;

some had plenty to say about trends in real wages and living standards; but rarely did one author have much to say about the behavior of one relative to the other. What follows is a brief review of what they thought was happening to land rents and land prices.

The United Kingdom offers the richest -- and best known -- literature on land rents, and it is written in two parts. First, there were the furious debates in the 1830s and 1840s over the Corn Laws, a debate in which all participants seemed to agree that protection raised land rents and lowered wages, thus artificially lowering the wage-rental ratio prior to repeal (Irwin, 1989; Williamson, 1990). Second, there was the so-called great agricultural depression between 1873 and 1896 (Fletcher, 1961). It is fair to say that the conventional wisdom has always viewed the British agricultural depression as being driven by declining agricultural prices and grain invasion. True, the extent of the agricultural depression in Britain had long been exaggerated: grain prices fell far more than did prices of cheese, butter, meats and vegetable products; and the large-holding grain-producing interests in the southeast of England complained louder than did the small-holding livestock and dairying interests in the northwest. But even when the Royal Commission of 1897 finally got the facts right, they still believed that

The grave situation ... is due to a long-continued fall in prices [and] as the maintenance of this competition involves the continued depreciation of agricultural [land] values, we must look forward to a further reduction ... (Tracy, 1982, p. 48 quoting the 1897 Royal Commission).

While until recently there had been very little evidence documenting Irish land price and land rent trends, the predominant view had long been that they also fell:

It is a commonplace that falling price levels are disastrous for agricultural interests ... In Ireland in the 1880's, the landlord class

bore the brunt of the blows (Solow, 1971, p. 181).

German land prices were rising, not falling as in the United Kingdom, and that fact was well-known to participants in the debate between free traders and protectionists. Rising land prices clearly meant that contemporaries could not have appealed to the arguments of Malthus-Mill-Ricardo or Heckscher-Ohlin, but rather to tariffs:

Tariffs in the 1880s had prevented land prices from falling in response to the new competition ... (Barkin, 1970, p. 194; see also Tracy, 1982, pp. 103-6).

Land prices increased greatly after the 1902 tariffs. Indeed, some have argued that land

prices bore no relation at all to the health of agriculture because they were based on the hopes of continued and augmented government support ... (Barkin, 1970, p. 260).

The land speculation thesis was also supported by Clapham (1951, p. 214), but the Prussian Minister of Agriculture made a speech before the Diet on February 7, 1907 that sounds very much like Avner Offer's rising-positional-value-of-land thesis (Dawson, 1914, p. 244). Not everyone shares these views, however. Some, like Perkins (1981, pp. 93-4), feel that the rise in German land values can be traced to a land-using shift into rootcrops and intensification, much like Denmark.

The link between land rents and grain prices seems to be widely held in France, and the protectionist trend was spearheaded by landlords concerned about their rents (Kemp, 1989, p. 731). Furthermore, between 1880 and the 1890s,

the curve of land rents hugs rather tightly the movement of the price of wheat ... despite a growing diversification of agricultural production (Hubscher, 1971, pp. 376-77).

After 1892, the Meline Tariff offered agricultural protection which was

reputed to be the stiffest in the Old World (Tracy, 1982, p. 71), and until 1903 it was reinforced by the prohibition of cattle imports for reasons of animal health, after which the prohibition was replaced by enormous duties.

What about the New World? Oddly enough, while wage-rental ratios were falling (and rent-wage ratios rising) in America, the populists complained (Buck, 1920; Higgs, 1971, pp. 79-102; Mayhew, 1972). The populists in the American Mid-West were owner-operators, and the rise in farm rents relative to wages was clearly to their advantage, yet they were unhappy enough with economic events to try to get Bryan elected in 1896. Modern historians seem to adopt the view that the populist movement died out in America following the "closing of the frontier" (which, according to the Superintendent of the Census of 1890, occurred only a few years before the 1896 presidential election) and the farm price boom up to World War I. In any case, landowners in Argentina certainly had a far more optimistic attitude towards land values and land rents than did populists in the American Mid-West. An investigation by the Sante Fe government concluded in 1902 that:

The landowner has believed that if in less than ten years a league worth 10,000 pesos can reach the exaggerated price of 100,000, there is no reason for the rents not to continue to increase yearly in that same proportion (quoted in Scobie, 1971, p. 122).

Di Tella and Zymelman (1967, 1973) believe that part of the Argentine land boom came to an end because of the exhaustion of prime agricultural land in the Pampas, something that sounds a lot like the closing-of-the-frontier thesis which is such an important part of American historiography.

V. ANGLO-AMERICAN CONVERGENCE: A COMPUTABLE GENERAL EQUILIBRIUM ACCOUNTING

One way to explore the determinants of this wage-rental ratio

convergence is to apply counterfactual analysis to multi-sector, open, computable general equilibrium (CGE) models. A previous paper by two of the present authors has already applied this CGE approach to isolate the impact of late 19th century commodity-price convergence on the shrinking Anglo-American real wage gap (O'Rourke and Williamson, 1992). This section will now apply these models to Anglo-American wage-rental ratio trends. True, these are only two countries of the eleven for which we have wage-rental ratio data. It is also possible that these two countries may have been unusual. Nevertheless, it seems useful to explore the implications of the CGE approach before turning to the econometrics in Section VI, especially given that such models can trace their ancestry back directly to Heckscher and Ohlin.

The British and the US models include tradable commodities and non-tradable services, but otherwise they are kept simple. They take into account linkages such as the role of New World food as a key wage good in both economies, the role of New World cotton as a key input to manufacturing in both economies, and the role of Old World manufactured exports as they competed with domestic manufactures in US markets. In the tradition of Heckscher and Ohlin, the models take the following as given: endowments of capital, labor and land; technologies in all sectors; and the relative prices of tradable commodities. The two models are estimated with data drawn from the late 19th century.

With such models in hand, we can then proceed to assess the impact of commodity-price and endowment trends on Anglo-American wage-rental convergence. Table 3 reports the results. We start with the influence of commodity prices and the Heckscher-Ohlin hypothesis.

Panel B reports the estimated impact of the Anglo-American commodity-

price convergence discussed in Section III. It asks: what was the impact of the Anglo-American convergence of commodity prices (at least of traded commodities) on real wages and real farm rents (both deflated by a consumer price index), and thus wage-rental ratios in Britain and the United States? Commodity-price convergence served to raise the real wage in Britain by 21.4% over the period 1870-1913 as a whole. The same price convergence served to raise real wages in America by only a trivial amount, 0.3%, and thus the net effect was to erode the Anglo-American real wage gap, the price-induced real wage rate growth difference favoring Britain, by 21.1%. Commodity-price convergence tended to raise farm land rents in America by 13.4%, to lower them in Britain by 54.2%, and thus to erode the Anglo-American land rent gap, the price-induced land rent growth difference favoring the United States, by 67.6%. The net effect of all of this on the wage-rental ratio was to lower it in the US by 11.6% and raise it in Britain by 165.1%, and thus to erode the Anglo-American wage-rental ratio, the price-induced wage-rental ratio growth difference favoring Britain, by 176.7%.

How much of the spectacular convergence in Anglo-American wage-rental ratios might, therefore, be explained by commodity-price convergence? The figures in Table 2 document a 173% rise in the British wage-rental ratio between 1870 and 1910; Panel B in Table 3 suggests that commodity-price convergence might explain almost all of that rise, 165.1%. The American wage-rental ratio fell by 50%, and it appears that commodity-price convergence might explain a bit less than a quarter of that fall, 11.6%. The British wage-rental ratio caught up on the American in the late 19th century, and commodity-price convergence explains a large share of that impressive Anglo-American wage-rental convergence: commodity-price convergence accounts for

about four-fifths of the Anglo-American wage-rental ratio trends ($165.1 - [11.6] / 173 - [-50] = .792$).

At least as far as Anglo-American wage-rental convergence was concerned, Heckscher and Ohlin were right: commodity-price convergence made a powerful contribution to factor-price convergence. But it was hardly the only force at work. Some might argue, for example, that the closing of the American frontier mattered. However, that piece of conventional wisdom is unlikely to have the predicted affect once we note that land-labor ratios diminished faster in Britain than in America (see Appendix 2):

	1912 relative to 1872 (1872=100):				
	Labor	Land	Land/Labor	Capital	Capital/Labor
Britain	152.0	104.0	68.4	218.1	143.5
USA	285.4	232.9	81.6	415.5	145.5

What about capital accumulation and the rate of capital deepening? While it was faster in America, the differences do not seem to be very large. In short, it looks like changing factor endowments cannot account for much of the wage-rental ratio convergence. Looks can be deceiving, however: these two economies had vastly different structures, agriculture very big in America and very small in Britain. Panel A in Table 3 nets out the influence of these changing endowments. The combined increase in capital, labor and land in America served to raise the wage by 20% and rents by 36.7%, thus to lower the wage-rental ratio. The combined increase in capital, labor and land in Britain served to raise the wage by 24% and rents by 10.1%, thus to raise the wage-rental ratio. The way to interpret these results is the following: land-intensive agriculture was an important part of the late 19th century American economy, and thus the falling land-labor ratio had the standard (and classical) impact, lowering the wage-rental ratio; capital-intensive manufacturing was an important part of the British economy, and thus the falling land-labor ratio

there was swamped by the rising capital-labor ratio.

In any case, endowment changes can only be made to account for a little more than a fourteenth of the British wage-rental rise (12.6/173), for about a quarter of the American wage-rental fall (-12.2/-50), and for a ninth of the Anglo-American wage-rental ratio trends combined (12.6-[-12.2]/173-[-50]=.111). Thus, commodity-price convergence and endowment changes combined account for nine-tenths of the Anglo-American wage-rental trends (24.8+176.7/223). We are left with only a tenth of the wage-rental trends unexplained. Was the Anglo-American experience unusual?

VI. EXPANDING THE SAMPLE: AN ECONOMETRIC APPROACH

We are not yet in a position to expand the CGE analysis to other countries in our sample, but another way to test the theories offered in Section III concerning the determinants of wage-rental ratios and their convergence across the late 19th century, is to estimate regressions of the following sort:

$$\text{WGRENT}_{it} = b_1 \text{LANDLAB}_{it} + b_2 \text{CAPLAB}_{it} + b_3 \text{PAP}_{it} + b_4 \text{PROD}_{it} + b_z \text{Z}_{it}$$

where, for each country i , at time t , we define the variables in natural logarithms (see Appendix 1 and 2 for sources):

$$\text{WGRENT}_{it} = \log \text{ of the nominal wage minus } \log \text{ of the nominal value of land;}$$

$$\text{LANDLAB}_{it} = \log \text{ of the quantity of land minus } \log \text{ of the labor force;}$$

CAPLABit = log of the capital stock minus log of the labor force;
PAPMit = log of the agricultural goods price minus log of the
manufacturing goods price;
PRODit = log of labor productivity (GDP per worker);
Z(j)it = country dummy, equal to 1 when i=j, otherwise zero.

We have been able to augment our 1870-1914 wage-rental ratio data base to include factor endowments, relative commodity prices and productivity for all but four of our eleven countries, Argentina, Canada, Ireland and Spain.

Since relative factor prices appear on the left-hand side of this expression, relative commodity prices and relative factor endowments (land-labor and capital-labor ratios) are therefore appropriate for the right-hand side too. Given the stress which contemporaries, historians, Heckscher and Ohlin have placed on commodity prices, it might be useful to say a few words about PAM. According to that literature, the link between the relative price of tradable grains and the wage-rental ratio was often broken by two events: tariffs often raised domestic farm prices far above world prices, breaking down the influence of commodity-price convergence; and relatively non-tradable farm products like meat, butter, cheese and vegetables often sharply increased their share of farm output, and since these products underwent a far less dramatic price fall, the output switch often served to mute the impact of the more tradable farm-commodity (grain) price convergence. PAM should include both influences: the impact of tariffs should be embedded in the relative price and so too should the impact of any switch in farm output away from grains. However, we are not sure that the imperfect country PAM time series in our data base (Appendix 2: Appendix Table 1) always obey these rules. One

way to find out is to allow country dummy variables to interact with PAM in the regression.

According to Malthus, Mill and Ricardo, big land-labor ratios should be associated with big wage-rental ratios, so $b_1 > 0$. According to a weak version of Heckscher and Ohlin model, high relative prices of agricultural goods should be associated with low wage-rental ratios, so $b_3 < 0$. The stronger version, implied by the factor-price equalization theorem, would be confirmed if $b_1 = b_2 = 0$: that is, if factor endowments were uncorrelated with factor prices. In addition, if manufacturing was more capital-intensive than agriculture, the weaker version of the Heckscher-Ohlin model would predict $b_2 > 0$. That is, accumulation forces should have favored industrial expansion, lowering the relative demand for land used in agriculture, thus serving to raise the wage-rental ratio. In addition, we use GDP per worker as a proxy for those productivity-enhancing industrialization forces: if those forces were land-saving (as seems likely in the land-scarce Old World), then $b_4 > 0$; if, instead, these forces were labor-saving (as seems likely in the labor-scarce New World), then $b_4 < 0$. Finally, the dummy variable vector of coefficients b_2 captures all constants of proportionality, allowing the use of index numbers for each country, since variable levels are typically not commensurate across countries; it has no economic interpretation.

Hypothesis Testing

Table 4 presents the econometric evidence, where the sample consists of seven countries using five-year period averages from 1870 to 1914. The first column reports the results for the pooled sample of all seven countries, where the PAM variable is allowed to interact with a country dummy. The second and

the third columns report the results for the New World (Australia [AUS] and the USA) and the Old, respectively. The last two columns break the Old World sample down into the two parts, "free trade" countries (Britain [GBR], Denmark [DEN] and Sweden [SWE]) and "protectionist" (France [FRA] and Germany [GER]). Chow tests clearly indicate that the New World and the Old World have different structures, and thus should be treated separately. While the Chow test statistic is less powerful, it shows that the Old World "free trade" and "protected" groups should also be treated separately.

The results are quite good: 29 of the 34 estimated coefficients have the correct sign; most of the 29 pass conventional significance tests; 4 out of 5 with the wrong sign do not pass conventional significance tests; and the variance explained is quite high. This constitutes strong support for both Malthus-Mill-Ricardo and Heckscher-Ohlin: not only do relative commodity prices matter, but so too do relative factor endowments. Capital-deepening and land-deepening both raise the wage-rental ratio, although the impact is larger in the New World (where agriculture was bigger) than in the Old (where agriculture was smaller). A rise in the relative price of agricultural goods favors returns to land over returns to labor, and the estimate is often greater than unity -- a corollary of what trade theorists call the magnification effect (Jones, 1965). Note, however, the results for Australia and Denmark, where a rise in the relative price of agricultural goods favors labor. We have no explanation for the perverse Australian result, and we intend to explore it further. We do, however, have an explanation for the "perverse" Danish result, and we will discuss it at length below. Economy-wide labor productivity growth plays a significant role, and one that conforms to qualitative economic histories: that is, while productivity growth was land-

saving in the full sample (+0.705, column 1), it was labor-saving in the New World (-0.852, column 2) and land-saving in the Old World (+1.046, column 3).

Explaining Convergence

How important were these forces in contributing to the dramatic convergence in wage-rental ratios? Tables 5A and 5B offer some surprising answers. In each of the two tables, Panel A reports the actual trends (% change per decade) in the wage-rental ratio and all four right-hand side variables. Panel B lists the Table 4 regression coefficients used in the decomposition analysis reported in Panels C and D. Table 5A uses the regression coefficients from the full sample (Table 4: column 1), while Table 5B uses those from the sub-samples (Table 4: columns 2, 4 and 5). The Chow tests in Table 4 argue that we should focus on the results in Table 5B. In any case, the decomposition analysis simply multiplies the changes in the right-hand side variables in Panel A times the regression coefficients in Panel B, thus allowing us to infer what forces were doing most of the work in driving wage-rental ratios across the late 19th century. These are reported for each country as well as for New World and Old World averages.

Consider first the results for the USA and Britain. As we found with the CGE analysis in Section V, there is support here too for Heckscher and Ohlin. The increase in PAPM in America (5.9% per decade) and its decrease in Britain (-6.5% per decade) reflects dramatic price convergence, and it accounts for a large share of the Anglo-American wage-rental convergence: indeed, about 61% of the fall in the American wage-rental ratio is explained by PAPM, while it accounts for about 40% of the rise in the British ratio. About half of the Anglo-American convergence in the wage-rental ratio is explained by commodity-price convergence (Panel D: 49.6%), a figure, while large, is still quite a

bit smaller than that which we found in the CGE analysis reported above in Section V (79.2%). Once again, the Heckscher and Ohlin factor-price-equalization insight is confirmed by Anglo-American experience. Differences in land-labor ratio trends, however, contribute nothing to wage-rental ratio convergence (Panel D: +0.3%). There is no support for the closing-the-frontier thesis here. Capital-deepening also contributes nothing to convergence; indeed, capital-deepening tended to offset the forces of convergence (Panel D: +16.4%). The big surprise lies with the powerful contribution of factor-saving forces underlying Anglo-American productivity advance: labor-saving accounted for 90.8% of the fall in the American wage-rental ratio; land-saving accounted for 54.2% of the rise in the British wage-rental ratio; and the combination accounted for 71% of the convergence.

Factor-saving productivity advance and commodity-price convergence were the prime movers underlying the spectacular late 19th century Anglo-American wage-rental ratio convergence. What was true of Anglo-America, however, was less true elsewhere. Commodity-price convergence didn't matter as much. Small values under PAPM in Panel C could, of course, simply reflect effective protectionist policies, at least on the continent. But not only are the values small, they are of the "wrong" sign (e.g., wage-rental ratios are rising in France, Germany, Denmark and Sweden, but trends in PAPM were serving to lower them). This result could be explained by more-than-offsetting tariffs. It could also be explained by a switch out of grain-producing activities and in to grain-using activities (Denmark being the canonical case). It is a great irony that PAPM has a negative entry for Sweden (Panel C: -4.3%), given that the factor-price-equalization theorem was constructed by two Swedes. The true test of the Heckscher-Ohlin theorem is, of course, the Swedish coefficient on

PAPM in Table 4 (cols. 3 and 5). Significant negative coefficients support the theorem, but it is still an irony that PAPM was moving over time in Sweden such as to cause divergence. While we need more detailed analysis of continental response to grain invasions, note that trends in PAPM also contributed very little to the Australian collapse in the wage-rental ratio: Ohlin was correct in asserting that "trade increase[d] the price of land in Australia ... while tending to keep wages down" (Flam and Flanders, 1991, pp. 91-92), but incorrect in asserting that it was an important force. We need to learn more about this New World case, and that of Argentina.

For the New World and Old World overall, we have the following results. Changing land-labor ratios accounted for a tenth of the wage-rental ratio convergence (Panel D: 10.3%), while capital-deepening accounted for far less (Panel D: 1.8%). In combination, these forces were powerful in Australia (confirming Butlin and Sinclair), France and Germany, but they were weak in Britain, Denmark, Sweden and the USA. These endowment influences offer only mixed support for the views of Mill, Ricardo and Viner. Commodity-price convergence accounted for more than a quarter of the wage-rental ratio convergence (Panel D: 26.9%). The big surprise is that the factor-saving bias of productivity advance associated with industrialization accounted for almost a half of the wage-rental ratio convergence (Panel D: 45.1%). The unexplained residual is fairly small (Panel D: 15.8%).

VII. ASSESSMENT AND AGENDA

Economic convergence within the currently industrialized OECD countries has been taking place for at least a century, and the late 19th century was

one important part of that experience. It was manifested by aggregates like GDP per capita and GDP per man-hour. More importantly, it was also manifested by factor-price convergence. Furthermore, the most important part of this historical experience involved a collapse of factor-price differentials between the Old World and New.

This paper has focused on the convergence of wage-rental ratios, and the relative scarcities of land and labor. In 1870, labor was very scarce and land was very abundant in the New World, while the opposite was true of the Old World. By 1913, the gaps had narrowed. The wage-rental ratio fell sharply everywhere in the New World, while it rose sharply almost everywhere in the Old World. What accounted for the convergence?

The late 19th century trade boom saw the convergence of commodity prices, and the Heckscher-Ohlin theorem of factor-price-equalization predicts that some of the factor-price convergence should have been driven by commodity-price convergence. It turns out that Heckscher and Ohlin were right, but more right for Anglo-America than for other participants in the convergence process. Some of this can be explained, of course, by protective tariff responses in the Old World, and some of it by a rapid switch from grain-producing to grain-using activities in agriculture. It also turns out that the stress which Mill, Ricardo and Viner placed on changes in factor endowments (land, labor and capital) is correct, but the magnitudes were typically weak. Faster capital-deepening and slower erosion in land-labor ratios in the Old World contributed to convergence, but not much. We expected a bigger contribution given the mass migrations to the New World, but apparently these were partially offset by a quickening in accumulation and land settlement. Much to our surprise, however, the most important force

contributing to factor-price convergence was a strong labor-saving bias in the New World and a strong land-saving bias in the Old World, an endogenous response to relative factor scarcities.

Future research on this important issue should go in three directions; augmentation of the late 19th century data base to include more countries, like Argentina in the New World and the Mediterranean in the Old; a more detailed assessment of individual country experience, especially in response to commodity-price convergence and factor-saving bias; and an extension of the analysis to other episodes, like the interwar years.

Table 1

Factor Prices in England and the United States: Land and Labor 1790 and 1850

		Land Prices	Weekly Rent	Weekly Farm Wage	Ratios of Wages to: Rent Land Prices	
England	1790	£20	15s 7d	7s	.449	.0175
	1850	£29	22s	9s 7d	.435	.0165
United States	1790	\$2.50	\$0.10	\$2.30	23.000	.9200
	1850	\$11.14	\$0.45	\$3.80	8.444	.3411

 Source: Christensen, 1981, Table 1, p. 313.

Table 2

Old World Import Tariff Levels in 1913

Country	Average level of duties on:	
	manufactures	wheat
Austria-Hungary	20%	35%
Belgium	9	0
Denmark	--	0
Finland	28	0
France	21	38
Germany	13	36
Italy	20	40
Netherlands	--	0
Norway	--	4
Portugal	--	Prohibitive
Spain	34	43
Sweden	25	28
Switzerland	8	2
United Kingdom	0	0

Source: Bairoch, 1989.

Table 3

Trends in the Ratio of Wages to Land Values 1870-1910 (1900=100)

Country	1870	1890	1910
Old World, Free Trade			
Britain	42.28	84.99	115.42
Denmark	32.89	62.06	101.09
Ireland	12.61	66.86	70.31
Sweden	41.41	70.02	108.88
Average	32.30	70.98	98.93
Old World, Protected			
France	59.97	112.97	122.36
Germany	67.51	86.47	95.57
Spain	102.55	123.21	67.52
Average	76.68	107.55	95.15
New World			
Argentina	167.58	106.45	31.95
Australia	289.74	118.54	75.64
United States	127.99	103.23	64.07
Average	195.10	109.41	57.22
Ratio of New World to:			
Old World, Free Trade	6.04	1.54	.58
Old World, Protected	2.54	1.02	.60

Source: Predicted values from regressions run on time and time squared, from time series underlying Figures 1-3. Group averages are unweighted. New World excludes Canada since the latter offers data only for 1901-1915.

Table 4

The Estimated Impact of Anglo-American Commodity Price Convergence and Factor Endowment Changes on Wage-Rental Ratios c1870-c1913 (in percent)

Impact of:	Wage Rate	Farm Rent	Wage-Rental Ratio
Panel A: Input growth (land, labor and capital combined)			
USA	20.0	36.7	-16.7
Britain	24.0	10.1	+13.9
Britain minus USA	+4.0	-26.6	+30.6
Panel B: Commodity price convergence			
USA	0.3	13.4	-13.1
Britain	21.4	-54.2	+75.6
Britain minus USA	+21.1	-67.6	+88.7

Notes: Panel B is taken from O'Rourke and Williamson, 1992, Table 2. Panel A uses the text table input growth estimates and the CGE models for the USA and Britain reported in O'Rourke and Williamson, 1992, Appendix 3.

Table 5
Hypothesis Testing
The Determinants of the Wage-Rental Ratio in the New and Old Worlds 1875-1914

Regression	1	2	3	4	5
Sample	ALL	NEWWORLD	OLDWORLD	OLDPROT	OLDFREE
LANDLAB	1.019 (6.444)	1.246 (12.465)	0.662 (3.021)	-0.728 (2.184)	0.834 (2.380)
CAPLAB	0.979 (3.319)	1.528 (3.919)	0.407 (1.262)	0.684 (2.608)	0.475 (0.761)
PROD	0.705 (3.655)	-0.852 (3.598)	1.046 (5.512)	-0.747 (1.487)	1.104 (3.969)
AUSPAPM	0.762 (1.202)	0.583 (1.210)	-	-	-
USAPAPM	-6.090 (10.655)	-1.941 (2.083)	-	-	-
FRAPAPM	-4.784 (7.173)	-	-4.745 (8.789)	-0.399 (0.378)	-
GERPAPM	-0.930 (1.822)	-	-0.914 (1.759)	-1.258 (2.092)	-
GBRPAPM	-1.640 (3.676)	-	-1.260 (3.283)	-	-1.357 (2.236)
DENPAPM	1.192 (0.917)	-	0.137 (0.138)	-	-0.026 (0.025)
SWEPAPM	-0.450 (1.421)	-	-0.627 (2.149)	-	-0.856 (2.034)
Restrictions	0.000	0.020	0.000	0.525	0.374
R-squared	.834	.936	.879	.821	.933
SEE	0.123	0.096	0.101	0.078	0.094
NOBS	56	16	40	16	24
DF	39	9	27	9	15

Chow Test: {1} versus {2, 3}, $F(3, 36) = 7.907$, $P = 0.000$.

Chow Test: {2, 3} versus {2, 4, 5}, $F(3, 33) = 3.588$, $P = 0.0238343$.

Notes: Dependent variable is WGRENT. Estimation OLS with fixed effects. Country effects (intercepts) not shown. Absolute t-statistics in parentheses. Restrictions is the P-value for the test that the PAPM coefficients are equal across countries. NOBS is number of observations. DF is degrees of freedom. NEWWORLD = {AUS,USA}; OLDPROT = {FRA,GER}; OLDFREE = {GBR,DEN,SWE}.

Table 6A
 Decomposition of changing wage-rental ratios I

A: Underlying data 1870-1914 (% change per decade)

	WGRENT	LANDLAB	CAPLAB	PAPM	PROD
AUS	-25.5%	-12.8%	-3.5%	-2.6%	2.1%
USA	-18.8%	-7.0%	13.0%	5.9%	20.0%
FRA	10.5%	-10.0%	7.5%	0.6%	7.2%
GER	6.4%	-13.4%	16.0%	2.4%	11.7%
GBR	22.0%	-10.7%	7.2%	-6.5%	10.8%
DEN	24.8%	-2.6%	8.0%	1.5%	23.8%
SWE	23.1%	-1.2%	12.7%	5.0%	21.6%

B: Regression Coefficients (from Table 5, regression 1)

	LANDLAB	CAPLAB	PAPM	PROD
AUS	1.019	0.979	0.762	0.705
USA	1.019	0.979	-6.090	0.705
FRA	1.019	0.979	-4.784	0.705
GER	1.019	0.979	-0.930	0.705
GBR	1.019	0.979	-1.640	0.705
DEN	1.019	0.979	1.192	0.705
SWE	1.019	0.979	-0.450	0.705

Table 6A (Continued)
Decomposition of changing wage-rental ratios I

C: Explaining changes (% change per decade)

	change:	due to:	due to:	due to:	due to:	RESIDUAL
	WGRENT	LANDLAB	CAPLAB	PAPM	PROD	
AUS <i>shares</i>	-25.5% 100.0%	-13.0% 51.1%	-3.4% 13.5%	-2.0% 7.9%	1.5% -5.9%	-8.5% 33.4%
USA <i>shares</i>	-18.8% 100.0%	-7.1% 37.8%	12.7% -67.8%	-36.1% 192.2%	14.1% -75.2%	-2.4% 13.0%
FRA <i>shares</i>	10.5% 100.0%	-10.1% -96.9%	7.3% 69.8%	-2.8% -26.5%	5.1% 48.6%	11.0% 105.1%
GER <i>shares</i>	6.4% 100.0%	-13.7% -214.6%	15.7% 245.4%	-2.3% -35.4%	8.2% 129.0%	-1.6% -24.4%
GBR <i>shares</i>	22.0% 100.0%	-10.9% -49.4%	7.1% 32.1%	10.6% 48.0%	7.6% 34.6%	7.7% 34.8%
DEN <i>shares</i>	24.8% 100.0%	-2.7% -10.8%	7.9% 31.8%	1.7% 7.0%	16.8% 67.8%	1.0% 4.2%
SWE <i>shares</i>	23.1% 100.0%	-1.2% -5.2%	12.4% 53.7%	-2.3% -9.8%	15.2% 66.0%	-1.1% -4.7%
NEWWORLD (avg.) <i>shares</i>	-22.1% 100.0%	-10.1% 45.5%	4.6% -21.0%	-19.0% 86.1%	7.8% -35.3%	-5.5% 24.7%
OLDWORLD (avg.) <i>shares</i>	32.4% 100.0%	-17.1% -52.7%	14.9% 46.0%	10.3% 31.7%	14.2% 43.7%	10.2% 31.3%

D: Explaining convergence (% change per decade)

	change:	due to:	due to:	due to:	due to:	RESIDUAL
	WGRENT	LANDLAB	CAPLAB	PAPM	PROD	
NEWWORLD minus OLDWORLD <i>shares</i>	-54.5% 100.0%	7.0% -12.9%	-10.3% 18.8%	-29.3% 53.7%	-6.4% 11.7%	-15.6% 28.7%
US minus GB <i>shares</i>	-40.8% 100.0%	3.8% -9.3%	5.7% -13.9%	-46.6% 114.3%	6.5% -15.9%	-10.1% 24.8%

Table 6B
 Decomposition of changing wage-rental ratios II

A: Underlying data 1870-1914 (% change per decade)

	WGMENT	LANDLAB	CAPLAB	PAPM	PROD
AUS	-25.5%	-12.8%	-3.5%	-2.6%	2.1%
USA	-18.8%	-7.0%	13.0%	5.9%	20.0%
FRA	10.5%	-10.0%	7.5%	0.6%	7.2%
GER	6.4%	-13.4%	16.0%	2.4%	11.7%
GBR	22.0%	-10.7%	7.2%	-6.5%	10.8%
DEN	24.8%	-2.6%	8.0%	1.5%	23.8%
SWE	23.1%	-1.2%	12.7%	5.0%	21.6%

B: Regression Coefficients (from Table 5, regressions 2, 4, 5)

	LANDLAB	CAPLAB	PAPM	PROD
AUS	1.246	1.528	0.583	-0.852
USA	1.246	1.528	-1.941	-0.852
FRA	-0.728	0.684	-0.399	-0.747
GER	-0.728	0.684	-1.258	-0.747
GBR	0.834	0.475	-1.357	1.104
DEN	0.834	0.475	-0.026	1.104
SWE	0.834	0.475	-0.856	1.104

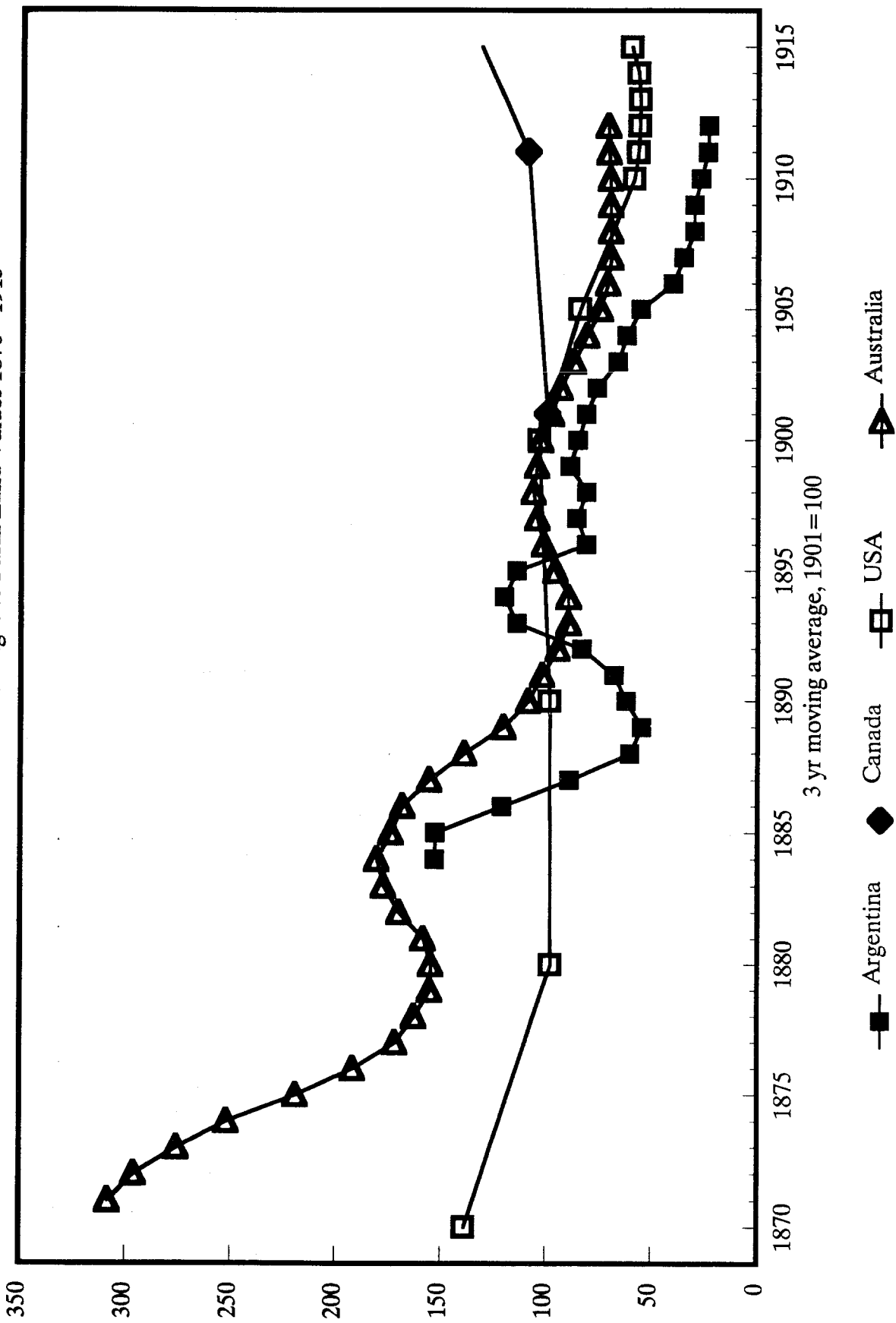
Table 6B (Continued)
Decomposition of changing wage-rental ratios II

C: Explaining changes (% change per decade)						
	change:	due to:	due to:	due to:	due to:	RESIDUAL
	WGRENT	LANDLAB	CAPLAB	PAPM	PROD	
AUS shares	-25.5% 100.0%	-15.9% 62.5%	-5.4% 21.1%	-1.5% 6.0%	-1.8% 7.1%	-0.8% 3.3%
USA shares	-18.8% 100.0%	-8.7% 46.2%	19.9% -105.8%	-11.5% 61.3%	-17.0% 90.8%	-1.4% 7.5%
FRA shares	10.5% 100.0%	7.2% 69.3%	5.1% 48.8%	-0.2% -2.2%	-5.4% -51.5%	3.7% 35.6%
GER shares	6.4% 100.0%	9.8% 153.4%	11.0% 171.6%	-3.1% -47.8%	-8.7% -136.7%	-2.6% -40.4%
GBR shares	22.0% 100.0%	-8.9% -40.5%	3.4% 15.5%	8.8% 39.7%	11.9% 54.2%	6.8% 31.0%
DEN shares	24.8% 100.0%	-2.2% -8.9%	3.8% 15.4%	0.0% -0.2%	26.3% 106.2%	-3.1% -12.6%
SWE shares	23.1% 100.0%	-1.0% -4.2%	6.0% 26.0%	-4.3% -18.6%	23.9% 103.3%	-1.5% -6.5%
NEWWORLD (avg.) shares	-22.1% 100.0%	-12.3% 55.6%	7.2% -32.8%	-6.5% 29.5%	-9.4% 42.6%	-1.1% 5.1%
OLDWORLD (avg.) shares	32.4% 100.0%	-6.7% -20.6%	8.2% 25.3%	8.2% 25.2%	15.2% 46.8%	7.5% 23.2%

D: Explaining convergence (% change per decade)						
	change:	due to:	due to:	due to:	due to:	RESIDUAL
	WGRENT	LANDLAB	CAPLAB	PAPM	PROD	
NEWWORLD minus OLDWORLD shares	-54.5% 100.0%	-5.6% 10.3%	-1.0% 1.8%	-14.7% 26.9%	-24.6% 45.1%	-8.6% 15.8%
US minus GB shares	-40.8% 100.0%	0.3% -0.6%	16.4% -40.3%	-20.2% 49.6%	-29.0% 71.0%	-8.3% 20.2%

Figure 1

New World Trends in Ratio of Wages to Farm Land Values 1870-1915



SOURCES: see Appendix: Sources and Notes

Figure 2

"Free Trade" Trends in the Ratio of Wages to Farm Land Values 1870-1914

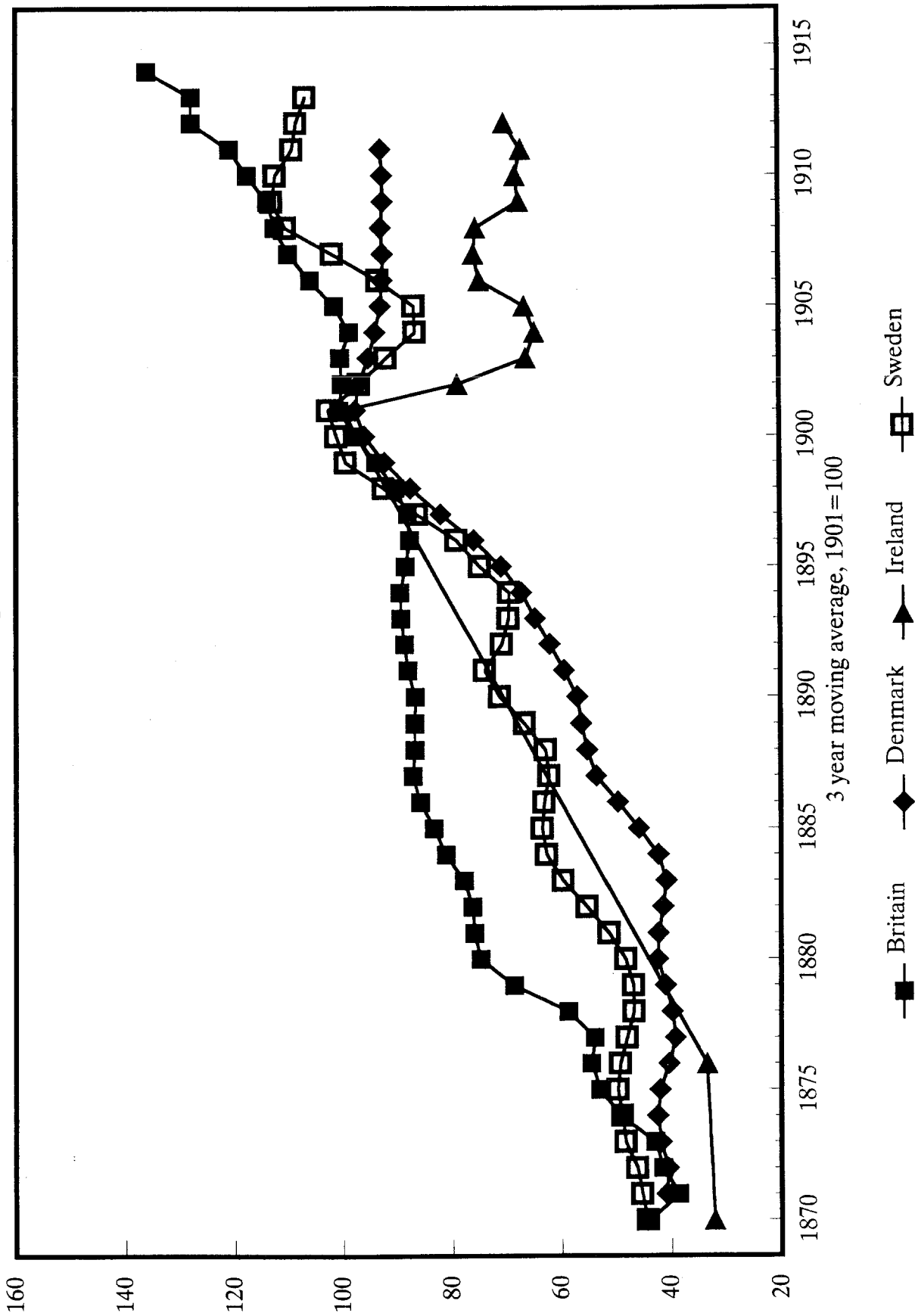
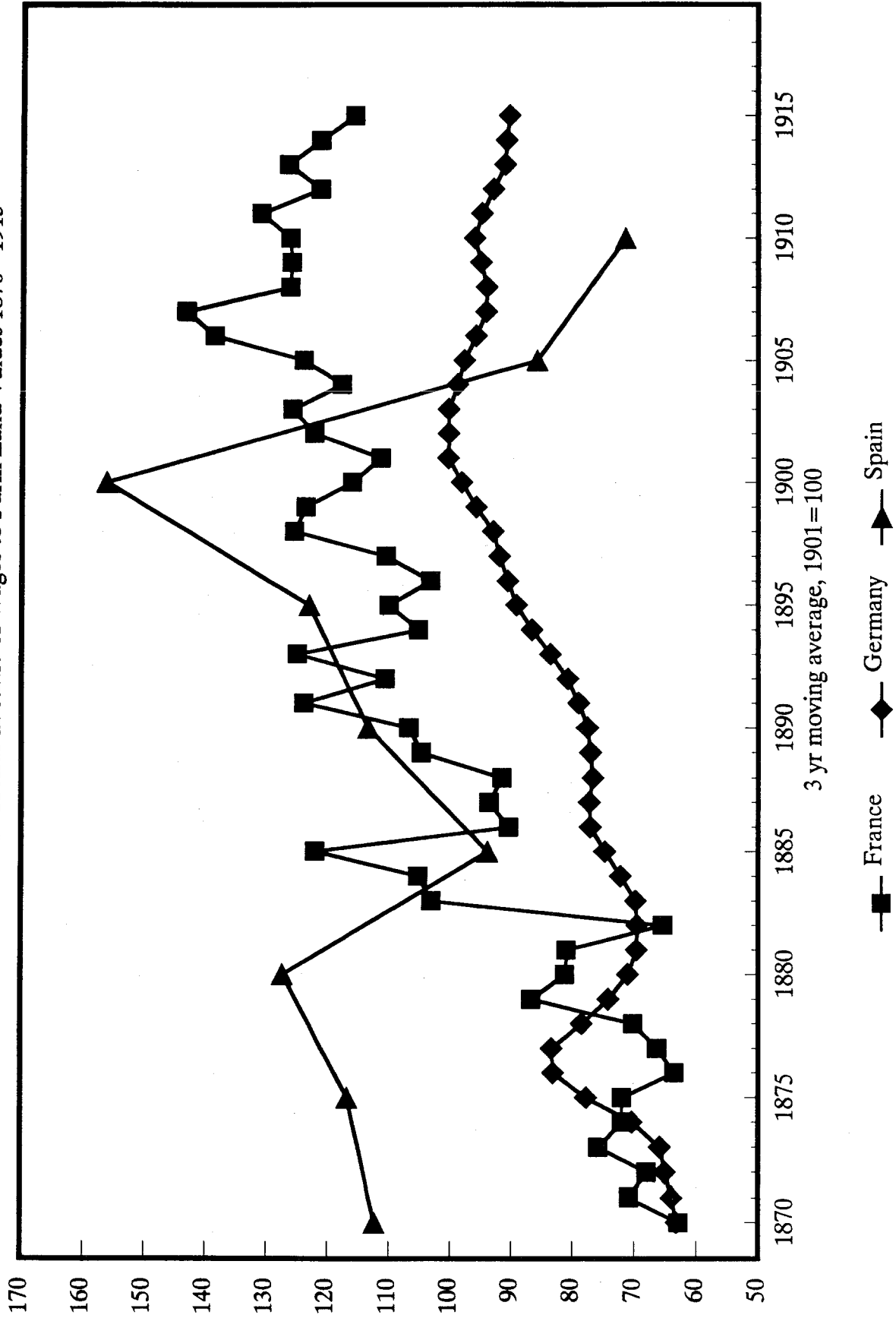


Figure 3

"Protected" Old World Trends in Ratio of Wages to Farm Land Values 1870-1915



SOURCES: see Appendix: Sources and Notes

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APPENDIX 1. DATA SOURCES FOR WAGE-RENTAL RATIOS

What follows are the sources for the wage-rental ratios reported in the text. The data cover eleven late 19th century "countries" (Ireland is treated as a separate country): Australia, Argentina, Canada, and the USA in the New World; and Britain, Denmark, France, Germany, Ireland, Spain, and Sweden in the Old World. Unless otherwise noted, the wage in the numerator is a nominal urban unskilled wage rate and it is taken from the data base underlying Williamson (1992). The rent in the denominator always refers to farmland, and almost always refers to nominal land values or prices per unit. The exceptions are Britain, Ireland, and Spain, where they refer to nominal rents per unit.

ARGENTINA

Land Values (prices from sales of rural land in Buenos Aires province, per hectare, in pesos moneda nacional (\$m/n)):

Roberto Cortes Conde, El Progreso Argentino, 1880-1914 (Buenos Aires: Editorial Sudamericana, 1979), Table 3.8, p.164 and Table 3.10, p.166.

The wage/land value ratio has been indexed on 1901=100. A three-year moving average is presented in text Figure 1, "New World."

AUSTRALIA

Land Values (local government assessments of rural land, implicit price, pounds per acre, Victoria):

Alan M. Taylor, "The Value of Land in Australia Before 1913," Australian National University, Source Papers in Economic History, no. 19, 1992, p. 20.

Wages, 1870-1900:

Urban unskilled nominal wages in pounds per year, G. Withers, unpublished data base, n.d.

Wages, 1901, 1906-1914:

Nominal industrial wage index (1955=100), B.R. Mitchell, International Historical Statistics, The Americas and Australasia, (Detroit: Gale Research Company, 1983), Table C4, column j, p. 184, (index of money wages in industry).

The wage/land value ratio has been indexed on 1901=100. A three-year moving average is presented in text Figure 1, "New World."

BRITAIN

Land Rent, 1881-1920:

H.A. Rhee, The Rent of Agricultural Land in England and Wales, 1870-1943 (Oxford: Institute for Research in Agricultural Economics, 1949; for the Central Landowners' Association), Table 2, pp.44-46, based on a weighted average of nominal rents per acre of farmland, ten series.

Land Values, 1870-1880:

Norton, Trist, and Gilbert, "A Century of Land Values: England and Wales," in E.M. Carus-Wilson (ed.), Essays in Economic History (London: Edward Arnold, 1966), pp.129-131. Average prices of a "representative" portion of marketable agricultural estates 30-6,000 acres, purely agricultural, excluding "fancy property."

Land Values, 1881-1920:

The land rent series above were converted into land values by dividing the rents by the British consol rate, taken from B. Mitchell and P. Deane, Abstract of British Historical Statistics (Cambridge: Cambridge University Press, 1962), Table 8, p.455.

The wage/land value ratio has been indexed on 1901=100. A three-year moving average is presented in text Figure 2, "Free Trade."

CANADA

Land Values (average values of land per acre):

Seventh Census of Canada, 1931, Agriculture, Vol.VIII, Department of Trade and Commerce, Dominion Bureau of Statistics, Canada, 1936, Table 5, pp. 6, 46, 76, 146, 199, 383, 539, 591, 663, and 730. The 1921 census counts as farms only holdings larger than one acre. The 1901 and 1911 censuses include smaller holdings, but these do not significantly affect the results. Farms operated by share tenants and by cash and share tenants are included.

The wage/land value ratio has been indexed on 1901=100 in text Figure 1, "New World."

DENMARK

Land Values, 1845-1900:

Jens Christensen, Landbostatistik: Handbog I Dansk Landbohøistorisk Statistik 1830-1900, Landbohøistorisk Selskab, Copenhagen, 1985, Table VII.2, pp.106-107 (land prices per Tonder Hartkorn, in Kroner).

Land Values, 1885-1912:

Various issues of Statistik Aarbog, the Danish statistical yearbook published by Danmarks Statistik. These contain the same information as the Christensen source. The two sources report exactly the same numbers for the overlapping years 1885-1900, except for 1889, where the Statistical Yearbook's number is used.

Wages (industrial wages for unskilled males):

Hans Chr. Johansen, Danmarks Historie, Bind 9, Okonomiske Statistik, 1814-1980 (Gyldendal: Copenhagen, 1985), Table 7.5, pp.294-295, column 2 (ore per hour).

The wage/land value ratio has been indexed on 1901=100. A three-year moving average is presented in text Figure 2, "Free Trade."

FRANCE

Land Values:

Maurice Levy-Leboyer, Le Revenu Agricole et la Rente Fonciere en Basse-Normandie: Etude de Croissance Regionale (Editions Klincksieck: Paris, 1972), Table K-56, pp.186-189 (land price series for Argences, a sub-region).

The wage/land value ratio has been indexed on 1901=100. A three-year moving average is presented in text Figure 3, "Protected."

GERMANY

Land Values:

Walther G. Hoffmann, Das Wachstum der Deutschen Wirtschaft Seit der mitte des 19 Jahrhunderts (Berlin: Springer-Verlag, 1965), Table 139, pp.569-570, (price index for agricultural land, 1913=100).

Wages:

B.R. Mitchell, European Historical Statistics 1750-1975, Second Revised Edition (New York: Facts on File, 1981), Table C4, pp.193-194, (index of money wages in industry, 1900=100).

The wage/land value ratio has been indexed on 1901=100. A three-year moving average is presented in text Figure 3, "Protected."

IRELAND

Land Rents, 1854-1908:

C. O'Grada (Ireland Before and After the Famine: Explorations in Economic History, 1800-1925 (Manchester: Manchester University Press, 1988), Table 33, p. 130) estimates agricultural rent income in 1854, 1876, and 1908. Mitchell (British Historical Statistics, pp. 190-1)

reports total acreage of agricultural land under cultivation for the same years. Dividing the former by the latter gives an estimate of rent per acre as: 1854, 0.663; 1876, 0.763; and 1908, 0.545.

Land Rents, 1901-1913:

D. Nunan, ("Price Trends for Agricultural Land in Ireland 1901-1986," Irish Journal of Agricultural Economics and Rural Sociology 12 (1987): 51-77, Appendix A, Table 1, pp. 69-71) reports conacre rents in the Limerick area. We link the Nunan series with the O'Grada series at 1908.

Wage Rates, 1870-1913:

We use F. D'Arcy, "Wages of Labourers in the Dublin Building Industry 1667-1918," Saothar 14 (1989), pp. 17-32. An alternative for the 1870-1901 period would be to use Wilson Fox's farm wage series (Board of Trade, Thirteenth Abstract of Labour Statistics of the United Kingdom 1907-08, London, 1910: H.M. Stationery Office, Cd. 5041, pp. 73 and 137). Fox's series rises somewhat less steeply up to 1901 than does D'Arcy's, and thus the wage rental ratio based on D'Arcy would rise a bit less steeply too. However, since we have been using urban unskilled wages throughout in our eleven-country panel, we use the D'Arcy series here.

The wage/land rent ratio has been indexed on 1901=100 in text figure 2, "Free Trade."

SPAIN

Land Rents:

Juan Carmona, El comportamiento economico de la nobleza espanola en el siglo XIX: La Casa de Alcanices 1790-1910 (Doctoral thesis, Universidad Complutense de Madrid, 1991), Table 2. First, an unweighted average was taken of columns (4) and (5), pasture land in the Toledo area and large estates. Second, an unweighted average was taken of this created series and column (1), large wheat-growing estates in the Seville and Cordoba areas. (1900/04=100)

Land Values:

The land rents were converted to land values using the expression, value = rent/interest rate.

Interest Rate:

1867-1873, British consol rate: Mitchell and Deane, Abstract (1962), Table 8, p.455.

1874-1882 (Spanish discount rate): Estadisticas Historicas de Espana: Siglos XIX-XX (Madrid: Fundacion Banco Exterior, 1989), Table 9.8, p.388.

1883-1920 (Spanish interest rate): P.M. Acena and Leandro Prados de la Escosura (eds.), La Nueva Historia Economica en Espana (Madrid: Editorial Tecnos, 1985), Table 9, p.278.

These three series were linked together and then used to convert land rents into land values.

The wage/land value ratio has been indexed on 1901=100 in text Figure 3, "Protected."

SWEDEN

Land Values (kroner per hectare):

Erik Lindahl, Einar Dahlgreen, and Karin Koch [Staff of the Institute for Social Sciences, University of Stockholm], Wages, Cost of Living and National Income in Sweden 1860-1930; Volume III: National Income of Sweden 1961-1930, Part Two (London: P.S. King and Son, 1937), Table 126, p.393.

Wages (day rates of male workers in agriculture, markegang returns, ore): Gosta Bagge, Erik Lundberg, and Ingvar Svenilsson [Staff of the Institute for Social Sciences, University of Stockholm], Wages, Cost of Living and National Income in Sweden 1860-1930; Volume II: Wages in Sweden 1860-1930, Part Two (London: P.S. King and Son, 1935), Table 169, col. a, pp.113-114.

The wage/land value ratio has been indexed on 1901=100. A three-year moving average is presented in text Figure 1, "Free Trade."

UNITED STATES

Land Values (nominal, purchase-value of farmland per acre, in dollars): Peter H. Lindert, "Long-run Trends in American Farmland Values," Working Paper No.45, Agricultural History Center, University of California, Davis (February 1988), Table 1, following p.5.

The wage/land value ratio has been indexed on 1901=100. A three-year moving average is used for the years 1911-1921 in text Figure 1, "New World." The other observations are at census dates.

APPENDIX 2: DATA SOURCES FOR ECONOMETRIC ANALYSIS

We sought data for ten countries: Australia (AUS), Argentina (AGN), Canada (CAN), and the USA in the New World; and Britain (GBR), Denmark (DEN), France (FRA), Germany (GER), Spain (SPA), and Sweden (SWE) in the Old World. However, due to missing information, the following are excluded from the analysis: Argentina, Canada and Spain.

The data is annual 1870-1914 wherever possible. Missing years were subject to interpolation along an exponential trend:

W: nominal wage index (see Appendix 1)
VLAND: nominal land value index (see Appendix 1)
LAND: total useable land stock index
K: total capital stock index
L: total labor force index
PA: price index of agricultural goods
PM: price index of manufactured goods
Y: real output index

The following ratios were derived:

WGREN T = $\ln (W/VLAND)$
LANDLAB = $\ln (LAND/L)$
CAPLAB = $\ln (K/L)$
PAPM = $\ln (PA/PM)$
PROD = $\ln (Y/L)$

AUSTRALIA

LAND: Wray Vamplew, ed., Australians: Historical Statistics (Broadway, NSW: Fairfax, Syme & Weldon), p. 73, land use in all colonies/states, excluding territories.

K: Alan M. Taylor, "External Dependence, Demographic Burdens and Argentine Economic Decline after the Belle Epoque," Journal of Economic History, Vol. 52, December, 1992, Appendix, aggregate capital stock in constant 1910/11 million pounds. Extended to 1870 similarly.

L: Vamplew, p. 147.

PA: Vamplew, pp. 133 and 217, geometric mean of price index of pastoral and agricultural components of GDP, weights corresponding to current price GDP share of each component.

PM: Vamplew, p. 217, price index of manufacturing component of GDP.

Y: Vamplew, p. 219, GDP price deflator index.

UNITED STATES

LAND: 1870-1900: Twelfth Census of the United States, 1900, Vol. V, Agriculture, Part I, United States Census Office, Washington, 1902, Table II, acres of improved land in farms, p. xviii. 1900: Fourteenth Census of the United States, 1920, Vol. V, Agriculture, General Report and Analytical Tables, 1922, Table 6, improved land in farms, p. 36-37.

K: John W. Kendrick and M.R. Pech, Productivity Trends in the United States (Princeton: Princeton University Press, 1961), Table A-XV, "National Economy: Real Capital Stocks, by Major Sector, 1867-1957," pp. 320-322. The numbers for 1869-78 and for 1879-88 are the annual averages for the decads. In millions of 1929 dollars. "Domestic Economy," column 3.

L : 1870-1900: Occupations at the Twelfth Census, 1900, Special Reports, Department of Commerce and Labor, Bureau of the Census, Washington, 1904, Table IV, p. 1. 1910 & 1920: Fourteenth Census of the United States, 1920, Vol. IV, Population, Occupations, Department of Commerce, Bureau of the Census, Washington, 1923, Table 2, p. 34. These data are of "total persons 10 years of age and over engaged in gainful occupations."

PA: Historical Statistics of the United States. PA was created by linking the "Farm products" series E42 (BLS) & E53 (Warren and Pearson).

PM: Historical Statistics of the United States. PM was created by linking the "All commodities" series E40 (BLS) & E52 (Warren and Pearson).

Y: Mitchell, Table K1, GNP in constant prices, pp. 887 and 889.

FRANCE

LAND: Arable land is used as a proxy. Mitchell, total of columns in Table D1, "Area of Main Cereal, Potato, and Sugar Beet Crops," pp. 213 and 224, and area of vineyards from Table D3, "Area of vineyards and output of wine," pp. 298 and 300, in thousands of hectares.

K: Also M. Levy-Leboyer and F. Bourguinon, The French Economy in the Nineteenth Century: An Essay in Econometric Analysis (Cambridge: Cambridge University Press, 1990), Table 7.8, "Breakdown of the stock of fixed capital for 1820-1913," row ?, in thousand million francs, p. 277.

L, selected dates: Mitchell, Table C1, p. 163. These economy-wide labor force figures were computed by summing over all the occupational categories listed by Mitchell. Also Levy-Leboyer and Bourguinon, Table 7.16, "Total population and active population," p. 294, in millions. The above two series were interpolated.

PA: Levy-Leboyer and Bourguinon, Table A-IV, "Output, price and wage indices (base: 1908-1912)," column 6.

PM: Levy-Leboyer and Bourguinon, Table A-IV, column 7.

Y: Levy-Leboyer and Bourguinon, Table A-III, "GDP by type of expenditure, 1820-1913 (million francs, current prices)," column 1.

GERMANY

LAND: Walther G. Hoffmann, Das Wachstum Der Deutschen Wirtschaft Seit Der Mitte Des 19. Jahrhunderts (Berlin: Springer-Verlag, 1965), Table

48, column 19, pp. 272-273, (LANDAR plus fallow, pasture, and miscellaneous land areas).

K: Hoffmann, Table 39, column 7, capital stock in constant 1913 prices, pp. 253-254.

L: Hoffmann, Table 20, column 9, pp. 204-206. These employment figures include the self-employed. Most of those counted are men, but some female family members who help are also included among the employed. Unfortunately, the females workers were not accurately reported before 1907, so the employment figures for 1870-1907 underreport the total number of employed workers in the economy.

PA: Hoffmann, Table 137, column 4, agricultural producer price index, pp. 561-562.

PM: Hoffmann, Table 148, column 15, deflator for NNP at market prices using the capital balance, in 1913 prices, pp. 598-601.

Y: Mitchell, Table K1, NNP in constant 1913 prices, in millions of marks, pp. 817 and 821.

BRITAIN

LAND: B. R. Mitchell and P. Deane, Abstract of British Historical Statistics (Cambridge: Cambridge University Press, 1962), Agriculture Table 1, "Acreage of Crops -- Great Britain," pp. 78-79, acreage of crops, rotation grasses, permanent pasture, and fallow.

K: Charles H. Feinstein and Sidney Pollard, eds., Studies in Capital Formation in the United Kingdom 1750-1920 (Oxford: Clarendon Press, 1988), Table VIII, "Capital Formation and Capital Stocks, Great Britain 1760-1860 and United Kingdom 1850-1920," column 7, net stock of capital in millions of pounds at 1900 prices, pp. 441-443.

L: Mitchell and Deane, Labour Force Table 1, p. 60, total labor force.

PA: Mitchell and Deane, Prices Table 3, "The Rousseaux Price Indices," column 3, "Total Agricultural Products," pp. 471-473.

PM: Mitchell and Deane, Prices Table 3, column 4 "Principal Industrial Products," average of 1865 and 1885 = 100, pp. 471-473.

Y: Mitchell and Deane, National Income Expenditure Table 2, column 3, "Net National Income at 1900 Prices, Total (L mill)," pp. 367-368.

DENMARK

LAND: Hans Chr. Johansen, Danmarks Historie, Bind 9: Dansk Okonomisk Statistik 1814-1980 (Denmark: Gyldendalske Boghandel, 1985), Table 2.2, column 7, p. 129.

K: Niels Kaergard, Okonomisk Vaekst: En Okonometrisk Analyse af Danmark 1870-1981 (Denmark: Jurist-og Okonomforbundets Forlag, 1991), Table 7, column 6, pp. 516.

L: Hansen, Table 1, column 5, labor force in thousands, pp. 229-231.

PA: Hansen, Table 18, Column 11, pp. 323-324, total agricultural production price index is used for 1870-1900. 1900-1914 from Kaergard, Table 1, column 4, pp. 578-579. The two price indices have been linked together and indexed on 1901=100.

PM: Johansen, Table 8.1, pp. 298-301. Column 4 (wholesale price index) is used for 1876 to 1913. For 1870 to 1875, column 1 (consumer price index) was linked with column 4.

Y: B.R. Mitchell, European Historical Statistics (New York: Facts on File, 1981), Table K1, column 3, GNP in million krone at constant 1929 prices, pp. 817 and 820.

SWEDEN

LAND: Arable land is used as a proxy. Mitchell, Table D1, "Area of Main Cereal, Potato, and Sugar Beet Crops," sum of the seven columns, pp. 219 and 235.

K: Urban Karlstrom, Economic Growth and Migration During the Industrialization of Sweden, Doctoral dissertation, Stockholm School of Economic, 1985, Appendix B, Table 9, "Capital Stock 1871-1910 (current prices)," sum of columns 1 through 5, p. 187. This series was deflated using an investment price index from O. Krantz and C.A. Nilsson, Swedish National Product 1861-1970, (Kristianstad: CWK Gleerup, 1975). The index was created by linking the domestic investment deflator series on pp. 48, 56, 66, and 76. The series is for total domestic investment in machinery and buildings. The linked series has been indexed on 1901=100.

L: Mitchell, Table C1, p. 170. The economy-wide labor force figures were computed by summing over all the occupational categories listed by Mitchell. Since it is not clear that Mitchell's categories cover all employed workers, these figures may not be reliable. The labor force figures include those in the armed forces; according to footnote 49 on page 173, the 1870 figure "probably" includes some "inactive persons."

PA : Krantz and Nilsson, Swedish National Product 1861-1970 (Kristianstad: CWK Gleerup, 1975). PA was created by linking the agricultural deflator series on pages 105, 111, 117, and 124

PM : Krantz and Nilsson. PM was created by linking the manufacturing deflator series on pages 107, 113, 118, and 126.

Y: Mitchell, Table K1, pp. 818 and 825.

Appendix Table 1
Basic Data

Country	Years	WGRENT	LANDLAB	CAPLAB	PAPM	PROD
AUS	1870-1874	1.064	6.428	0.011	0.217	-3.236
AUS	1875-1880	0.561	6.471	-0.052	0.167	-3.095
AUS	1880-1884	0.516	6.593	-0.098	0.132	-3.043
AUS	1885-1889	0.395	6.565	-0.130	0.108	-2.982
AUS	1890-1894	-0.044	6.285	-0.152	-0.031	-3.107
AUS	1895-1899	0.036	6.137	-0.204	0.111	-3.234
AUS	1900-1904	-0.108	6.056	-0.225	0.134	-3.194
AUS	1905-1909	-0.371	6.027	-0.223	0.216	-3.126
AUS	1910-1914	-0.330	6.024	-0.175	0.075	-3.020
USA	1870-1874	0.232	2.732	1.455	-0.144	-6.478
USA	1875-1880	0.051	2.772	1.388	-0.120	-6.413
USA	1880-1884	0.018	2.787	1.553	-0.063	-6.243
USA	1885-1889	-0.017	2.767	1.465	-0.090	-6.169
USA	1890-1894	-0.065	2.736	1.654	-0.014	-6.050
USA	1895-1899	-0.057	2.687	1.723	-0.067	-6.002
USA	1900-1904	-0.076	2.632	1.756	-0.003	-5.879
USA	1905-1909	-0.347	2.567	1.781	0.015	-5.805
USA	1910-1914	-0.606	2.529	1.843	0.087	-5.713
FRA	1870-1874	-0.433	0.154	-5.366	-0.067	0.322
FRA	1875-1880	-0.236	0.116	-5.320	0.006	0.295
FRA	1880-1884	-0.140	0.108	-5.281	0.060	0.320
FRA	1885-1889	0.081	0.082	-5.223	0.011	0.234
FRA	1890-1894	0.035	0.056	-5.161	-0.009	0.286
FRA	1895-1899	0.141	-0.071	-5.204	-0.031	0.206
FRA	1900-1904	0.244	-0.161	-5.178	-0.067	0.253
FRA	1905-1909	0.224	-0.206	-5.132	-0.054	0.352
FRA	1910-1914	0.130	-0.233	-5.059	0.026	0.547
GER	1870-1874	-0.256	#N/A	-5.466	-0.047	0.057
GER	1875-1880	-0.312	0.302	-5.382	-0.074	0.101
GER	1880-1884	-0.285	0.254	-5.313	-0.042	0.061
GER	1885-1889	-0.240	0.190	-5.247	-0.117	0.156
GER	1890-1894	-0.110	0.129	-5.163	-0.042	0.239
GER	1895-1899	-0.010	0.060	-5.072	-0.089	0.359
GER	1900-1904	-0.018	-0.012	-4.980	-0.121	0.388
GER	1905-1909	-0.045	-0.090	-4.888	-0.045	0.485
GER	1910-1914	-0.088	-0.169	-4.822	0.011	0.510
GBR	1870-1874	-0.895	0.951	-1.788	0.067	-5.530
GBR	1875-1880	-0.554	0.945	-1.676	0.185	-5.464
GBR	1880-1884	-0.257	0.922	-1.615	0.168	-5.411
GBR	1885-1889	-0.150	0.869	-1.609	0.085	-5.270
GBR	1890-1894	-0.116	0.809	-1.608	0.147	-5.201
GBR	1895-1899	-0.114	0.744	-1.573	0.061	-5.094
GBR	1900-1904	0.001	0.682	-1.482	0.000	-5.114
GBR	1905-1909	0.079	0.619	-1.428	-0.071	-5.117
GBR	1910-1914	0.218	0.571	-1.423	-0.041	-5.086
DEN	1870-1874	-0.875	0.846	#N/A	-0.152	0.159
DEN	1875-1880	-0.907	0.852	1.889	-0.102	0.184
DEN	1880-1884	-0.878	0.870	1.891	-0.061	0.350
DEN	1885-1889	-0.647	0.867	1.904	-0.064	0.425
DEN	1890-1894	-0.480	0.850	1.927	-0.005	0.560
DEN	1895-1899	-0.204	0.847	1.963	-0.034	0.704
DEN	1900-1904	-0.036	0.885	2.043	-0.082	0.802
DEN	1905-1909	-0.076	0.821	2.112	-0.054	0.912
DEN	1910-1914	-0.040	0.760	2.170	-0.051	1.017
SWE	1870-1874	-0.754	-0.170	-3.961	-0.177	-0.271
SWE	1875-1880	-0.733	-0.150	-3.897	-0.085	-0.210
SWE	1880-1884	-0.590	-0.115	-3.832	-0.076	-0.164
SWE	1885-1889	-0.456	-0.071	-3.783	-0.127	-0.084
SWE	1890-1894	-0.339	-0.047	-3.733	-0.036	0.020
SWE	1895-1899	-0.151	-0.055	-3.679	-0.060	0.178
SWE	1900-1904	-0.045	-0.083	-3.608	0.032	0.289
SWE	1905-1909	0.010	-0.145	-3.511	0.100	0.407
SWE	1910-1914	0.075	-0.191	-3.454	0.091	0.546

Notes: For variable definitions see text.

Source: See text.

Appendix Table 2
Sample Statistics: Regions

Years	Region	DWGREN	DLANLAB	DCAPLAB	DPAPM	DPROD
1875-1914	ALL	6.1%	-8.2%	8.7%	0.9%	13.9%
1875-1914	NEWWORLD	-22.1%	-9.9%	4.7%	1.6%	11.1%
1875-1914	OLDWORLD	17.3%	-7.6%	10.3%	0.6%	15.0%
1875-1914	OLDPROT	8.4%	-11.7%	11.7%	1.5%	9.4%
1875-1914	OLDFREE	23.3%	-4.8%	9.3%	0.0%	18.7%
1875-1894	ALL	9.6%	-4.7%	7.8%	0.3%	12.8%
1875-1894	NEWWORLD	-24.1%	-7.4%	5.5%	-3.0%	11.7%
1875-1894	OLDWORLD	23.1%	-3.6%	8.6%	1.7%	13.3%
1875-1894	OLDPROT	15.7%	-7.8%	12.6%	0.6%	4.3%
1875-1894	OLDFREE	28.0%	-0.8%	6.0%	2.4%	19.3%
1895-1914	ALL	3.4%	-10.9%	9.4%	1.3%	14.7%
1895-1914	NEWWORLD	-20.6%	-11.7%	4.1%	5.2%	10.6%
1895-1914	OLDWORLD	13.1%	-10.6%	11.5%	-0.2%	16.3%
1895-1914	OLDPROT	2.9%	-14.7%	11.1%	2.2%	13.3%
1895-1914	OLDFREE	19.8%	-7.9%	11.8%	-1.8%	18.3%

Notes: For variable definitions see text. D denotes a first difference of a log-level (growth rate). Means are averages of five-year period averages, expressed as growth rates per decade. Sub-samples are NEWWORLD = {AUS, USA}; OLDWORLD = {FRA, GER, GBR, DEN, SWE}; OLDPROT = {FRA, GER}; OLDFREE = {GBR, DEN, SWE}.

Source: Appendix Table 1.

Appendix Table 3
Sample Statistics: Countries

Years	Country	DWGREN	DLANDLAB	DCAPLAB	DPAPM	DPROD
1875-1914	AUS	-25.5%	-12.8%	-3.5%	-2.6%	2.1%
1875-1914	USA	-18.8%	-7.0%	13.0%	5.9%	20.0%
1875-1914	FRA	10.5%	-10.0%	7.5%	0.6%	7.2%
1875-1914	GER	6.4%	-13.4%	16.0%	2.4%	11.7%
1875-1914	GBR	22.0%	-10.7%	7.2%	-6.5%	10.8%
1875-1914	DEN	24.8%	-2.6%	8.0%	1.5%	23.8%
1875-1914	SWE	23.1%	-1.2%	12.7%	5.0%	21.6%
1875-1894	AUS	-40.4%	-12.4%	-6.7%	-13.2%	-0.8%
1875-1894	USA	-7.7%	-2.4%	17.8%	7.1%	24.2%
1875-1894	FRA	18.0%	-4.0%	10.6%	-1.0%	-0.6%
1875-1894	GER	13.4%	-11.5%	14.6%	2.1%	9.1%
1875-1894	GBR	29.2%	-9.1%	4.5%	-2.5%	17.6%
1875-1894	DEN	28.4%	-0.1%	2.6%	6.5%	25.1%
1875-1894	SWE	26.3%	6.8%	11.0%	3.3%	15.3%
1895-1914	AUS	-14.3%	-13.0%	-1.1%	5.3%	4.3%
1895-1914	USA	-27.0%	-10.4%	9.4%	5.0%	16.9%
1895-1914	FRA	4.8%	-14.4%	5.1%	1.8%	13.1%
1895-1914	GER	1.1%	-14.9%	17.1%	2.6%	13.6%
1895-1914	GBR	16.7%	-11.9%	9.3%	-9.4%	5.8%
1895-1914	DEN	22.0%	-4.5%	12.2%	-2.3%	22.9%
1895-1914	SWE	20.7%	-7.2%	13.9%	6.3%	26.3%

Notes: For variable definitions see text. D denotes a first difference of a log-level (growth rate). Means are averages of five-year period averages, expressed as growth rates per decade.

Source: Appendix Table 1.