FACTOR PRICE CONVERGENCE IN THE LATE NINETEENTH CENTURY*

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Abstract

We examine a dramatic historical episode of factor price convergence in the late nineteenth century. Our focus is convergence between Old World and New, and the analysis centers on land and labor. Wage-rental ratios boomed in the Old World and collapsed in the New, moving the resource-rich, labor-scarce New World closer to the resource-scarce, labor-abundant Old World. We use econometrics and simulations to identify pro-convergence forces which include commodity price convergence, factor accumulation, and factor-saving biases. The results confirm that open-economy characteristics and international market integration are important sources of convergence.

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1. FACTOR PRICES AND CONVERGENCE IN THE LONG RUN

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 convergence has a very long history. Under the leadership of William Baumol (Baumol, Blackman, and Wolff 1989), Robert Barro (1991; Barro and Sala-i-Martin 1991) and many others, the literature on post-World War II economic convergence has reached enormous proportions, but few economists in this new tradition pay serious attention to history. This seems surprising: after all, the literature was initiated by economic historians like Alexander Gerschenkron (1952) and Moses Abramovitz (1986) with a keen view of the long run. Furthermore, few 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 nineteenth century pay considerable attention to trade, capital flows, and migration, but pay little attention to their impact on convergence. This paper bridges the gap.

When measured by GDP per capita, labor productivity per worker-hour, or real wages, currently-industrialized nations have converged on one another, at least since 1870 (Maddison 1982; Abramovitz 1986; Baumol, Blackman, and Wolff 1989; De Long 1988; Williamson 1995). However, the convergence did not take place without interruption: 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"; long-run convergence slowed down and eventually 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 convergence resumed after World War II while international trade and capital flows gradually regained pre-World War I levels of integration, and guest workers and illegals pushed migrations back towards pre-quota levels.

A 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 experiences with human capital accumulation and technical progress, but most shared something in common—their integration into world 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 GDP per capita and labor productivity. 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 factor-price convergence.

Why should factor-price convergence matter for the broader convergence debate, a debate usually concerned with the convergence properties of an aggregate indicator like GDP per worker? It matters crucially, since aggregates like GDP are, by definition, a collection of endowments weighted by factor prices. In a more disaggregative view, the *absolute* convergence in the levels of variables like GDP per worker or real wages depends on the *relative* convergence of the whole set of factor prices. For example, let Y be GDP, P the price level of GDP, v_i the endowment of factor i (where v_L=L, the endowment of homogeneous labor), and let w_i be the price of factor i (where w_L= W, the wage of labor). The factor-income definition of GDP implies that $P\,Y = \Sigma_i\, w_i\, v_i$. By rearrangement of this identity,

$$(1) \qquad \frac{Y}{L} = \frac{W}{P}\left(1 + \sum_{i \neq L} \frac{w_i}{w_L}\frac{v_i}{v_L}\right).$$

Thus, the convergence of absolute labor-productivity (Y/L), so commonly studied in the literature, may be accounted for by absolute convergence in real wages (W/P), or by relative convergence in factor endowments (v_i/v_L) or factor prices (w_i/w_L).[i] This decomposition has a

[i] In a standard profit maximizing framework with constant returns to scale, we expect $w_i(v_1,v_2,\ldots)$ to be homogeneous of degree zero. We may then write $w_i/w_L = w_i/w_L(v_1/v_L, v_2/v_L, \ldots)$.

natural appeal when considering the process of convergence in the greater Atlantic economy of the late nineteenth century. Mass migrations were the result of global labor-market integration which brought about absolute real wage convergence. Meanwhile, international capital and labor mobility entailed both factors chasing abundant resources at the New World frontier, an international factor reallocation which raised labor-land and capital-land ratios in the New World toward those in the Old World—that is, it caused relative factor endowment convergence, and, *ceteris paribus*, a convergence in relative factor prices associated with the leveling of factor scarcities across countries (Williamson 1995; O'Rourke and Williamson 1994; Taylor and Williamson 1994).

This paper uses standard trade-theoretic approaches to understand the determinants of factor price convergence. The period of interest is the late nineteenth century, when economic convergence among the current OECD countries (and in the "greater Atlantic economy") was dramatic; 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 analysis centers on land and labor, the two most important factors of production in the nineteenth century. Section 2 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 3 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? The remainder of the paper brings evidence to bear on theory: Section 4 attacks the problem with econometrics and Section 5 complements the argument with simulations using applied computable general-equilibrium models. We conclude with an assessment and a research agenda.

2. THE WAGE-RENTAL RATIO CONVERGENCE FACTS

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 and how the gap evolved over time. The latter is resolved by the evidence on the ratio of wages to land values 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 1995), 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).[ii]

[ii] As Appendix 1 points out, we also have no choice but to use land values as a proxy for land rents for the late nineteenth 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 nineteenth 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 nineteenth 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 nineteenth 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; Obstfeld 1994), they may have been less so vis-à-vis the periphery (like Spain). Furthermore, global financial markets became *better* integrated as the late nineteenth 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 nineteenth century wage-rental ratio convergence documented in Figures 1–3 would persist if properly measured by land rents.

The figures draw on a late-nineteenth century panel data-set we have constructed documenting wage-rental convergence among eleven countries. Four New World countries are plotted in Figure 1—Argentina, Australia, Canada and the United States; four "free trade" Old World countries in Figure 2—Denmark, Great Britain, Ireland and Sweden; and three "protectionist" Old World countries in Figure 3—France, Germany and Spain. The data is fully documented in the Appendix. A word is in order concerning 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, and as the new theories of endogenous tariffs predict, the response was especially strong on the continent. But comparative measures of late nineteenth 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 1989, p. 22–23) 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. While these categories could be, and have been, debated (Nye 1991; Irwin 1993; O'Rourke forthcoming), they serve well enough to motivate what follows.

[Tables 1–2 and Figures 1–3 about here]

What does the evidence reveal? 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 1901=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 by a factor of four, from about 2.5 to about 0.6.

3. THEORY

What explains this impressive relative factor-price convergence?

First, one might appeal to the discovery and exploitation of land and resources at the open frontiers in the New World. As Peter Lindert (1988, pp. 1–26) has 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 restored. David Ricardo and John Stuart Mill told similar, but more explicit, stories. Yet what of the "safety valve" of emigration? Since Europeans moved to New World land in massive numbers in the late nineteenth century, wage-rental ratios should have fallen by much more in the New World than in Europe, a Mill-Ricardo argument that should help account for the opposing factor-price trends in these two parts of the world. Latin American scholars have argued thus to explain the late nineteenth century fall in wage-rental ratios there.[iii] In the

[iii] Carlos Díaz-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

Australian literature, Sinclair (1976, especially p. 5) sketched a model based explicitly on relative resource abundance and international factor transfer between core and periphery. The paradigm, dating back to Mill (1848), places emphasis on international factor reallocation as the mechanics by which a fundamental disequilibrium is resolved: capital and labor chase higher returns (and each other) migrating from the Old World to the New.[iv]

Second, one could explore accumulation forces. To the extent that physical and human capital (skills) are used more intensively in industry than agriculture, rapid accumulation (associated with the industrial revolution) should favor the relative expansion of industry and the relative demand for labor, thus raising the wage-rental ratio. Together, accumulation and factor-mobility effects such as those just mentioned play a key role in today's multi-sector trade models. Endowments (or factor intensities)—whether measured by land-labor ratios or capital-labor ratios—constitute a key exogenous force in all variants of the Ricardo-Viner (sector-specific-factor) and Heckscher-Ohlin (mobile-factor) models of trade.

Third, one might invoke other (non-endowment) economic forces associated with 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

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emigration to Argentina" (pp. 21–22). However, recent evidence on Argentine immigration (Taylor 1994) and European emigration (Hatton and Williamosn 1994) is inconsistent with this thesis. Certainly, 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 São Paulo and Santos areas 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).

[iv] Sinclair's model drew its inspiration from Butlin (1964). Much of existing Australian literature follows in this Mill-Ricardo tradition. While Ian McLean (1990, p. 8) offers a 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 (1927) used it effectively for Canada, and it has found a welcome home in writings on other settler economies (Green and Urquhart 1976; Schedvin 1990).

tends to lower the relative price of industrial goods.[v] 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 relative to the New World 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 nineteenth century New World was labor-saving and land-using, as an 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.[vi]

Fourth, one might have recourse to trade theory, where the factor-price-equalization theorem has been a durable tool for seventy years.[vii] 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. Should falling transport costs (unimpeded by any protective reaction from importing countries) tend to equalize prices of traded commodities, then countries will tend to 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

[v] 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.

[vi] The intertemporal application of the induced-innovation hypothesis reappears in cross-sectional accounts of trade patterns in the 1980s (Trefler 1993).

[vii] The remainder of this section draws on O'Rourke and Williamson (1994).

ambiguous about how much.[viii] Moreover, as a classic article by Mundell (1957) argued, countries attempting to insulate themselves from such forces via protection might stimulate additional capital and labor flows, which would have the same ultimate effect.[ix] 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 nineteenth 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 nineteenth 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*?

This list of potential sources of factor price convergence provokes several questions. We can think of three key issues. Were factor endowments major determinants of trade and factor prices in the late nineteenth century? Was there pronounced commodity-price convergence in the late nineteenth century? If the first two propositions hold, did factor-endowment and commodity-price trends make a significant contribution to the observed factor price (wage-rental) convergence? The last question is the main focus of our paper, but answers to the first two questions certainly bear on the validity of our approach.

Consider the first question. Several recent papers have analyzed the determinants of comparative advantage in British and American manufacturing in the late nineteenth century.

[viii] Given the attention which trade theory has paid to the factor-price equalization theorem, it is surprising that a recent survey by Rassekh and Thompson (1993, pp. 11–12) could report that the theorem had received no empirical attention prior to the 1980s.

[ix] Although it should be noted that in the context of the late nineteenth century, when capital and labor both chased New World land, pushing back the frontier in the process, trade and factor flows may actually have been complements rather than substitutes.

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 Estevadeordal (1993) 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.[x]

Consider the second question. Economic historians have long been aware of the revolutionary decline in transport costs underlying overseas trade in the late nineteenth 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 Knick Harley (1988).[xi]

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[x] Also note that Whitney (1968) found no evidence of a Leontief paradox in the United States using 1899 data. Leamer (1980) has argued, of course, that there was never a paradox even in Leontief's data.

[xi] 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: while Liverpool grain prices exceeded Chicago prices by 60 percent in 1870, the spread was only 14 percent in 1912 (O'Rourke and Williamson 1994). The price gap for meat and animal fats declined from 93 percent to 18 percent over the same period, the gap for iron products fell from 80 to 20 percent, for 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, then, are broadly in the affirmative. What remains is the third question. How much of the late nineteenth century wage-rental convergence documented in Figures 1–3 can be accounted for by commodity-price convergence (Heckscher-Ohlin factor-price equalization effects); how much by trends in land-labor and capital-labor ratios; and how much by other forces like productivity bias?

4. AN ECONOMETRIC APPROACH

Insights from the Heckscher-Ohlin and Ricardo-Viner open-economy models concerning the determinants of wage-rental-ratio convergence across the late nineteenth century can be applied by estimating factor-price equations. For example, consider any multi-sector model in a standard open-economy revenue-maximizing framework (cf. Dixit and Norman 1980, ch. 2). With constant returns to scale, we would expect general factor-price functions of the form

(2) $w_j = \alpha_j f_j(v_j, p_i)$, with f_j homogeneous degree 0 in v_j, degree 1 in p_i,

where the v_j and w_j are vectors representing the endowments and prices of factors j, p_i is a vector of prices of (traded) final goods i, and α_j represents a factor-specific shift term for each j. Given factor endowments relative to a base factor endowment v_j/v_0 and final good prices relative to a base final good price p_i/p_0, it is then straightforward to derive a general *relative* factor price function of the form

(3) $(w_j/w_{j'}) = (\alpha_j/\alpha_{j'})\, g_{j\,j'}(v_j/v_0, p_i/p_0)$, with $g_{j\,j'}$ homogeneous degree 0 in v_j and in p_i.

Our estimation relies on such a model, where $(w_j/w_{j'})$ is the ratio of the wage to the value of land. In our interpretation, $(\alpha_j/\alpha_{j'})$ represents factor-saving effects arising from productivity bias, for example. The arguments v_j/v_0 include land-labor and capital-labor ratios, and p_i/p_0 measures the terms of trade between agricultural and manufacturing goods. Formally, given the data available, we adopted a specification of the form

(4) $\mathrm{WGRENT}_{it} = \beta_{0i} + \beta_1\, \mathrm{LANDLAB}_{it} + \beta_2\, \mathrm{CAPLAB}_{it} + \beta_{3i}\, \mathrm{PAPM}_{it} + \beta_4\, \mathrm{PROD}_{it}$,

where for each country i, in period t, we define the variables in natural logarithms:

WGRENT_{it} = log of the wage-rental ratio (nominal wage divided by nominal value of land);

$LANDLAB_{it}$ = log of the land-labor ratio (quantity of land divided by labor force);

$CAPLAB_{it}$ = log of the capital-labor ratio (capital stock divided by labor force);

$PAPM_{it}$ = log of the terms of trade (agricultural goods price divided by manufacturing goods price);

$PROD_{it}$ = a Solovian residual (log of output per worker minus 0.4 times CAPLAB minus 0.1 times LANDLAB).[xii]

Since relative factor prices appear on the left-hand side of equation (4), relative commodity prices and relative factor endowments (land-labor and capital-labor ratios) are appropriate for the right-hand side. 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 (see Appendix; data scarcity forces us to exclude Argentina, Canada, Ireland and Spain). Such data are not entirely comparable internationally (for example, we have no way to correct for varying land quality), so an index-number interpretation must be given to each series, and the estimation of (4) in log-levels must include fixed-effect coefficients to mop up the proportionality constants for each country.

Given the stress which contemporaries, historians, Heckscher and Ohlin have placed on commodity prices, it might be useful to say a few words about PAPM. According to that literature, the link between the relative price of tradable agricultural goods (principally, grains) and the wage-rental ratio was often broken by two events. First, tariffs often raised domestic farm prices far above world prices, breaking down the influence of commodity-price convergence. Second, relatively non-tradable farm products (like meat, butter and vegetables) increased their share of farm output while undergoing a less dramatic price convergence, and thus the output switch often served to mute the impact of the more tradable farm-commodity (grain) price convergence. PAPM should include both influences: the impact of tariffs should be

[xii] That is , we take land's share as 10% of income, capital's share as 40%, and labor's share implicitly 50%. These shares are not unreasonable for the "greater Atlantic economy" of the late nineteenth century. See Taylor and Williamson (1994), where evidence on factor shares is discussed.

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 PAPM time series in our data base always obey these rules. One way to find out is to allow country dummy variables to interact with PAPM in the regression, yielding country-specific estimates in the form of the β_{3i} coefficients.[xiii]

What about the expected signs of the coefficients in the equation (4)? The Ricardo-Viner (specific factors) model, or, more generally, the three-factor two-good model, is the natural framework within which to answer the question. In this 3×2 context, land and capital are the two 'extreme' factors associated with agriculture and manufacturing respectively, and labor is the 'middle' factor. With more goods than factors, factor-price equalization does not hold, and endowments influence factor prices. Roy Ruffin (1981) shows that in general land and capital are 'enemies,' and that both are 'friends' with labor. Thus, increases in land and capital endowments increase wages and reduce rents, while increases in labor endowments lower wages and increase rents: both β_1 and β_2 should be positive.

Theory is ambiguous about the sign of the β_{3i} coefficients, however. It seems intuitive that increasing the price of agricultural goods should raise rents more than wages, and lower the wage-rental ratio; but Henry Thompson (1985, 1986) has shown that commodity price changes can have counterintuitive effects on factor prices in a 3×2 setting: an increased price of food could actually lower rents, rather than increase them. The sign of β_4 is also indeterminate, and depends on the workings of PROD, a Solovian residual, introduced as a proxy for productivity-enhancing technological forces. If the forces were land-saving (as seems likely in the land-scarce Old World), then we would expect $\beta_4 > 0$; if, instead, the forces were labor-saving (as seems likely in the labor-scarce New World), then we ought to see $\beta_4 < 0$.

[xiii] Of course, one could allow country dummies to interact with *all* of the right-hand side variables—except that scarce degrees of freedom would be completely exhausted. An alternative is to interact each right-hand side variable (LANDLAB, CAPLAB, PAPM, PROD) individually with country dummies, and test for pooling. The results suggest that the PAPM interaction is the most significant of all in terms of cross-country slope-coefficient variation.

[Table 3 about here]

Table 3 presents the econometric evidence, where the panel data is drawn from a sample of seven countries using five-year period averages from 1870 to 1914. Estimation is by OLS using fixed effects—the variables had country means removed before the regression. The first column reports the results for the pooled sample of all seven countries. In all cases the PAPM variable is allowed to interact with a country dummy since F-tests of restrictions indicate that the PAPM coefficients vary significantly across countries. An F-test clearly indicates that the New World and the Old World have different structures, and thus should be treated separately, as in columns 2 and 3. The results are quite good: of the 23 estimated coefficients, 19 have the correct sign; most of the 19 pass conventional significance tests; and those with the wrong sign (PAPM coefficients for Australia and Denmark) are not even weakly significant. The variance explained is quite high: country dummies (intercepts) have already been removed but still the R^2 is over .8 in all cases. Panel Durbin-Watson statistics (DW) do not differ significantly from 2; thus serial correlation is not an issue, and cointegration problems do not arise.[xiv] The cointegration properties of the estimated equation (4), as always only weakly testable, justify our specification and an interpretation of the results as estimates of long-run equilibrium factor-price equations. Moreover, if the variables are truly cointegrated we can finesse the question of simultaneity bias: although the right-hand side variables in (4) are surely endogenous—and in ways that are certainly of interest for questions of trade and factor-flow analysis—the standard properties of a cointegrating regression allow us to accept our β estimates as consistent (Hamilton 1994, p. 588).

[xiv] Several diagnostic tests were undertaken to verify the cointegration property, although the small sample meant that the tests were inevitably weak. First, following the Sargan-Bhargava procedure, we found that the Durbin-Watson statistic is significantly greater than zero in all cases (the 1% critical value is DW = 0.46; see Mills 1990, p. 272). Second, we implemented the standard Dickey-Fuller and Phillips-Perron tests, both of which strongly rejected the null hypothesis of a unit root (we used tests with a constant but no time trend; and we used the test statistic $T(\rho-1)$; see Hamilton 1994, Ch. 17). Third, we applied a standard Bayes test that provided further evidence in favor of accepting the cointegration hypothesis (we used the standard RATS implementation of this test).

Broadly speaking, we interpret these results as strong support for both the Ricardo-Viner *and* Heckscher-Ohlin theories: 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 impact is usually greater than unity when significant—a corollary of what trade theorists call the magnification effect (Jones, 1965).[xv] Economy-wide 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 (+0.71, column 1), it was labor-saving in the New World (–0.85, column 2) and land-saving in the Old World (+1.05, column 3), a finding consistent with the induced-innovation hypothesis.

So much for statistical significance, but what of quantitative significance? How important were the various forces in contributing to the dramatic convergence in wage-rental ratios? Table 4 offers some surprising answers. Panel A reports the actual trends (log change per decade) in the wage-rental ratio and all four right-hand side variables for each country. Panel B lists the regression coefficients from the sub-samples (Table 3, columns 2 and 3), used in the subsequent decomposition analysis (reported in Panels C and D). The decomposition analysis simply multiplies the changes in the right-hand side variables (Panel A) by the regression coefficients (Panel B), allowing us to infer what forces were doing most of the work in driving trends in wage-rental ratios across the late nineteenth century.

[Table 4 about here]

Consider first a pairwise comparison—the results for the USA and Britain. The increase in PAPM in America (+0.059 per decade) and its decrease in Britain (–0.065 per decade) reveal a dramatic price convergence, one that accounts for a large share of the Anglo-American wage-

[xv] 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. We do, however, have an explanation for the perverse Danish result, and we will discuss it at length below.

rental convergence. Almost two thirds of the fall in the American wage-rental ratio is explained by PAPM (Panel C: 61.3 percent), while it accounts for about one third of the rise in the British ratio (Panel C: 36.9 percent). Combining the two, we find that about half of the Anglo-American convergence in the wage-rental ratio is explained by commodity-price convergence (Panel D: 48.1 percent). Thus, the Heckscher-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 percent): there is no support for the closing-the-frontier thesis here. Capital-deepening also contributes nothing to convergence: in fact, it makes for divergence (Panel D: –23.2 percent). There is, however, a strong factor-saving bias underlying Anglo-American productivity advance: a labor-saving bias accounted for 70.4 percent of the fall in the American wage-rental ratio and a land-saving bias accounted for 42.7 percent of the rise in the British wage-rental ratio (Panel C); the combination accounted for about half of the convergence (Panel D: 55.4 percent), leaving a residual of one fifth unexplained. The powerful Anglo-American factor-saving effects are consistent with the qualitative assertions of economic historians.

A factor-saving bias in productivity change and commodity-price convergence were the prime movers underlying the spectacular late nineteenth century wage-rental ratio convergence on the Anglo-American axis. Experience was, however, a bit different elsewhere. Commodity-price convergence didn't matter as much, and factor accumulation mattered more. Small values under PAPM in Panel C could, of course, simply reflect protectionist policies, at least on the continent; but not only are the values small, they are of the "wrong" sign (for example, wage-rental ratios were rising in France, Germany and Sweden, but trends in PAPM were serving to *lower* them; Denmark has a perverse PAPM trend *and* a badly signed coefficient, but two wrongs don't make a right). Such results could be explained by more-than-offsetting tariffs. They 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 *negative* entries for Sweden (Panel C: –0.032 per decade), given that the factor-price-equalization theorem was

constructed by two Swedes.[xvi] 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 (Panel D, row 1). Changing land-labor ratios accounted for none of the wage-rental ratio convergence (indeed, these effects were countervailing: –2.6 percent), while capital-deepening accounted for about one eighth (12.7 percent). These endowment influences offer mild support for the Ricardo-Viner model. Commodity-price convergence accounted for about a quarter of the wage-rental ratio convergence (25.5 percent), offering stronger support for Heckscher and Ohlin. Factor-saving productivity advance exerted a strong influence on wage-rental ratio convergence (45.9 percent), highlighting the importance of innovation induced by factor scarcities.

5. ANGLO-AMERICAN CONVERGENCE: A CGE ACCOUNTING

How robust might our results be? A complementary way to explore the determinants of wage-rental ratio convergence is to apply counterfactual simulation analysis to multi-sector, open-economy, computable general equilibrium (CGE) models. This section will now apply such models to Anglo-American experience.[xvii] True, Britain and the United States are only two countries of the eleven for which we have wage-rental ratio data, and we have seen that these two countries may have been unusual. Nevertheless, it seems useful to compare the implications of the CGE simulation approach with the econometric results in Section 4.

[xvi] The true test of the factor-price-equalization theorem is, of course, the Swedish coefficient on PAPM in Table 4 (columns 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.

[xvii] The models are fully documented in a paper by two of the present authors which isolates the impact of late nineteenth century commodity-price convergence on the shrinking Anglo-American real wage gap (O'Rourke and Williamson 1994).

The British and the U.S. models include tradable commodities (agricultural and non-agricultural) and non-tradable services.[xviii] Britain imports, and the US exports, food and raw materials such as cotton, the latter a key input into manufacturing in both economies. Britain exports, and the US imports, manufactured goods. Factor endowments and technologies are taken as given, as are the relative prices of traded goods.[xix] The two models are calibrated to data for 1870–71.

[Table 5 about here]

Table 5 reports the results; for the sake of comparison, panel A reports the actual movements in real wages, rents, and the wage-rental ratio. We start with the influence of commodity prices and the Heckscher-Ohlin hypothesis. Panel C reports the impact of the Anglo-American commodity-price convergence discussed in Section 3 on nominal factor returns in Britain and the United States. Commodity-price convergence raised agricultural prices in the US and lowered them in Britain, while having the opposite effects on manufactured goods prices in the two countries. Not surprisingly, the result was that rents fell in Britain and rose in the US, while returns to capital (not shown) increased in Britain relative to the US. The effect in both countries on nominal wages was positive. However, food was a key consumption good in this period, and so these commodity price shocks reduced the consumer price index in Britain and increased it in the US. The net effect was to increase real British wages by 20.3 percent, while leaving US real wages relatively unaffected (Panel D). Commodity price shocks increased the British wage-rental ratio by 152.3 percent, and lowered the US ratio by 10.6 percent: they can thus explain over two thirds of the rise in the British wage-rental ratio and a bit less than a fifth of the fall in the US wage-rental ratio. Relative to the US, the British wage-rental ratio increased by 674.9 percent in the late nineteenth century (Panel E), and commodity price convergence

[xviii] In the US model, agricultural intermediate goods such as cotton are separated out from the rest of agriculture to take account of US market power in these commodities.

[xix] Cotton exports face a downward sloping world demand curve; and US manufactures substitute imperfectly with imported manufactures in consumption.

explains a fair share of this impressive factor price convergence: roughly one quarter (182.2 percent).[xx]

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).[xxi] Relative trends in land-labor ratios on their own should thus have led to wage-rental ratios *falling* in Britain relative to the US, not rising. What about capital accumulation and the rate of capital deepening, as well as the export of capital and labor from Britain to the US and elsewhere? While capital accumulation *was* faster in America, the differences do not seem to be very large. Capital-labor ratios actually moved very similarly in the two countries in the late nineteenth century. In short, it looks like changing factor endowments cannot account for much of the wage-rental convergence. Looks can be deceiving, however: these two economies had vastly different structures, agriculture being very big in America and very small in Britain. Panel B in Table 5 nets out the influences of these changing endowments. The combined increase in capital, labor and land in America served to raise the wage by 20 percent and rents by 36.7 percent, thus lowering the wage-rental ratio. In Britain,

[xx] Why does commodity-price convergence have a bigger impact on the British economy than on the US economy? We can think of at least three reasons. First, Britain was a much more open economy than was the US: imports accounted for roughly a quarter of British GDP in 1870, whereas they accounted for less than ten percent of US GDP. Second, the US was more technologically dynamic than Britain, and so it makes sense that the forces we have been exploring explain a smaller proportion of the US experience. Third, we may have understated American commodity-price convergence by focusing on price gaps between big midwestern cities and Europe. Price gaps between the farmgate and Chicago or Cincinnati probably declined by more than price gaps between those cities and London.

[xxi] The relevant data is as follows, for 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

endowment trends led to wages increasing by 24 percent and rents by 10.1 percent, implying an increase in the wage-rental ratio. Endowment trends *did* therefore lead to wage-rental convergence. How can this paradoxical finding be explained? In both countries, falling land-labor ratios had the standard classical effect of lowering the wage-rental ratio, while rising capital-labor ratios had the opposite effect. In Britain, agriculture was insignificant enough that the former effect was swamped by the latter: in America, however, agriculture mattered enough that land-labor effects dominated.

In summary, according to the CGE accounting, endowment changes explain almost 6 percent of the increase in the British wage-rental ratio, 21 percent of the decline in the US wage-rental ratio, and a little more than 4 percent of the increase in the wage-rental ratio in Britain relative to the US. Together, commodity price and endowment trends can explain 85 percent of the increase in the British wage-rental ratio, 36 percent of the fall in the US ratio, and 39 percent of the relative increase in the British ratio. The residual unaccounted for by these forces might plausibly be attributed to cross-country biases in technological change, an exogenous determinant omitted from the CGE analysis but apparent in the New World-Old World econometric results. Overall, the CGE results are consistent with the econometric findings presented earlier, and exhibit similar orders of magnitude for commodity-price effects (explaining 20 to 50 percent of factor price convergence) and factor-endowment effects (explaining less than 10 percent).

6. ASSESSMENT AND AGENDA

Economic convergence within the currently industrialized OECD countries has been taking place for at least a century, and the late nineteenth century was one important part of that experience. Convergence has been manifested in absolute form by aggregates like GDP per capita and GDP per man-hour. More importantly, it was also manifested by relative 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? Our results confirm the empirical relevance of standard trade models in explaining the evolution of factor prices in the late-nineteenth century world economy. While factor markets were becoming increasingly integrated during this period, trade and technological change acted as substitutes for factor migration in driving the world economy toward factor price equilibrium. This conclusion also applies to absolute convergence in GDP per worker or GDP per capita levels since these variables, used so often in the convergence debate, are just a weighted average of individual factor prices. The late-nineteenth century trade boom saw the convergence of commodity prices, and the factor-price-equalization theorem 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 relatively weak. We expected a bigger contribution given the mass migrations to the New World, but apparently these forces were partially offset by a quickening in accumulation and land settlement.[xxii] A third 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.

[xxii] Endogenous expanding New World frontiers and capital stocks clearly represented a source of *divergence* in the late nineteenth century (Taylor 1995; Taylor and Williamson 1994; Williamson 1995).

Future research on these issues might proceed in several directions. We think it would be desirable to augment our late nineteenth century database to include more countries, like Argentina in the New World and the Mediterranean in the Old. We would also welcome more detailed assessments of individual country experience, including growth and structural change in response to commodity-price convergence and factor-saving bias, the accumulation of labor and capital, and endogenous frontier dynamics, the latter being particularly relevant in the New World. We also see a natural extension of the analysis to the interwar years when open-economy pro-convergence forces collapsed—with a move toward protectionist trade policies, migration restrictions, and turbulent international capital markets—and when long-run convergence trends were reversed, at least for a time. Finally, we think it is surely time to implement the same kind of analysis for the past four decades of rising globalization.

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APPENDIX

The derived variables used in the econometric analysis in this study are shown in Table 6, and this appendix documents the sources of the underlying data.

[Table 6 about here]

1. DATA SOURCES FOR WAGE-RENTAL RATIOS

What follows are the sources for the wage-rental (WGRENT) ratios reported in the text. The data cover eleven late nineteenth 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 (1995). 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. The wage-to-land-value ratio is indexed on 1911=100 (except Spain, 1907=100) and a three-year moving average is used (where possible) when the series are displayed in Figures 1–3.

ARGENTINA

Land Values: Prices from sales of rural land in Buenos Aires province, per hectare. R. Cortés Conde, *El progresso argentino, 1880–1914* (Buenos Aires: Editorial Sudamericana, 1979), Table 3.8, p. 164 and Table 3.10, p. 166.

AUSTRALIA

Land Values: Local government assessments of rural land, implicit price, pounds per acre, Victoria. A. 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. 1901, and 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.

BRITAIN

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." 1881–1920, land rents from 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. The land rents were converted to land values using the expression, value = rent/interest rate, using 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.

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.

DENMARK

Land Values: 1845–1900: Land prices per Tønder Hartkorn, in Kroner. J. Christensen, *Landbostatistik: Handbog I Dansk Landbohistorisk Statistik 1830–1900*, Landbohistorisk Selskab, Copenhagen, 1985, Table VII.2, pp.106–107. 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. H.C. Johansen, *Danmarks Historie, Bind 9, Økonomisk Statistik, 1814–1980* (Gyldendal: Copenhagen, 1985), Table 7.5, pp.294–295, column 2, ore per hour.

FRANCE

Land Values: Land price series for Argences, a sub-region. M. 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

GERMANY

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

IRELAND

Land Values: 1854–1908: Agricultural rent income in 1854, 1876, and 1908 from C. Ó Gráda, *Ireland Before and After the Famine: Explorations in Economic History, 1800–1925* (Manchester: Manchester University Press, 1988), Table 33, p. 130; total acreage of agricultural land under cultivation for the same years from Mitchell (*British Historical Statistics*, pp. 190–1). Dividing the former by the latter gives an estimate of rent per acre as: 1854, 0.663; 1876, 0.763; and 1908, 0.545. 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 Ó Gráda series at 1908. The rents were not converted to values by any interest rate adjustment.
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.

SPAIN

Land Values: Land rents from J. Carmona, *El comportamiento económico de la nobleza española 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 Córdoba areas. (1900/04=100) The land rents were converted to land values using the expression, value = rent/interest rate. Interest rate for 1867–1873 is British consol rate: Mitchell and Deane, *Abstract* (1962), Table 8, p. 455; for 1874–1882 is Spanish discount rate:

Estadísticas historicas de España: Siglos XIX–XX (Madrid: Fundación Banco Exterior, 1989), Table 9.8, p. 388; for 1883–1920 is Spanish interest rate: P.M. Aceña and L. Prados de la Escosura (eds.), *La nueva historia económica en España* (Madrid: Editorial Tecnos, 1985), Table 9, p. 278. These three series were linked together and then used to convert land rents into land values.

SWEDEN

Land Values: Kroner per hectare. E. Lindahl, E. Dahlgreen, and K. 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. G. Bagge, E. Lundberg, and I. Svennilson [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.

UNITED STATES

Land Values: Nominal, purchase-value of farmland per acre, in dollars. P. 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.

2. DATA SOURCES FOR EXPLANATORY VARIABLES

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), Ireland (IRL), Spain (SPA), and Sweden (SWE) in the Old World. However, due to missing information, the following are excluded from the analysis: Argentina, Canada, Ireland and Spain. The data is annual 1870-1914 wherever possible. Missing years were subject to interpolation along an exponential trend. Variables are:

W: nominal wage index (see Appendix section 1)
VLAND: nominal land value index (see Appendix section 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 were derived:

WGRENT = ln (W/VLAND)
LANDLAB = ln (LAND/L)
CAPLAB = ln (K/L)
PAPM = ln (PA/PM)
PROD = a Solovian productivity residual calculated according to the formula

$$\ln (Y/L) - 0.4 \ln (K/L) - 0.1 \ln (LAND/L)$$

AUSTRALIA

LAND: Land use in all colonies/states, excluding territories. W. Vamplew, ed., *Australians: Historical Statistics* (Broadway, NSW: Fairfax, Syme & Weldon, 1987), p. 73.

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

L: Total work force. Vamplew, p. 147.

PA: Geometric mean of the price index of pastoral and agricultural components of GDP, weights corresponding to current price GDP share of each component. Vamplew, pp. 133 and 217.
PM: Price index of the manufacturing component of GDP. Vamplew, p. 217.
Y: Real GDP index. A. Maddison, *Phases of Capitalist Development*, (Oxford: Oxford University Press, 1982), pp. 172 & 174.

BRITAIN

LAND: Acreage of crops, rotation grasses, permanent pasture, and fallow. B.R. Mitchell and P. Deane, *Abstract of British Historical Statistics* (Cambridge: Cambridge University Press, 1962), pp. 78–79.
K: Net stock of capital in millions of pounds at 1900 prices. Charles H. Feinstein and Sidney Pollard, eds., *Studies in Capital Formation in the United Kingdom, 1750–1920* (Oxford: Clarendon Press, 1988), Table VIII, column 7, pp. 441–443.
L: Total labor force. Mitchell and Deane, Table 1, p. 60.
PA: The Rousseaux Price Index for total agricultural products. Mitchell and Deane, Prices Table 3, column 3, pp. 471–473.
PM: Price index for principal industrial products, average of 1865 and 1885 equals 100. Mitchell and Deane, Table 3, column 4, pp. 471–473.
Y: Total net national income at 1900 prices, in millions of pounds. Mitchell and Deane, Table 2, column 3, pp. 367–368.

DENMARK

LAND: Total agricultural area. H.C. Johansen, *Danmarks Historie, Bind 9: Dansk Økonomisk Statistik 1814–1980* (Copenhagen: Gyldendalske Boghandel, 1985), Table 2.2, column 7, p. 129.
K: Total capital in millions of 1929 krone. Niels Kaergard, *Økonomisk Vaekst: En Økonometrisk Analyse af Danmark 1870–1981* (Copenhagen: Jurist-og Økonomforbundets Forlag, 1991), Table 7, column 6, pp. 516.
L: Labor force in thousands. Svend Aage Hansen, *Økonomisk Vaekst i Danmark, Bind 2: 1914–1983* (Copenhagen: University of Copenhagen, 1983), Table 1, column 5, pp. 229–231.
PA: Total agricultural production price index. 1870–1900 from Hansen, Table 18, column 11, pp. 323–324. 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: Wholesale price index. Johansen, Table 8.1, pp. 298–301, column 4 is used for 1876 to 1913. For 1870 to 1875, column 1 (consumer price index) was linked with column 4.
Y: GNP in million krone at constant 1929 prices. Mitchell, *European Historical Statistics*, Table K1, column 3, pp. 817 and 820.

FRANCE

LAND: Arable land is used as a proxy. B.R. Mitchell, *European Historical Statistics 1750-1975*, 2nd revised edn. (New York: Facts on File, 1981). 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, pp. 298 and 300, in thousands of hectares.
K: The capital stock series was created by deflating Levy-Leboyer and Bourguignon's agricultural and nonagricultural fixed capital stock series (in thousand million francs) in Table 7.8 with their price series in Table A-IV, and then weighting the series by their respective GDP shares, taken from Table A-I. 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, p. 277; Table A-I, pp. 312–16; Table A-IV, pp. 327–331.
L, selected dates: Mitchell, *European Historical Statistics*, 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, p. 294, active population in millions. The above two series were interpolated.
PA: Price index for agriculture, 1908–12 base. Levy-Leboyer and Bourguinon, Table A-IV, column 6, pp. 327-331.
PM: Price index for industry, 1908–12 base. Levy-Leboyer and Bourguinon, Table A-IV, column 7, pp. 327–331.
Y: Real GDP index. Maddison, pp. 172 and 174.

GERMANY

LAND: Land planted with crops plus fallow, pasture, and miscellaneous land areas. W.G. Hoffmann, *Das Wachstum Der Deutschen Wirtschaft Seit Der Mitte Des 19. Jahrhunderts* (Berlin: Springer-Verlag, 1965), Table 48, column 19, pp. 272–273.
K: Capital stock in constant 1913 prices. Hoffmann, Table 39, column 7, 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: Agricultural producer price index. Hoffmann, Table 137, column 4, pp. 561–562.
PM: Deflator for NNP at market prices using the capital balance, in 1913 prices. Hoffmann, Table 148, column 15, pp. 598–601.
Y: NNP in constant 1913 prices, in millions of marks. Mitchell, *European Historical Statistics*, Table K1, pp. 817 and 821.

SWEDEN

LAND: Arable land is used as a proxy. Mitchell, *European Historical Statistics*, Table D1, sum of the seven columns, pp. 219 and 235.
K: Capital stock in current prices, 1871–1910. U. Karlstrom, *Economic Growth and Migration During the Industrialization of Sweden*, Ph.D. dissertation, Stockholm School of Economics, 1985, Appendix B, Table 9, 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 for total domestic investment in machinery and buildings on pp. 48, 56, 66, and 76. The linked series has been indexed on 1901=100.
L: Mitchell, *European Historical Statistics*, 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: Agricultural price index. Krantz and Nilsson. PA was created by linking the agricultural deflator series on pages 105, 111, 117, and 124
PM: Manufacturing price index. Krantz and Nilsson. PM was created by linking the manufacturing deflator series on pages 107, 113, 118, and 126.
Y: GDP in constant 1913 prices, in million kroner. Mitchell, *European Historical Statistics*, Table K1, pp. 818 and 825.

UNITED STATES

LAND: Acres of improved land in farms. 1870–1900: *Twelfth Census of the United States, 1900*, Vol. V, *Agriculture*, Part I, (Washington, D.C.: United States Census Office, 1902) Table II, p. xviii. 1900: *Fourteenth Census of the United States, 1920,* Vol. V, *Agriculture*, General Report

and Analytical Tables (Washington, D.C.: Department of Commerce, Bureau of the Census, Washington, 1922), Table 6, p. 36-37.
K: Real domestic capital stock in millions of 1929 dollars. The numbers for 1869–78 and for 1879–88 are the annual averages for the decades. John W. Kendrick and M.R. Pech, *Productivity Trends in the United States* (Princeton, N.J.: Princeton University Press, 1961), Table A-XV, column 3, pp. 320-322.
L: Total persons 10 years of age and over engaged in gainful occupations. 1870–1900: *Occupations at the Twelfth Census, 1900*, Special Reports (Washington, D.C.: Department of Commerce and Labor, Bureau of the Census, 1904), Table IV, p. 1. 1910 & 1920: *Fourteenth Census of the United States, 1920*, Vol. IV, *Population, Occupations*, Table 2, p. 34.
PA: *Historical Statistics of the United States*. PA was created by linking the "Farm products" series E42 (BLS) and E53 (Warren and Pearson).
PM: *Historical Statistics of the United States*. PM was created by linking the "All commodities" series E40 (BLS) and E52 (Warren and Pearson).
Y: GNP in constant 1958 prices, in billions of dollars. B.R. Mitchell, *International Historical Statistics, The Americans and Australasia* (Detroit: Gale Research Company, 1983), Table K1, pp. 887 and 889.

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TABLE 1

Old World Import Tariff Levels in 1913

Country	Average level of duties (%)	
	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 2

Trends in the Ratio of Wages to Land Values, 1870–1910 (1901=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	0.58
Old World, Protected	2.54	1.02	0.60

Note: Index numbers are not comparable across countries.
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 has data only for 1901–1911.

TABLE 3

The Determinants of the Wage-Rental Ratio in the New and Old Worlds, 1875–1914

Regression	1	2	3
Sample	ALL	NEWWORLD	OLDWORLD
LANDLAB	1.09**	1.16**	0.77**
	(6.88)	(11.39)	(3.53)
CAPLAB	1.26**	1.19**	0.83**
	(5.37)	(3.43)	(3.17)
PROD	0.71**	–0.85**	1.05**
	(3.66)	(3.60)	(8.79)
AUS×PAPM	0.76	0.58	—
	(1.20)	(1.21)	
USA×PAPM	–6.09**	–1.94*	—
	(10.66)	(2.08)	
FRA×PAPM	–4.78**	—	–4.74**
	(7.17)		(8.79)
GER×PAPM	–0.93*	—	–0.91*
	(1.82)		(1.76)
GBR×PAPM	–1.64**	—	–1.26**
	(3.68)		(3.28)
DEN×PAPM	1.19	—	0.14
	(0.92)		(0.14)
SWE×PAPM	–0.45	—	–0.63*
	(1.42)		(2.15)
R^2	.834	.936	.879
Standard Error of Estimate	0.12	0.10	0.10
Number of Observations	56	16	40
Degrees of Freedom	39	9	27
Durbin-Watson	2.10	2.60	1.83
Restrictions	p=0.00**	p=0.02*	p=0.00**
Cointegration tests:			
Durbin-Watson	p<0.01**	p<0.01**	p<0.01**
Dickey-Fuller (0 lags): Z_{DF}	–51.43**	–19.02**	–38.07**
Phillips-Perron (4 lags): Z_{PP}	–43.45**	–14.74*	–34.43**
Bayes: t^2	56.19	24.27	51.27
F-Test, {column 1} versus {columns 2, 3}: $F(3, 36) = 7.91$, $p = 0.00$.			

** significant in one-tailed test at 1% level; * at 5% level.

Notes: Dependent variable is WGRENT. Estimation is panel OLS with fixed effects (variables have country means removed prior to regression). Absolute *t*-statistics in parentheses. Restrictions is the test that the PAPM coefficients are equal across countries. Durbin-Watson cointegration test follows Sargan-Bhargava testing for *DW*=0. Dickey-Fuller and Phillips-Perron test for unit root in the residuals and include a constant term but no trend. All regressions and tests are implemented using the RATS econometrics software. NEWWORLD = {AUS,USA}; OLDWORLD = {FRA,GER,GBR,DEN,SWE}.

TABLE 4

Decompostion of Changing Wage-Rental Ratios, 1875–1914

A: Underlying data 1870–1914 (log change per decade)

	WGRENT	LANDLAB	CAPLAE	PAPM	PROD
AUS	–0.255	–0.128	–0.035	–0.026	0.048
USA	–0.188	–0.070	0.130	0.059	0.155
FRA	0.105	–0.100	0.075	0.006	0.052
GER	0.064	–0.134	0.160	0.024	0.066
GBR	0.220	–0.107	0.072	–0.065	0.090
DEN	0.248	–0.026	0.080	0.015	0.209
SWE	0.231	–0.012	0.127	0.050	0.167

B: Regression Coefficients (from Table 3, regressions 2 and 3)

	LANDLAB	CAPLAE	PAPM	PROD
AUS	1.161	1.187	0.583	–0.852
USA	1.161	1.187	–1.941	–0.852
FRA	0.766	0.826	–4.745	1.046
GER	0.766	0.826	–0.914	1.046
GBR	0.766	0.826	–1.260	1.046
DEN	0.766	0.826	0.137	1.046
SWE	0.766	0.826	–0.627	1.046

TABLE 4 (continued)

Decompostion of Changing Wage-Rental Ratios, 1875–1914

C: Explaining changes (log change per decade)

	change in WGRENT	due to LANDLAB	due to CAPLAB	due to PAPM	due to PROD	residual
AUS	–0.255	–0.148	–0.042	–0.015	–0.041	–0.008
shares	*100.0%*	*58.2%*	*16.4%*	*6.0%*	*16.1%*	*3.3%*
USA	–0.188	–0.081	0.154	–0.115	–0.132	–0.014
shares	*100.0%*	*43.0%*	*–82.2%*	*61.3%*	*70.4%*	*7.5%*
FRA	0.105	–0.076	0.062	–0.027	0.055	0.092
shares	*100.0%*	*–72.9%*	*58.9%*	*–26.3%*	*52.2%*	*88.1%*
GER	0.064	–0.103	0.132	–0.022	0.069	–0.012
shares	*100.0%*	*–161.4%*	*207.0%*	*–34.7%*	*108.5%*	*–19.3%*
GBR	0.220	–0.082	0.060	0.081	0.094	0.067
shares	*100.0%*	*–37.2%*	*27.0%*	*36.9%*	*42.7%*	*30.5%*
DEN	0.248	–0.020	0.066	0.002	0.218	–0.019
shares	*100.0%*	*–8.1%*	*26.8%*	*0.8%*	*88.1%*	*–7.6%*
SWE	0.231	–0.009	0.104	–0.032	0.174	–0.007
shares	*100.0%*	*–3.9%*	*45.2%*	*–13.6%*	*75.5%*	*–3.2%*
NEWWORLD (avg.)	–0.221	–0.115	0.056	–0.065	–0.087	–0.011
shares	*100.0%*	*51.8%*	*–25.5%*	*29.5%*	*39.1%*	*5.1%*
OLDWORLD (avg.)	0.324	–0.128	0.126	0.074	0.164	0.089
shares	*100.0%*	*–39.6%*	*38.8%*	*22.8%*	*50.6%*	*27.5%*

D: Explaining convergence (log change per deceade)

	change in WGRENT	due to LANDLAB	due to CAPLAB	due to PAPM	due to PROD	residual
NEWWORLD minus OLDWORLD	–0.545	0.014	–0.069	–0.139	–0.250	–0.100
shares	*100.0%*	*–2.6%*	*12.7%*	*25.5%*	*45.9%*	*18.4%*
US minus GB	–0.408	0.001	0.095	–0.196	–0.226	–0.081
shares	*100.0%*	*–0.3%*	*–23.2%*	*48.1%*	*55.4%*	*20.0%*

Notes: See text and Table 3.
Sources: See Appendix.

TABLE 5

The Estimated Impact of Anglo-American Commodity-Price Convergence and Factor Endowment Changes on Wage-Rental Ratios, 1870–1913: CGE simulation

	Movements (in percent):			
	Wage Rate	Farm Rent	Wage-Rental Ratio	C.P.I.
A: Actual, real returns				
USA	-	+2	.	
Britain	-	.	+2	
B: Impact of input growth (land, labor and capital combined) on real returns				
USA	-	-	.	
Britain	-	-	-	
C: Impact of commodity price convergence on nominal returns				
USA	-	-	.	-
Britain	-	.	+1	
D: Impact of commodity price convergence on real returns				
USA		-		
Britain	-	.		

E: Relative movements in Anglo-American wage-rental ratios			
Actual	Due to:	Input Growth	Commodity-Price Convergence
+674.9		-	+1

Notes: Panels A, C and D taken from O'Rourke and Williamson (1994), Table 3 and erratum thereto. Panel B uses the footnote table input growth estimates and the CGE models for the USA and Britain. Panel E reports movements in the ratio of the British to the American wage-rental ratio.

TABLE 6

Basic Data
A: Panel Data Series

Country	Years	WGRENT	LANDLAB	CAPLAB	PAPM	PROD
AUS	1875–1879	0.561	6.471	–0.052	0.167	–3.721
	1880–1884	0.516	6.593	–0.098	0.132	–3.664
	1885–1889	0.395	6.565	–0.130	0.108	–3.587
	1890–1894	–0.044	6.285	–0.152	–0.031	–3.674
	1895–1899	0.036	6.137	–0.204	0.111	–3.766
	1900–1904	–0.108	6.056	–0.225	0.134	–3.709
	1905–1909	–0.371	6.028	–0.223	0.216	–3.640
	1910–1914	–0.330	6.024	–0.175	0.075	–3.553
USA	1875–1879	0.051	2.772	1.388	–0.120	–7.245
	1880–1884	0.018	2.787	1.553	–0.063	–7.143
	1885–1889	–0.017	2.767	1.465	–0.090	–7.032
	1890–1894	–0.065	2.736	1.654	–0.014	–6.986
	1895–1899	–0.057	2.687	1.723	–0.067	–6.959
	1900–1904	–0.076	2.632	1.756	–0.003	–6.845
	1905–1909	–0.347	2.567	1.781	0.015	–6.775
	1910–1914	–0.606	2.529	1.843	0.087	–6.703
FRA	1875–1879	–0.236	0.116	–5.320	0.006	2.412
	1880–1884	–0.140	0.108	–5.281	0.060	2.422
	1885–1889	0.081	0.082	–5.223	0.011	2.315
	1890–1894	0.035	0.056	–5.161	–0.009	2.345
	1895–1899	0.141	–0.071	–5.204	–0.031	2.294
	1900–1904	0.244	–0.161	–5.178	–0.067	2.340
	1905–1909	0.224	–0.206	–5.132	–0.054	2.426
	1910–1914	0.130	–0.233	–5.059	0.026	2.594
GER	1875–1879	–0.312	0.302	–5.382	–0.074	2.224
	1880–1884	–0.285	0.254	–5.313	–0.042	2.161
	1885–1889	–0.240	0.190	–5.247	–0.117	2.236
	1890–1894	–0.110	0.129	–5.163	–0.042	2.291
	1895–1899	–0.010	0.060	–5.072	–0.089	2.382
	1900–1904	–0.018	–0.012	–4.980	–0.121	2.381
	1905–1909	–0.045	–0.090	–4.889	–0.045	2.449
	1910–1914	–0.088	–0.169	–4.822	0.011	2.456
GBR	1875–1879	–0.554	0.945	–1.676	0.185	–4.889
	1880–1884	–0.257	0.922	–1.615	0.168	–4.858
	1885–1889	–0.150	0.869	–1.609	0.085	–4.713
	1890–1894	–0.116	0.809	–1.608	0.147	–4.639
	1895–1899	–0.114	0.744	–1.573	0.061	–4.539
	1900–1904	0.000	0.682	–1.482	0.000	–4.589
	1905–1909	0.079	0.619	–1.428	–0.071	–4.608
	1910–1914	0.218	0.571	–1.423	–0.041	–4.574
DEN	1875–1879	–0.907	0.852	1.889	–0.102	–0.657
	1880–1884	–0.878	0.870	1.891	–0.061	–0.493
	1885–1889	–0.647	0.867	1.904	–0.064	–0.423
	1890–1894	–0.480	0.850	1.927	–0.005	–0.296
	1895–1899	–0.204	0.847	1.963	–0.034	–0.166
	1900–1904	–0.036	0.885	2.043	–0.082	–0.104
	1905–1909	–0.076	0.822	2.112	–0.054	–0.015
	1910–1914	–0.040	0.760	2.170	–0.051	0.073
SWE	1875–1879	–0.733	–0.150	–3.897	–0.085	1.364
	1880–1884	–0.590	–0.115	–3.832	–0.076	1.380
	1885–1889	–0.456	–0.071	–3.784	–0.127	1.436
	1890–1894	–0.339	–0.047	–3.733	–0.036	1.517
	1895–1899	–0.151	–0.055	–3.679	–0.060	1.655
	1900–1904	–0.045	–0.083	–3.608	0.032	1.741
	1905–1909	0.010	–0.145	–3.511	0.100	1.826
	1910–1914	0.075	–0.191	–3.454	0.091	1.947

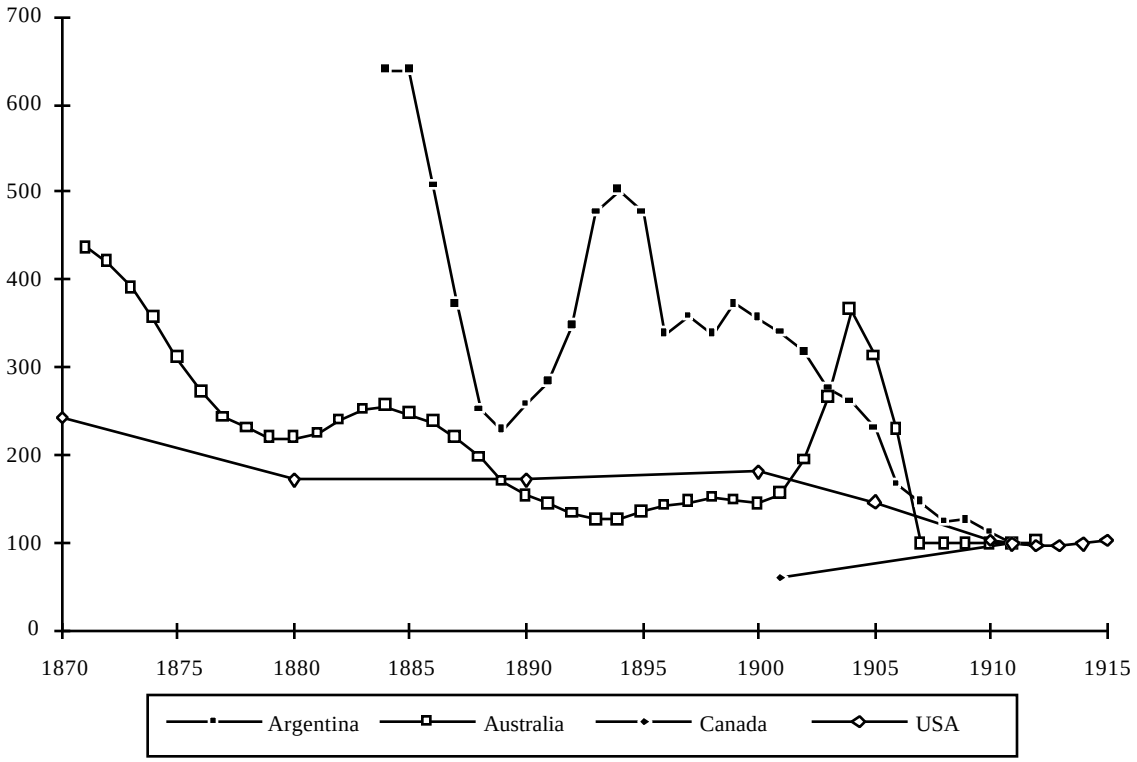
TABLE 6 (continued)

Basic Data
B: Sample Statistics

		DWGRENT	DLANDLAB	DCAPLAB	DPAPM	DPROD
A. By Region						
1875–1914	ALL	0.061	–0.082	0.087	0.009	0.112
	NEWWORLD	–0.221	–0.099	0.047	0.016	0.102
	OLDWORLD	0.173	–0.076	0.103	0.006	0.117
1875–1894	ALL	0.096	–0.047	0.078	0.003	0.102
	NEWWORLD	–0.241	–0.074	0.055	–0.030	0.102
	OLDWORLD	0.231	–0.036	0.086	0.017	0.102
1895–1914	ALL	0.034	–0.109	0.094	0.013	0.120
	NEWWORLD	–0.206	–0.117	0.041	0.052	0.101
	OLDWORLD	0.131	–0.106	0.115	–0.002	0.128
B. By Country						
1875–1914	AUS	–0.255	–0.128	–0.035	–0.026	0.048
	USA	–0.188	–0.070	0.130	0.059	0.155
	FRA	0.105	–0.100	0.075	0.006	0.052
	GER	0.064	–0.134	0.160	0.024	0.066
	GBR	0.220	–0.107	0.072	–0.065	0.090
	DEN	0.248	–0.026	0.080	0.015	0.209
	SWE	0.231	–0.012	0.127	0.050	0.167
1875–1894	AUS	–0.404	–0.124	–0.067	–0.132	0.031
	USA	–0.077	–0.024	0.178	0.071	0.173
	FRA	0.180	–0.040	0.106	–0.010	–0.044
	GER	0.134	–0.115	0.146	0.021	0.045
	GBR	0.292	–0.091	0.045	–0.025	0.167
	DEN	0.284	–0.001	0.026	0.065	0.241
	SWE	0.263	0.068	0.110	0.033	0.102
1895–1914	AUS	–0.143	–0.130	–0.011	0.053	0.061
	USA	–0.270	–0.104	0.094	0.050	0.142
	FRA	0.048	–0.144	0.051	0.018	0.125
	GER	0.011	–0.149	0.171	0.026	0.082
	GBR	0.167	–0.119	0.093	–0.094	0.033
	DEN	0.220	–0.045	0.122	–0.023	0.185
	SWE	0.207	–0.072	0.139	0.063	0.215

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 log-level change per decade. Sub-samples are NEWWORLD = {AUS,USA}; OLDWORLD = {FRA,GER,GBR,DEN,SWE}.
Sources: see Appendix.

Figure 1: Ratio of wages to land values 1870–1910, New World countries (1911=100)

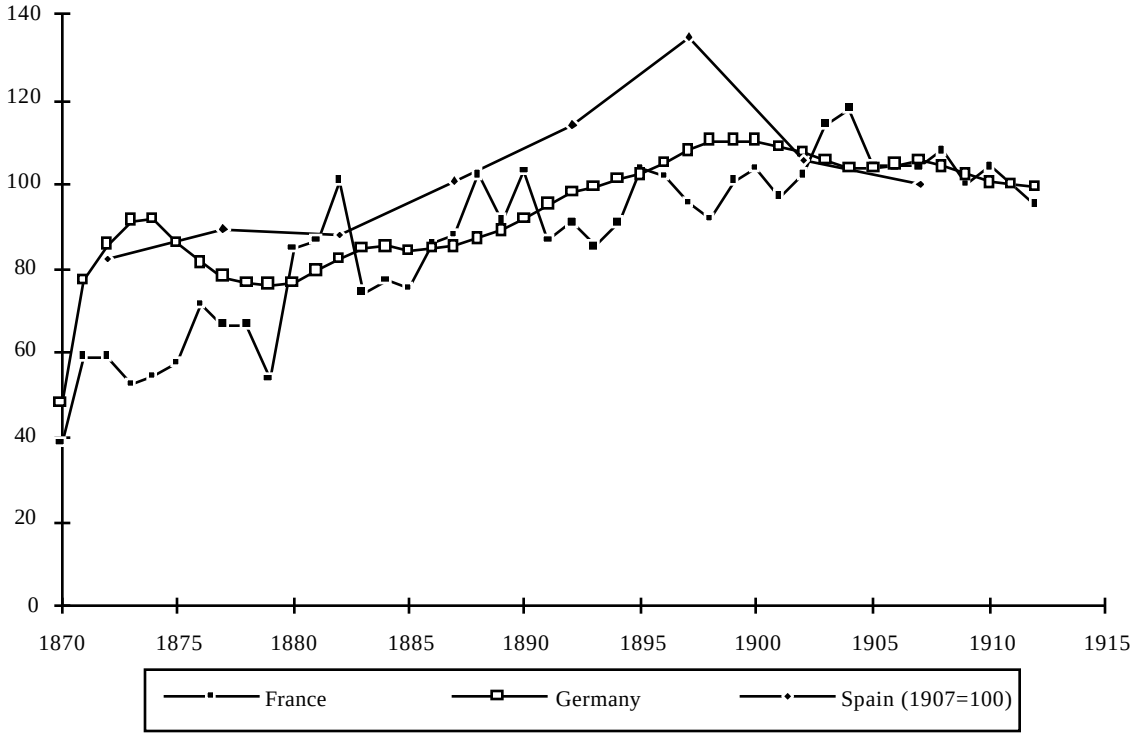


Sources: See Appendix.

Figure 2: Ratio of wages to land values 1870–1910, Old World "free trade" countries (1911=100)

Sources: See Appendix.

Figure 3: Ratio of wages to land values 1870–1910 Old World "protected" countries (1911=100)



Sources: See Appendix.