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WHEN, WHERE, AND WHY? EARLY INDUSTRIALIZATION IN THE POOR PERIPHERY 1870-1940

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ABSTRACT

This paper documents industrial output and labor productivity growth around the poor periphery 1870-1940 (Latin America, the European periphery, the Middle East, South Asia, Southeast Asia and East Asia). Intensive and extensive industrial growth accelerated there over these seven critical decades. There was an acceleration by the precocious leaders and more poor countries joined their club. Furthermore, many were actually catching up on Germany, the US and the UK. The paper then reports an early effort to identify the sources underlying the spread of the industrial revolution to the poor periphery. Productivity growth certainly made their industries more competitive in home and foreign markets, but other forces may have mattered more. Ever-cheaper labor gave them an edge in labor-intensive industries, increasingly cheap fuel and non-fuel intermediates from globally integrating markets appear to have taken resource advantages away from the European and North American leaders, and real exchange rate depreciation raised the price of import-competing manufactured goods at home. Tariffs helped protect the home market, but more modestly. All of this took place long before the popular post-WWII ISI strategies, especially in Latin America and Russia, where they had their origin.

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1. Motivation

There are some parts of Africa and Asia where modern factories are rare even today, where most local manufactures are still produced by artisans in small shops, and where only the minority live in cities. But in some parts of the poor periphery modern industrialization started more than a century ago. Latin America had two emerging industrial leaders in the late 19th and early 20th century – Brazil and Mexico, East Asia had two – Japan and Shanghai, and the European periphery had at least three – Catalonia, the north Italian triangle and Russia. This paper will show that some of these periphery industrializers were growing fast enough to have started catching up on the established industrial leaders (Germany, the United States and the United Kingdom). It will also show that the pace greatly accelerated in the interwar decades: many more joined the catching up club – Argentina, Colombia, Greece, India, Italy, Korea, Manchuria, Peru, the Philippines, Taiwan, and Turkey; and the overall rates of industrial output growth accelerated even for the leading periphery industrializers – most notably, Brazil, Japan, Mexico and Russia. Why did industrialization in the poor periphery start in the half century 1870-1913 (long before the Third World growth miracles of the late 20th century) and why in these places? Why did the spread of the industrial revolution to the poor periphery accelerate so dramatically in the interwar years? What were the main forces driving the diffusion of modern industry?

No doubt the answers are as complex as any question dealing more generally with the causes of modern economic growth, and no doubt any answer should include fundamentals like culture, geography, institutions and good government. But there is, in addition, a simpler explanation that would appeal to the growth theorist: As the Great

Divergence took place, labor became increasingly expensive in the industrial core relative to the poor periphery. Thus, the poor periphery became increasingly competitive in labor-intensive manufacturing. Here's another simpler explanation to add to the list: after a dramatic rise in the poor periphery's terms of trade up to its late 19th century peak (Williamson 2008, 2011), it then fell almost as dramatically to the 1930s (Prebisch 1950; Singer 1950), thus producing a sharp rise in the relative price of manufactures, favoring home industry. Here's yet a third simple explanation to add to the growing list: trade and exchange rate policy changed dramatically in favor of import-competing manufactures. And here's still a fourth simple explanation to add: those poor countries scarce in manufacturing intermediates (cotton, minerals) and the coal or petroleum to run their steam engines, found these disadvantages *vis a vis* well endowed industrial powers evaporating as world markets delivered those intermediates at ever-cheaper prices. In all four cases, global forces had a chance to shine.

But why do I care so much about industrialization when the rest of the recent development/history literature has been content with GDP per capita and proxies for same?[1] The answer is that I believe that industry and cities are carriers of growth, not just proxies for the same. There are at least six decades of theory that strongly supports my belief. Certainly the new endogenous growth theories (e.g. Krugman 1981, 1991a, 1991b; Krugman and Venables 1995; Romer 1986, 1990; Lucas 2009: see also the summary in Baldwin and Martin 2006) imply that urban-industrial activities contain far more cost-reducing and productivity-enhancing forces than do traditional agriculture and traditional

[1] I refer here to the spectacular contributions of the economists Daron Acemoglu, Simon Johnson, James Robinson and their followers, as well as economic historians exploring the great divergence, like Robert Allen and Kenneth Pomeranz, and all the many scholars who have used Angus Maddison's famous data.

services.[2] This notion is so embedded in mainstream economic thinking that it gets important exposure in modern surveys of growth theory (e.g. Helpman 2004: Chp. 5). Indeed, how else can industrialization – that is, an increase in the share of economic activity based in industry – take place without more rapid rates of total factor productivity growth there? After all, it is relatively rapid productivity advance in industry that lowers its relative costs and prices, raises demand for its output, pulls resources from other less dynamic sectors to augment its capacity to meet that increased demand, and makes it expand in relative size. Thus, given that industry achieves much higher growth rates during the industrial revolution than do other sectors, GDP growth rates quicken as the dynamic sector pulls up the average. And as industry grows in relative importance, its impact on overall GDP growth rates rises as well. The explanations offered for this asymmetric effect favoring rapid productivity growth in urban industry are many. Here are just five: urban clusters foster agglomeration economies; denser urban product and factor markets imply more efficient markets; a more skill-intensive industry and its modern support services fosters the demand for and accumulation of skills; a denser urban-industrial complex tends to generate a more extensive productivity-enhancing knowledge transfer between firms; and industrial firms are more able to draw on technological best practice used by world leaders.

The historical evidence certainly confirms the theory. Figure 1 plots the correlation, both in logs, between GDP per capita observed between 1820 and 1950 (Maddison 2001), and the level of industrialization per capita 50 or 70 years earlier

[2] Although modern endogenous growth rarely cites them, they were anticipated in the 1950s and 1960s by two-sector models.

(Bairoch 1982). The correlation is steep and strongly significant implying that faster future growth is correlated with current levels of industrialization.

This paper measures industrial or manufacturing output growth in the poor periphery over the short century 1870-1940. It does it in three parts, roughly two decades each: 1870-1890, 1890-1913 and 1920-1940. It also compares the growth performance with that of the industrial leaders -- Germany, the United States and the United Kingdom -- to identify who was catching up, who was just keeping even, and who was falling behind.[3] It then reports industrial labor productivity growth to see who was catching up or falling behind in that dimension as well. To the extent that productivity advance was most directly affected by culture and institutions, we have a chance to see whether it was productivity or per input costs and output prices driving profitability in industry and thus the timing and location of early industrialization in the poor periphery.[4]

2. Industrial Catching Up in the Poor Periphery: When and Where?

The Data

Secondary sources have allowed me to document constant price 'industrial' output for 26 members of the poor periphery for 1920-1940, the last of my three periods: Argentina, Austria, Brazil, Bulgaria, Chile, China, Colombia, Egypt, Greece, Hungary, India, Indonesia, Italy, Japan, Korea, Mexico, Peru, the Philippines, Portugal, Romania, Spain, Taiwan, Turkey, Uruguay, the USSR, and Yugoslavia. Of course, the same

[3] This, of course, is the language of my mentor Moses Abramovitz (1986). Note, however, that Table 1 (p. 391) of his oft-cited EHA Presidential Address is based on 15 countries, only one of which – Japan – is not western European or an English-speaking European offshoot.

[4] Gregory Clark (1987) asked a similar question some time ago, but his focus was on between-country differences in 1910, while my focus is on within-country changes 1870-1940.

definition of 'industry' is not always used in all country studies: based on their primary sources, some scholars restrict the industry definition to manufacturing alone (12); some add construction to the total (2); some add in addition mining (2); some add in addition some combination of transportation and utilities (9); and one was forced to use non-agriculture (Turkey). Thus, heterogeneity exists in the data, but where the alternative series are available for any given country, the growth rates rarely if ever differ much across the industry definition. In addition, although some sources report net value added, some report gross value added and some report production or output indices, when a country source offers more than one such time series, the resulting growth rates differ very little.[5]

Not surprisingly, the sample shrinks a bit as we move back in time: while there are 26 countries in the 1920-1940 sample, seven disappear when moving back to 1890-1913, leaving 19; and the sample shrinks still further in 1870-1890 to 13. While I am still looking to expand the sample for the pre-1913 period, I doubt that many more will be added to the list any time soon.

Documenting manufacturing output growth in the poor periphery was hard enough, but finding the employment data to convert output to labor productivity growth was even harder. The somewhat smaller country samples for industrial labor productivity growth are 24 for 1920-1940, 16 for 1890-1913, and 10 for 1870-1890.

Appendix 1 reports the sources of the output growth rate estimates and Appendix 2 does the same for labor productivity.

[5] What matters far more is the importance of artisan non-factory manufactures production and its demise over time. Factory manufactures production grows faster than total manufactures production, and factory manufacturing labor productivity grows more slowly than total manufacturing productivity, as high productivity factories displace low productivity cottage industry.

Industrial Catching Up

Table 1 reports industrial output growth – always in constant prices – for the three leaders (again, Germany, the US, and the UK) and the sample of 26 in the poor periphery (there are two for China, the whole Mainland – including Manchuria -- and Shanghai alone). Between 1870 and 1890, the fastest industrializing region by far was Latin America, led by Argentina, Chile and Mexico. The two other industrialization hot spots were Russia in the European periphery and Japan in Asia, but even these two did not reach the rates of industrial output growth that Latin America achieved. Between 1890 and 1913, the poor periphery industrializing club widen and deepened: Serbia joined Russia in the European periphery; Brazil and Peru joined the Latin American club (but Chile dropped out); and China and colonial India joined Japan in Asian club. Between 1920 and 1940, the club got much bigger with the addition of Colombia, Greece, Italy, colonial Korea, colonial Manchuria, colonial Philippines, newly republican Turkey, and colonial Taiwan.

Two morals follow. First, colonial status and or lack of policy autonomy did not necessarily suppress industrialization. True, it *did* suppress it 1870-1890, confirming the conventional view: Table 2 shows that those with autonomy recorded much faster industrial output growth (relative to the leaders) than did those without autonomy, 1.03 versus -1.06 percent per annum, a 2.09 percent point spread favoring those with autonomy. However, this was *not* true over the half century thereafter: indeed, industrial output growth (relative to the leaders) favored those *without* autonomy 1890-1913, by 0.78 percentage points, and 1920-1940, by 0.50 percentage points.[6] Second, the spread of

[6] Thus, the evidence from this sample is not always consistent with the conventional wisdom: "The imperialist powers of the nineteenth and early twentieth centuries generally tried to use their colonies as

the industrial revolution to the poor periphery gained speed, depth and breadth as the short century unfolded, reaching an impressive crescendo in the two interwar decades.

What about catching up on the industrial leaders, Germany, the US and the UK? Table 3 reports the answer. Between 1870 and 1890, only Latin American industry was growing fast enough to start catching up to the industrial leaders (at a very hefty 2.75 percentage points per annum). Apart from precocious Latin America, only Russia in the European periphery and Japan in Asia could report any catching up in the first period. While Spain and Uruguay were holding their own, the rest were falling behind, especially India and Indonesia. Between 1890 and 1913, Latin America was still catching up on the leaders (now at 1.2 percentage points per annum), and Peru had joined the Latin American club (replacing Chile, which now had fallen behind[7]). Between 1920 and 1940, more than two thirds (an impressive 18 out of 26[8]) of our poor periphery sample were catching up on the leaders. Six of the eight falling behind were in the European periphery -- Austria, Bulgaria, Hungary, Romania, Serbia and Spain – joined by Chile and Egypt. Part of this impressive surge in catching up in the interwar can be traced, of course, to the slowdown in output growth among the three leaders due to the great depression (a 0.67 percentage point drop in their average industrial growth rates from 3.84 in 1890-1913 to 3.17 in 1920-1940). But in the Middle East and Asia, most of the catch up surge was due to an acceleration in the poor periphery itself. And in the European periphery and Latin America, the depression-induced fall in manufacturing growth rates was much less than

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markets for their manufactured goods and as stable sources of raw materials for their industrial production. Combined with their colonies' initial poverty, these imperial policies deterred the growth of manufacturing in most colonies" (Kim and Park 2008: p. 26). See, for example, Fieldhouse (1983) and Austin (2003). However, it must be said that our sample excludes Africa, much of western Asia, and most of Southeast Asia.

[7] Chile, which fell from rapid catching up 1870-1890 (+3.60) to rapid falling behind 1890-1913 (-2.10), underwent by far the biggest reversal in our time series.

[8] Or 19 out of 27, if Manchuria is added as a separate observation.

with the three leaders. In any case, the biggest industrial growth rate surge between the two periods 1890-1913 and 1920-1940 took place in the following six (where the figures are changes in annual growth rates between the two periods, and where the rates are relative to the three leaders: from Table 3): Brazil 0.93, India 1.57, Mexico 2.51, Japan 2.99, USSR 4.71, and Turkey 4.89.

3. How to Identify the Sources of Industrialization

Figure 2 shows that manufacturing output growth (relative to the three leaders) was not correlated with GDP per capita between 1870 and 1940 ($R^2 = 0.002$). Whatever were the fundamentals that determined GDP per capita – culture, geography or institutions, they did not spill over in to rates of industrialization. So, what *does* explain where and when manufacturing growth was fastest in the poor periphery?

For me, the best way to attack this question is first to lay out explicitly the determinants of manufacturing profitability and competitiveness. To state the obvious, profits per unit of output equal revenue less costs per unit of output, and a rise in manufacturing output growth should be driven by an increase in those profits. Consider the following statement, with t = time period (1870-1890, 1890-1913, 1920-1940) and j = country, both subscripts suppressed in the notation:

$$\pi = p - \{wl + uk + p_m m + p_f f\} \qquad (1)$$

where p = domestic output price (world price + shipping cost + tariff)

p_m = domestic non-fuel intermediate price (world price + shipping cost + tariff)

p_f = domestic fuel price (world price + shipping cost + tariff)

w = domestic wage cost per unit of labor

u = domestic user cost per unit of capital = ip_k

i = domestic real interest rate

p_k = domestic capital goods price (world price + shipping costs + tariff)

and $\underline{l}$, $\underline{k}$, $\underline{m}$, and $\underline{f}$ are the labor, capital, non-fuel intermediate and fuel inputs per unit of output (all variable over time and place).

To the extent that I am mainly interested in the timing of industry growth between each of the three periods 1870-1890, 1890-1913 and 1920-1940, it is the first difference in prices and costs (c) driving changes in profits that mattered. Thus,

$$d\pi = dp - dc = dp - d\{wl + uk + p_m m + p_f f\} \quad (2)$$

In rates of change (*),

$$d\pi/\pi = dp/p - dc/c = dp/p - \{\varphi_l w^* + \varphi_k u^* + \varphi_m p_m^* + \varphi_f p_f^*\} - \{\varphi_l l^* + \varphi_k k^* + \varphi_m m^* + \varphi_f f^*\}. \quad (3)$$

The last term of expression (3) measures total factor productivity growth, where falling input coefficients ($\underline{l}$, $\underline{k}$, $\underline{m}$, $\underline{f}$) imply positive total factor productivity growth rates which reduce costs, raise competitiveness, and improve profitability. Since very few countries in the poor periphery 1870-1940 offer estimates of manufacturing or industrial total factor productivity growth, I use industry labor productivity growth as a proxy in what follows.

How do I drape interpretive economic history on equation (3)? Here's the list: $\underline{dp/p}$: I assume all poor periphery countries in my sample were much too small to have influenced world manufacturing prices, and thus that they were price takers for those products.[9] Three forces would have served to raise the domestic price of manufactures: a

[9] I am referring here to the price of their imported manufactures, *not* to their export price, since many in my sample had a profound influence on their export prices, like Chile with its copper, Brazil with its coffee, or

fall in the terms of trade facing these primary product exporters and manufactures importers; a depreciation in their real exchange rates; and a rise in their tariffs (and non-tariff barriers) on manufactures.

$\varphi_l w^*$: Any fall in the home wage, compared with foreign competitors, would have lowered relative costs and raised relative profitability. As the great divergence between the industrial leaders and the poor periphery widened, it was manifested by bigger wage and living standard gaps. Those countries whose GDP per capita was falling behind fastest, at least had the increasing advantage of cheaper labor. This was especially true, of course, in labor-intensive manufacturing where φ_l was high.

$\varphi_k u^*$: Since the user cost of capital has a financial and a real component, ip_k, both might have mattered. As their financial capital markets integrated with world markets, and as these 'emerging markets' underwent a fall in the premium they had to pay for external finance, their interest rates should have fallen compared to their foreign competitors. Furthermore, if tariff policy was used to favor the import of capital goods relative to final manufactured products, the relative price of capital goods should have fallen compared with the leaders.

$\varphi_m p_m^*$ and $\varphi_f p_f^*$: Textile manufacturing needs cotton, wool, flax and silk intermediates, but many countries do not grow some or any of them. Metal manufacturing needs ores, but many countries do not mine them. Since these are high bulk, low value products, they were expensive to ship long distance in 1870, but transport revolutions had lowered those costs dramatically by 1940. Manufacturing in natural resource scarce countries in the poor periphery benefited by global market integration much more than did the resource-

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Egypt with its cotton. To repeat, none of them were large enough to influence the world price of manufactures.

abundant industrial leaders. In addition, modern steam-driven power in industry needed cheap fuel. Those without coal to mine or oil to pump, suffered severe competitive disadvantage in 1870, but that disadvantage had almost evaporated for any poor periphery country without coal or oil reserves in the more global world of 1940 when they could import the stuff cheaply.

$\underline{tfpg} = \underline{\{\varphi_l l^* + \varphi_k k^* + \varphi_m m^* + \varphi_f f^*\}}$: Fast total factor productivity growth ($\underline{tfpg}$), compared with the industrial leaders, would have improved competitiveness and profitability. Part of any relatively fast productivity advance would have been driven by the demise of low-productivity, small-scale cottage industry, and the relative rise in high-productivity large-scale factories. Part of it would have taken place by improvements on the factory floor. Part of it would have been due to between-industry and between-factory technology transfer associated with urban agglomeration, better and denser factor markets, and easier knowledge transfer. It also seems likely that this would be one channel through which better institutions and better government would shine. The other forces listed above deal instead with exogenous world forces and domestic policy, even though the latter was surely endogenous to local political power.

Before we press on to the empirical analysis, I need to make a qualifying comment about equation (3). The theory there implies that I should correlate *changes* in output growth between the three periods (driven by changes in profitability) with *changes* in the explanatory variables. It might be argued, however, that *changes* in output growth should be correlated with *levels* of the explanatory variables, and such correlations would augment the sample. We will try both in what follows.

4. What Mattered Most? An Early Exploration

This section is labeled 'an early exploration' since it consists of a simple bi-variate approach rather than a more complex multivariate assessment, and it is based on an very incomplete data set documenting competing explanatory variables. A more complete version will have to await additional documentation of some of the explanatory variables, and a completely new documentation of others.

Productivity Growth?

Let me start with the role of productivity growth and the reminder that labor productivity growth is being used as a proxy for tfpg. Figure 3a reports the correlation between manufacturing output growth less that of the three leaders (MOG-3) and manufacturing labor productivity growth less that of the three leaders (MLPG-3), both in percent per annum and averaged over each of the three periods. While the correlation is certainly positive and significant (R^2 =0.256), it still leaves a lot to be explained, namely the role of world markets, world transport costs, local labor costs, domestic trade policy, and domestic exchange rate policy.[10] This is even more true when *changing* MOG-3 between any two periods is correlated with *changing* MLPG-3, as in Figure 3b (R^2 = 0.147). Productivity growth catch-up contributed to output growth catch-up between 1870 and 1940, but other forces affecting output price and input costs did too.

[10] Of course, industrial productivity growth itself was not exogenous, but at least in part endogenous with respect to world markets, world transport costs and domestic policy, especially if across-border technological transfer rises with openness (Parente and Prescott 2002; Lucas 1993, 2009). But this is only an early exploration.

Cheaper Labor?

Many forces were at work over these three periods, but we should see some positive correlation between rising industrial growth rates relative to the leaders, d(MOG-3), and falling labor costs per unit of output relative to the leaders, or, as we see in Figure 4a, a negative correlation with the first differences in the GDP per capita proxy, d(GDPpc/3). The correlation is $R^2 = 0.174$, about the same as the correlation with changing productivity growth. However, when levels are correlated with levels in Figure 4b, the R^2 drops, suggesting that the next phase the analysis should use country fixed effects to the extent that the focus is timing, in which case ever-cheaper labor is likely to play a part in any explanation of the timing of industrialization in the poor periphery before 1940.

Tariff Protection?

Over the past two decades, the literature exploring the openness-growth connection has boomed (typically using tariffs as the measure of openness), no doubt because the results are very relevant to current policy formation in the Third World. The vast majority of the literature, however, has simply looked at the correlation with GDP per capita growth, and the result has been mixed, to say the least. The historical arm of that literature started with Bairoch's (1989) report of a *positive* (*negative*) correlation between tariff heights (openness) and GDP per capita growth for pre-1914 Europe, confirmed with better data by O'Rourke (2000), then challenged as spurious by Irwin (2002). However, Vamvakidis (2002) showed that this was specific to the pre-1914 period since the correlation switched sign and became *negative* (*positive*) thereafter, a

result confirmed by Clemens and Williamson (2004) on a world data base 1870-2000 and with lots of controls. Most recently, Astorga (2010) reports a *negative* openness-growth correlation for Latin America 1900-2004, also with controls.

What's missing from this confusing literature is, of course, an explicit assessment of the channel of causation leading to the macro GDP per capita growth effects and an assessment of the alleged recipient of the protection in poor countries – industry.[11]

High average tariffs meant even higher tariffs on finished manufactures in the poor periphery, perhaps two or three times higher.[12] And as Figure 5 shows they were very high indeed in autonomous Latin America and the European Periphery (see also Coatsworth and Williamson 2004; Williamson 2006). But the impact of tariff policy on industrialization in the poor periphery between 1870 and 1940 must have been mixed. While tariffs in Latin America and the European Periphery between 1870-1890 and 1890-1913 were very high and even rose, they changed hardly at all in Asia, where they remained low. And between 1890-1913 and 1920-1940, on average tariffs fell or remained the same everywhere in the poor periphery except Asia late in the interwar decades. Thus, if domestic policy mattered, it probably wasn't tariffs, as Figures 6a and 6b suggest.

Terms of Trade?

[11] There are some important recent exceptions, like Federico and Tena (1999) on Italy, Lains (2006) on Portugal, Tena (2006) on Spain, Nunn and Trefler (2010) on the 20th century Third World, and Gómez Galvarriato and Williamson (2009) on Latin America.

[12] See, for example, Bairoch (1993) and Williamson (2011: Chp. 13). Antonio Teña (personal correspondence) has estimated *ad valorem* tariffs on British manufacturing exports for four Latin American republics in 1914 (Argentina, Brazil, Chile and Mexico): while the tariff for all imports averaged 21.5 percent, the average tariff on British manufactures averaged 45 percent, more than twice as high. Similarly, for the European periphery (Greece, Italy, Portugal, Russia, Spain): while the average tariff on all imports in 1914 was 18.4 percent, the tariff on British manufactures was 46.2 percent, almost three times higher.

The seminal papers by Raul Prebisch (1950), Hans Singer (1950) and W. Arthur Lewis (1952) pointed out that the relative price of primary products had fallen dramatically for almost a century before their date of writing. Figure 7 replicates the Lewis-Prebisch-Singer finding. The papers by Prebisch and Singer offered support for more than two decades of anti-global policy, stressing how a short and medium term decline in the terms of trade would damage GDP performance. However, they did not mention what the terms of trade decline implied for local industry: a fall in the relative price of primary products implies, of course, a rise in the relative price of manufactures, and thus a stimulus to manufacturing in the poor periphery. Some of the 26 countries in our sample had steeper declines in their terms of trade than others, so the stimulus must have varied. But in general there must have been a ubiquitous industrialization stimulus: if the poor periphery underwent de-industrialization and Dutch disease during their spectacular terms of trade boom from the 1800s to the 1870s (Williamson 2008; 2011: Chp. 12), symmetry argues that they must have undergone 're-industrialization' and 'Dutch recovery' during the terms of trade bust from the 1870s to the 1930s. We shall see whether the data confirm this hypothesis in the next version of this paper.

Real Exchange Rates?

Did real exchange rate depreciation give an added stimulus to industrialization in the poor periphery over the seven decades before 1940? Depreciations do, of course, make imported manufactures more expensive, thus stimulating local industry. But how would nominal exchange rates be correlated with big terms of trade shocks? If exchange rates are fixed, and change only with policy, a terms of trade collapse and a policy-

induced exchange rate depreciation will give a mutually reinforcing stimulus to local manufacturing in the poor periphery. But even if the exchange rate is flexible, the effect is reinforcing: a terms of trade slump should cause a real exchange rate depreciation. Modern evidence from commodity exporters Australia, Canada and New Zealand, all with flexible exchange rates in recent years, confirm these predictions (Chen and Rogoff 2003). What about 1870-1940?

The standard view is that real exchange rates were stable during the gold standard era up to World War I. Although this standard view is based on Euro-centric evidence, Table 4 confirms it for the poor periphery as well. True, there are many empty cells in Table 4, and many in my 26 country sample are missing from the table. Yet, there was a 28 percent real local currency depreciation between 1890-1913 and 1920-1940, and the figure is about 37 percent relative to 1913. The real exchange rate depreciation in the poor periphery made manufacturing imports more expensive there and fostered some part of the local industrialization surge.[13] Just how much awaits more real exchange rate data.[14]

Relative Prices of Manufacturing Intermediates and Fuel?

There is, of course, an active debate among economic historians regarding the importance of coal and ore deposits in giving the industrial leaders their initial advantage. Still, the question needs to be posed in an open economy way since favorable endowments of manufacturing intermediates and fuel may lose their importance if free

[13] Some time ago, José Campa (1990) found this effect for Latin American industrial production in the 1930s by using the Eichengreen and Sachs (1985) approach. See also Edwards (1989).
[14] As Appendix 3 notes, the real exchange rate data available for the poor periphery is limited, especially for the interwar decades. However, much has been documented recently by Solomou and Catão (2000), Catão and Solomou (2005), and [add cites].

trade and transport revolutions make these inputs available cheaply to late-comers who don't have the endowments. Some time ago, Gavin Wright (1990) showed us that while its natural resource base was important in explaining the American leap to industrial leadership from 1870 to 1890, that advantage disappeared in the more global economy of 1940. One can only expect to find a similar switch – but of opposite sign -- for those parts of the poor periphery without a favorable natural resource endowment.

I have no data yet documenting the relative price of fuel and manufacturing intermediates (that is, relative to the output price), so their role will have to await the data. Much rides, of course, on φ_m and φ_f, the shares of intermediates and fuels in total manufacturing costs. But the intermediates cannot be in doubt: for example, in 1870s raw cotton accounted for 70 percent of total costs of Lancashire cotton textiles (Ellison 1886: p. 46), and one can only suppose the share was even higher where the stuff was more expensive, like Mexico.[15] Fuels, however, are a little less obvious: again in cotton textiles, the percent of coal costs in total costs varied between 2.2 for England, 5.5 for Alsace, 5-7 for India, and 9-16 for Catalonia (Balderston 2010: p. 571). While the cost shares were smaller for fuels compared to intermediates, the price variance is likely to have been higher: in 1882 Lancashire, the price of one ton delivered at the mill averaged $1.38; in 1882 Poland $4.48; in 1886 Russia $5.34; in 1882 Italy $6.35; and in 1882 Spain $7.13. We know coal prices converged between the 1870s and the 1930s, so this wide price spread must have diminished over time.

The User Cost of Capital?

[15] In the 1870s, Mexico had a tariff on raw cotton to protect local producers (Gómez Galvarriato and Williamson 2009).

We know that the premium attached to poor periphery interest rates fell as a global capital market developed from the mid-19th century to 1929 (Obstfeld and Taylor 2004; Mauro, Sussman, and Yafeh 2006), and thus that their financial capital disadvantage diminished. We also know that capital formation was greatly suppressed in countries where the relative price of capital goods was high (De Long and Summers 1991; Lee 1994; Taylor 1998; Collins and Williamson 2001). Presumably, therefore, the user cost of capital must have influenced industrial growth in the poor periphery 1870-1940.[16] How much awaits the data.

The Agenda

The agenda is clear. We have established where and when industrialization spread to the poor periphery in the seven decades after 1870: We know whose industry was catching up, whose was just holding its own, and whose was falling behind. Furthermore, we know that the spread deepened and widened over time, and that the intensive and extensive industrialization was positively correlated. The paper then offers a way to decompose the sources of this performance, and lists the external (e.g. global) and internal (e.g. local) factors which, in combination, will explain the timing and location of industrialization in the poor periphery. The next step is to accumulate the missing explanatory variables to complete the decomposition.

[16] There is, of course, no shortage of theoretical literature making the price of capital goods and accumulation connection. See, for example, Jones (1994).

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Williamson, J. G. (2008), "Globalization and the Great Divergence: Terms of Trade Booms and Volatility in the Poor Periphery 1782-1913," *European Review of Economic History* 12 (December): 355-91.

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Appendix 1: Data Sources for
Manufacturing/Industry Output Growth 1870-1940
(Note: All output indices in constant prices.)

Three Leaders

All three leaders are from S. N. Broadberry, *The Productivity Race: British Manufacturing in International Perspective, 1850-1990* (Cambridge: Cambridge University Press, 1997), cited below as SNB.
Germany: Output in manufacturing 1870-1913 and 1925-1938 from SNB, Appendix Table A3.1(a), pp. 42-44, based on Hoffman (1965: Table 15).
United Kingdom: Output in manufacturing 1869-1938 from SNB, Appendix Table A3.1(a), pp. 42-44, based on Feinstein (1972: Table 5.1), adjusted for the exclusion of Southern Ireland after 1920.
United States: Output in manufacturing 1869-1940 from SNB, Appendix Table A3.1(a), pp. 42-44, based on Kendrick (1961: Table D-II).

European Periphery (10)

Austria: Industrial production 1869-1913 from David F. Good, *The Economic Rise of the Habsburg Empire 1750-1914* (Berkeley, Calif.: University of California Press, 1984), Table A.2, p, 259 (based on Komlos) and 1923-1938 from Brian R. Mitchell, *International Historical Statistics: Europe 1750-1993* (New York: Stockton Press, 1998), Table D1, p. 421.
Bulgaria: Industrial production 1909-1929 from John R. Lampe and Marvin R. Jackson, *Balkan Economic History, 1550-1950: From Imperial Borderlands to Developing Nations* (Bloomington, Ind.: Indiana University Press, 1982), Table 2.7, p. 69; manufacturing output 1927-1938 from Lampe and Jackson (1982), Table 12.14, p. 484.
Greece: Industrial production from Brian R. Mitchell, *International Historical Statistics: Europe 1750-1993, 4th ed.* (New York: Stockton Press, 1998), Table B1, p. 151.
Hungary: Industrial production 1869-1913 from Good (1984), Table A.3, p, 260 (based on Komlos); manufacturing output 1913-1938 from Gyorgy Ranki, "Problems of the Development of Hungarian Industry, 1900-1944," *Journal of Economic History* 24, 2 (June 1964): 204-28, Tables 1 and 2, p. 214.
Italy: 1870-1913 manufacturing value added from Stefano Fenoaltea, "The growth of the Italian economy, 1861-1913: Preliminary second-generation estimates," *European Review of Economic History* 9 (December 2005), Table 3, p. 286; 1913-40 index of manufacturing value added ("media geo.") from Albert Carreras and Emanuele Felice, "L'industria Italiana dal 1911 al 1938: Ricostruzione della serie del valore aggiunto interpretazioni," *Rivista di Storia Economica* (forthcoming), Table 2.
Portugal: Industrial (including manufacturing, mining, electricity, water and construction) output 1878-1939 from Pedro Lains, "Growth in a Protected Environment: Portugal, 1850-1950," *Research in Economic History*, Volume 24 (2006), Table A1, p. 152.
Romania: Manufacturing output 1929-1938 from Lampe and Jackson (1982), Table 12.14, p. 484.

Russia/USSR: Industrial production indices 1870-1913 and 1928-1940 from Brian R. Mitchell, *International Historical Statistics: Europe 1750-1988* 3rd ed. (New York: Stockton Press, 1992), pp. 410 and 412.
Serbia/Yugoslavia: Serbia gross industrial output 1898-1910 from Lampe and Jackson (1982), Table 8.6, p. 250; Yugoslavia manufacturing output 1918-1938 from Lampe and Jackson (1982), Table 12.14, p. 484.
Spain: Prados index of industrial production from Albert Carreras and Xavier Tafunell (eds.), *Estadísticas historicas de Espana: Volume 1: Siglos XIX-XX* (Madrid: Fundacian BBVA1989), Caudro 5.11, pp. 396-8.

Latin America (7)

Argentina: Industrial output 1875-1915 from Gerardo della Paolera and Alan M. Taylor (eds.), *A New Economic History of Argentina* (Cambridge: Cambridge University Press, 2003), Table 9.2, 265; industrial production 1915-1940 from United Nations, *Economic Commission for Latin America, The Process of Industrialization in Latin America: Statistical Annex 19* (January 1966: ST/ECLA/Conf.23/L.2/Add.2), Table I-1, p. 1.
Brazil: Real industrial product 1900-1947 from Claudia L. S. Haddad, *Crescimento do Produto Real no Brasil 1900-1947* (Rio de Janeiro: FGV, 1978), Tabela 1, pp. 7-8.
Chile: Manufacturing GDP from Juan Braun *et al*., *Economía Chilena 1810-1995: Estadísticas Históricas* (Santiago: Pontifica Universidad Católica de Chile, 2000), Table 1.2, pp. 27-28.
Colombia: Industrial production 1925-1940 from United Nations, *Economic Commission for Latin America* (1966), Table I-1, p. 1.
Mexico: 1891-1900 real value cotton textile output from Armando Razo and Stephen Haber, "The Rate of Growth of Productivity in Mexico, 1850-1933: Evidence from the Cotton Textile Industry," *Journal of Latin American Studies* 30 (October 1998), Table 4, p. 498. Their observations1850-1889 have been omitted due to problems of comparability; manufacturing production 1900-1940 from Brian R. Mitchell, *International Historical Statistics: The Americas and Australasia* (Detroit, Mich.: Gale Research Co., 1983), p. 152.
Peru: PBI for the "secondary sector" from Bruno Seminario and Arlette Beltran, *Crecimento Economico en el Peru: 1896-1995: Neuvas Evidencias Estadisticas* (Lima: Universidad del Pacifico, 2000), Cuadro X.8, pp. 285-7.
Uruguay: Gross value of output 1870-1936 from Luis Bértola, *El PBI de Uruguay 1870-1936* (Montevideo nd), Parte III, Series Estadistica, Cuadro VI, p. 51-2, extended to 1940 using manufacturing value added, constant price, in Luis Bértola, *The Manufacturing Industry of Uruguay, 1913-1961: A Sectoral Approach to Growth, Fluctuations and Crisis* (Stockholm: Stockholm University, 1990), Table III.8, p. 107.

Middle East (2)

Ottoman Empire/Turkey: Non-agricultural output 1880-1949 from Sumru Altug, Alpay Filiztekin, and Sevket Pamuk, "Sources of long-term economic growth for Turkey, 1800-2005," *European Review of Economic History* 12, 3 (Dec. 2008), Table 3, p. 405.

Egypt: Bent Hansen and Girgis A. Marzouk, *Development and Economic Policy in the UAR (Egypt)* (Amsterdam: North-Holland, 1965) estimate GDP growth 1928-1939 (1954 prices, Chart 1.1, p. 3) at 1.60% per annum. However, Charles P. Issawi, *Egypt in Revolution: An Economic Analysis* (London: Oxford University Press, 1963, Table 7, p. 87) shows a decline in the manufacturing (including handicrafts) employment share 1927-1937 from 8.1 to 6.3%. Since there is no qualitative evidence of relatively fast (or even significant) growth in manufacturing labor productivity 1927/8-1937/9, manufacturing output is unlikely to have grown much faster than GDP. Thus, we assume manufacturing output growth 1920-1940 to have been about 1.60% per annum.

Asia (7)

China (Shanghai): Shanghai modern industry ouput 1895-1936 from Xinwu Xu and Hanming Huang, *Shanghai Jindai Gongyeshi* (1998), p. 342, cited in Debin Ma, "Economic Growth in the Lower Yangzi Region of China in 1911-1937: A Quantitative and Historical Analysis," *Journal of Economic History* 68 (June 2008), Table 1, p. 362.
China (Mainland): Industrial production in Mainland China 1912-1940 from John K. Chang, *Industrial Development in Pre-Communist China: A Quantitative Analysis* (Chicago: Aldine 1969), Table 14, pp. 60-61.
Indonesia: 1880-1940 gross value added in manufacturing from Pierre van der Eng, "The sources of long-term economic growth in Indonesia, 1880-2008," *Explorations in Economic History* 47,3 (July 20010), 294-309, Table A1, 304-6.
India: 1868-1900 net domestic product all manufacturing Alan Heston, "National Income," in Dharma Kumar and Meghnad Desai (eds.), *The Cambridge Economic History of India: Volume 2: c. 1757-c.1970* (Cambridge: Cambridge University Press, 1983), Tables 4.2, and 4.3A, pp. 396-8; 1900/1-1946/7 net value added all factory industry from S. Sivasubramonian, *The National Income of India in the Twentieth Century* (New Delhi: Oxford University Press, 2000), Table 4.27, pp. 256-8.
Japan: 1874-1940 value of production in manufacturing from Miyohei Shinohara, *Estimates of Long-Term Economic Statistics of Japan since 1868: Volume 10: Mining and Manufacturing* (Tokyo: Toyo Keizai Shinposha, 1972), pp. 145-147.
Korea: Net value of commodity product in factory manufacturing 1913-1940 from Sang-Chul Suh, *Growth and Structural Changes in the Korean Economy 1910-1940* (Cambridge, Mass.: Harvard University Press, 1978), Table A-12, p. 171. Duol Kim and Ki-Joo Park, "Colonialism and Industrialisation: Factory Labour Productivity of Colonial Korea, 1913-1937," *Australian Economic History Review* 48, 1 (March 2008): 26-46. report almost exactly the same rates of growth (Suh's 9.46 % p.a. vs Kim and Park's 9.78, both 1920-1939). Both refer to factories of 5 workers or more, but Suh appears to include rice cleaning (about half of factory output in 1930: Kim and Park (2008), p. 33) while Kim and Park exclude it. Finally, in an unpublished paper, Myung Soo Cha and Nak Nyeon Kim ("Korea's First Industrial Revolution, 1911-40," *Working Paper 2006-3*, Naksungdae Institute of Economic Research, June 2006, Table 1-B) report a manufacturing growth rate of 8.52 percent per annum 1920-1939. We favor the more inclusive Suh estimates.
The Philippines: Gross value added in manufacturing in 1985 pesos from Richard Hooley, "American economic policy in the Philippines, 1902-1940: Exploring a

statistical dark age in colonial statistics," *Journal of Asian Studies* 16 (2005), Table A.1, pp. 480-1.
Taiwan: Value of gross output in manufacturing 1910-1940 from Konosuke Odaka and I-Ling Liu, "Employment and Wages in Prewar Taiwan," in *Long-Term Economic Statistics of Taiwan, 1905-1995: An International Workshop* (Hitotsubashi University: Institute of Economic Research, May 1999), Table 7, p. 107.

Appendix 2: Data Sources for
Manufacturing/Industry Labor Productivity Growth 1870-1940
(Note: All output indices in constant prices.)

Three Industrial Leaders

All three leaders are from S. N. Broadberry, *The Productivity Race: British Manufacturing in International Perspective, 1850-1990* (Cambridge: Cambridge University Press, 1997), cited below as SNB.
Germany: Real output in manufacturing (1929=100), SNB, Appendix Table A3.1(a), pp. 42-44, based on Hoffman (1965: Table 15); employment in manufacturing, SNB, Appendix Table A3.1(a), pp. 42-44, based on Hoffman (1965: Table 15).
United Kingdom: Real output in manufacturing (1929=100), SNB, Appendix Table A3.1(a), pp. 42-44, based on Feinstein (1972: Table 5.1); employment in manufacturing, SNB, Appendix Table A3.1(a), pp. 42-44, based on Feinstein (1972: Tables 59 and 60), adjusted for the exclusion of Southern Ireland after 1920.
United States: Real output in manufacturing (1929=100), SNB, Appendix Table A3.1(a), pp. 42-44, based on Kendrick (1961: Table D-II); employment in manufacturing, SNB, Appendix Table A3.1(a), pp. 42-44, based on Kendrick (1961: Table D-II).

European Periphery (10)

Austria: Industrial production 1869-1913 from David F. Good, *The Economic Rise of the Habsburg Empire 1750-1914* (Berkeley, Calif.: University of California Press, 1984), Table A.2, p, 259 (based on Komlos) and 1923-1938 from Brian R. Mitchell, *International Historical Statistics: Europe 1750-1993* (New York: Stockton Press, 1998), Table D1, p. 421; 1869-1910 employment in manufacturing and construction and 1920-1939 employment in mining, manufacturing and construction, both from Mitchell (1998), Table B1, p. 145.
Bulgaria: Industrial production 1909-1929 from John R. Lampe and Marvin R. Jackson, *Balkan Economic History, 1550-1950: From Imperial Borderlands to Developing Nations* (Bloomington, Ind.: Indiana University Press, 1982), Table 2.7, p. 69; manufacturing output 1927-1938 from Lampe and Jackson (1982), Table 12.14, p. 484. Industrial labor force 1910-1930 from Lampe and Jackson (1982), Table 10.4, p. 336 and 1927-1938 from Lampe and Jackson (1982), Table 11.12, pp. 419-20, and Table 12.15, p. 485.
Greece: Industrial production and employment in manufacturing and construction from Brian R. Mitchell, *International Historical Statistics: Europe 1750-1993, 4th ed.* (New York: Stockton Press, 1998), Table B1, p. 151 and Table D1, p. 421.
Hungary: 1869-1913 industrial production from Good (1984), Table A.3, p, 260 (based on Komlos), and employment in manufacturing and construction from Mitchell (1998), Table B1, p. 151; 1913-1938 manufacturing output and employment from Gyorgy Ranki, "Problems of the Development of Hungarian Industry, 1900-1944," *Journal of Economic History* 24, 2 (June 1964): 204-28, Tables 1 and 2, p. 214.
Italy: Manufacturing value added 1870-1913 from Stefano Fenoaltea, "The growth of the Italian economy, 1861-1913: Preliminary second-generation estimates," *European*

Review of Economic History 9 (December 2005), Table 3, p. 286; 1913-40 index of manufacturing value added ("media geo.") from Albert Carreras and Emanuele Felice, "L'industria Italiana dal 1911 al 1938: Ricostruzione della serie del valore aggiunto interpretazioni," *Rivista di Storia Economica* (forthcoming), Table 2. Employment 1870-1940 based on census "active population" in industry, from Vittorio Daniele and Paolo Malanima, "Labour Force in Itaty 1861-2001: Structural Change and Regional Disparities," working paper (2010), Appendix, Table 5.
Portugal: Industrial (including manufacturing, mining, electricity, water and construction) output and employment (males) from Pedro Lains, "Growth in a Protected Environment: Portugal, 1850-1950, *Research in Economic History*, Volume 24 (2006), Table 8, p. 138 and Table A1, p. 152.
Romania: Manufacturing output 1929-1938 from Lampe and Jackson (1982), Table 12.14, p. 484; industrial employment 1919-1938 from Lampe and Jackson (1982), Table 11.12, pp. 419-20, and Table 12.15, p. 485.
Russia/USSR: Industrial production indices and employment in mining and manufacturing from Brian R. Mitchell, *International Historical Statistics: Europe 1750-1988* 3rd ed. (New York: Stockton Press, 1992), pp. 152, 410 and 412.
Serbia/Yugoslavia: Serbia gross industrial output 1898-1910 from John R. Lampe and Marvin R. Jackson, *Balkan Economic History, 1550-1950: From Imperial Borderlands to Developing Nations* (Bloomington, Ind.: Indiana University Press, 1982), Table 8.6, p. 250; Yugoslavia manufacturing output 1918-1938 from Lampe and Jackson (1982), Table 12.14, p. 484. Manufacturing employment 1918-1938 from Lampe and Jackson (1982), Table 12.15, p. 485 and Table 11.12, pp. 419-20.
Spain: Industrial (excluding construction) labor productivity from Leandro Prados de la Escosura, *El progreso economico de Espana* (Bilbao: Fundacion BBVA 2003, updated 2009).

Latin America (6)

Argentina: Industrial output 1875-1915 from Gerardo della Paolera and Alan M. Taylor (eds.), *A New Economic History of Argentina* (Cambridge: Cambridge University Press, 2003), Table 9.2, p. 265; industrial production 1915-1940 from United Nations, *Economic Commission for Latin America, The Process of Industrialization in Latin America: Statistical Annex 19* (January 1966: ST/ECLA/Conf.23/L.2/Add.2), Table I-1, p. 1. Manufacturing employment 1895-1914 from Vicente Vazquez-Presedo, *Estadisticas Historicas Argentinas (Comparadas): Primera Parte 1875-1914* (Buenos Aires: Ediciones Macchi, 1971), Table III-9, pp. 60-1; employment in mining, manufacturing and construction 1915-1947 from Brian R. Mitchell, *International Historical Statistics: The Americas and Australasia* (Detroit, Mich.: Gale Research Co., 1983), pp. 155 linked to employment in manufacturing 1925-40 from United Nations, *Economic Commission for Latin America* (1966), Table I-13, p. 13.
Brazil: Real industrial product 1900-1947 (1939=100) from Claudia L. S. Haddad, *Crescimento do Produto Real no Brasil 1900-1947* (Rio de Janeiro: FGV, 1978), Tabela 1, pp. 7-8; industrial employment (mining, manufacturing and construction) 1900-1914 from Brian R. Mitchell, *International Historical Statistics: The Americas 1750-1993* (New York: Stockton Press, 1993), Table B1, p. 108, linked at 1914 to manufacturing

employment 1914-1940 from United Nations, *Economic Commission for Latin America, The Process of Industrialization in Latin America: Statistical Annex 19* (January 1966: ST/ECLA/Conf.23/L.2/Add.2), Table I-13, p. 13.
Chile: Manufacturing GDP and labor force from Juan Braun *et al*., *Economía Chilena 1810-1995: Estadísticas Históricas* (Santiago: Pontifica Universidad Católica de Chile, 2000), Table 1.2, pp. 27-28 and Table 7.2, pp. 219-220.
Colombia: Industrial production and manufacturing employment 1925-1940 from United Nations, *Economic Commission for Latin America* (1966), Table I-1, p. 1 and I-13, p. 13.
Mexico: Manufacturing production and employment in manufacturing and construction from Brian R. Mitchell, *International Historical Statistics: The Americas and Australasia* (Detroit, Mich.: Gale Research Co., 1983), pp. 152 and 393.
Uruguay: Industrial Employment 1908-1940 from Luis Bértola, *The Manufacturing Industry of Uruguay, 1913-1961: A Sectoral Approach to Growth, Fluctuations and Crisis* (Stockholm: Stockholm University, 1990), Table IV.5, p. 124.

Middle East (2)

Ottoman Empire/Turkey: Non-agricultural labor force from Sumru Altug, Alpay Filiztekin, and Sevket Pamuk, "Sources of long-term economic growth for Turkey, 1800-2005," *European Review of Economic History* 12, 3 (Dec. 2008), Table 2, p. 399.
Egypt: Bent Hansen and Girgis A. Marzouk, *Development and Economic Policy in the UAR (Egypt)* (Amsterdam: North-Holland, 1965) estimate GDP growth 1928-1939 (1954 prices, Chart 1.1, p. 3) at 1.60% per annum. However, Charles P. Issawi, *Egypt in Revolution: An Economic Analysis* (London: Oxford University Press, 1963, Table 7, p. 87) shows a decline in the manufacturing (including handicrafts) employment share 1927-1937 from 8.1 to 6.3%. Since there is no qualitative evidence of relatively fast growth in manufacturing labor productivity 1927/8-1937/9, manufacturing output is unlikely to have grown much faster than GDP. Thus, we assume manufacturing output growth 1920-1940 to have been about 1.60% per annum. Issawi (1963, Table 7, p. 87) reports that manufacturing (including handicrafts) employment fell slightly 1927-1937 at -0.10% per annum. Thus, we assume manufacturing labor force growth 1920-1940 to have been about 1.70% per annum.

Asia (6)

India: 1875/77-1894/96 all manufacturing labor force from Alan Heston, "National Income," in Dharma Kumar and Meghnad Desai (eds.), *The Cambridge Economic History of India: Volume 2: c. 1757-c.1970* (Cambridge: Cambridge University Press, 1983), Tables 4.1, pp. 396-7; 1900/05-1935/40 labor productivity for all industry from S. Sivasubramonian, *The National Income of India in the Twentieth Century* (New Delhi: Oxford University Press, 2000), Table 7.19, p. 479.
Indonesia: Manufacturing employment estimated from Pierre van der Eng, "The sources of long-term economic growth in Indonesia, 1880-2008," *Explorations in Economic History* 47,3 (July 20010), 294-309, Table A2, 307-8.

Japan: Non-agricultural employment 1872-1905 from Kazushi Ohkawa and Miyohei Shinohara with Larry Meissner, *Patterns of Japanese Economic Development: A Quantitative Appraisal* (New Haven, Conn.: Yale University Press, 1979), Table A53, pp. 392 and in manufacturing 1906-1940, Table 54, p. 394, linked on 1905.
Korea: Employment in manufacturing factories with five or more workers from Sang-Chul Suh, *Growth and Structural Changes in the Korean Economy 1910-1940* (Cambridge, Mass.: Harvard University Press, 1978), Tables A-12, p. 171 and Table 20, p. 49. Duol Kim and Ki-Joo Park, "Colonialism and Industrialisation: Factory Labour Productivity of Colonial Korea, 1913-1937," *Australian Economic History Review* 48, 1 (March 2008): 26-46 have recently reported employment growth rates which are much higher, implying implausible low rates of productivity advance (0.38 % p. a.), so we use the older Suh estimates until the conflict can be resolved.
The Philippines: Employment in manufacturing from the 1903 (Volume II, p. 865), 1918 (Volume II, p. 841) and 1939 (Volume II, p. 484) *Censuses of the Philippines* (Manila, Bureau of Printing, 1905, 1921, and 1941).
Taiwan: Number of employees in manufacturing from Konosuke Odaka and I-Ling Liu, "Employment and Wages in Prewar Taiwan," in *Long-Term Economic Statistics of Taiwan, 1905-1995: An International Workshop* (Hitotsubashi University: Institute of Economic Research, May 1999), Table 7, p. 107.

Appendix 3: (Incomplete) Data Sources for Explanatory Variables in the Poor Periphery Industrialization 1870-1940 Project

The explanatory variables used thus far in the project are: average tariffs rates, the net barter terms of trade, relative wage costs, the real exchange rate and policy autonomy. The data base for some of these are incomplete, and for others, completely absent. The rest are taken from my earlier projects.

Average tariff rates (%): Calculated as import customs duties relative to total import values. These data have been used in Coatsworth and Williamson (2004), Clemens and Williamson (2004, 2010), and Williamson (2006). They are available from the author in the Blattman-Clemens-Williamson 1870-1940 data base. The BCW data base is missing many East European countries which are used in this new project. They will be collected soon.

Net Barter Terms of Trade (1913=100): These data have been used in Blattman, Hwang and Williamson (2007) and Williamson (2008). They are available from the author in the Blattman-Clemens-Williamson 1870-1940 data base. The BCW data base is missing many East European countries which are used in this new project. They will be collected soon.

Policy Autonomy (dummy variable): See Table 2, although the source (Clemens and Williamson 2010: Table 1, p. 28) offers far more detail.

Relative Wage Costs: As the text makes clear, we use a proxy, GDP per capita relative to the three leaders (Germany, the UK and the USA), and the GDP per capita data are from http://www.ggdc.net/Maddison/content.shtml (last accessed June 10, 2010).

Real Exchange Rates (1913=100): These are taken from many sources to be elaborated in another draft (when the many absent period/country observations are collected), and I have been greatly aided in the process by Pablo Astorga, Luis Bértola, Michael Bordo, Luis Catão, Kalina Dimitrova, Sophia Lazaretou, Matthias Morys, and Solomus Solomou.

Relative Capital Goods Prices (1913=100): Not collected thus far, but hope to retrieve them from the France-Germany-UK-US export (by destination) data base being collected in collaboration with Aurora Gómez Galvarriato. These will be used relative to local manufacturing prices.

Real Interest Rates: Not collected thus far.

Relative Manufacturing Intermediate Goods' Prices (1913=100): Not collected thus far, but hope to retrieve from the France-Germany-UK-US export (by destination) data base being collected in collaboration with Aurora Gómez Galvarriato. These will be used relative to local manufacturing prices.

Relative Fuel Prices (1913=100): Not collected thus far, but hope to retrieve from the France-Germany-UK-US export (by destination) data base being collected in collaboration with Aurora Gómez Galvarriato. These will be used relative to local manufacturing prices.

Table 1
Manufacturing output growth rates per annum (%)

	1870-1890	1890-1913	1920-1939
Three Leaders	***3.49***	***3.84***	***3.17***
Germany	3.19	3.87	3.37
UK	2.35	3.27	3.39
US	4.92	4.39	2.75
European Periphery	**3.11**	**3.79**	**3.46**
Austria	2.44	2.91	2.67
Bulgaria	na	na	2.87
Greece	na	na	5.39
Hungary	2.95	3.39	2.77
Italy	2.14	3.16	3.59
Portugal	2.13	2.61	3.30
Romania	na	na	1.87
Russia/USSR	5.45	5.16	9.20
Serbia/Yugoslavia	na	7.71	2.60
Spain	3.55	1.60	0.36
Latin America	***6.24***	***5.04***	***4.82***
Argentina	6.55	8.91	5.56
Brazil	na	5.75	5.65
Chile	7.09	1.74	2.83
Colombia	na	na	7.00
Mexico	7.80	3.80	5.64
Peru	na	6.19	3.65
Uruguay	3.53	3.86	3.41
Middle East	***na***	***1.73***	***3.78***
Egypt	na	na	1.60
Turkey	na	1.73	5.95
Asia	***2.13***	***4.90***	***5.88***
China			
Shanghai	na	9.56	8.07
Mainland	na	na	6.41
India	0.77	3.87	4.77
Indonesia	1.33	1.27	3.31
Japan	4.29	4.24	6.56
Korea	na	na	9.46
The Philippines	na	5.56	3.59
Taiwan	na	na	4.88

Note: The regional averages are unweighted.
Source: See Appendix 1.

Table 2. Policy Status and Industrial Growth (Relative to the Leaders) in the Poor Periphery 1870-1940

	1870-1890			1890-1913			1920-1940	
		No			No			No
Country	**Autonomy**	**Autonomy**	**Country**	**Autonomy**	**Autonomy**	**Country**	**Autonomy**	**Autonomy**
Argentina	3.06		Argentina	5.07		Argentina	2.39	
Austria	-1.05		Austria	-0.93		Austria	-0.50	
Chile	3.60		Chile	-2.10		Chile	-0.34	
Hungary		-0.54	Hungary		-0.45	Hungary	-0.40	
India		-2.72	India		0.03	India		1.60
Indonesia		-1.78	Indonesia		-2.57	Indonesia		0.14
Italy	-1.35		Italy	-0.68		Italy	0.42	
Japan		0.80	Japan	0.40		Japan	3.39	
Mexico	4.31		Mexico	-0.04		Mexico	2.47	
Portugal	-1.36		Portugal	-1.23		Portugal	0.13	
Russia	1.96		Russia	1.32		USSR	6.03	
Spain	0.06		Spain	-2.24		Spain	-2.81	
Uruguay	0.04		Uruguay	0.02		Uruguay	0.24	
			Brazil	1.91		Brazil	2.84	
			China		5.72	China	4.90	
			Peru	2.35		Peru	0.48	
			Philippines		1.72	Philippines		0.42
			Serbia	3.87		Yugoslavia	-0.57	
			Ottoman	-2.11		Turkey	2.78	
						Bulgaria	-0.03	
						Colombia	3.83	
						Egypt		-1.57
						Greece	2.22	
						Korea		6.29
						Romania	-1.30	
						Taiwan		1.71
Average	**1.03**	**-1.06**	**Average**	**0.11**	**0.89**	**Average**	**0.93**	**1.43**

Source: Clemens and Williamson (2010; Table 1, p. 28). Within period changes were: China 1929, taken as autonomous 1920-1940; and Japan 1900, taken as autonomous 1890-1913. Those without autonomy were either colonies or had signed 'unequal' treaties tying their policy hands, at least regards tariffs.

Table 3
Poor Periphery Manufacturing Growth Relative to Leaders 1870-1940
Periphery output growth rates less Three Leader averages
(% per annum)

	1870-1890	**1890-1913**	**1920-1939**
European Periphery	**-0.38**	**-0.05**	**+0.29**
Austria	-1.05	-0.93	-0.50
Bulgaria	na	na	-0.30
Greece	na	na	+2.22
Hungary	-0.54	-0.45	-0.40
Italy	-1.35	-0.68	+0.42
Portugal	-1.36	-1.23	+0.13
Romania	na	na	-1.30
Russia/USSR	+1.96	+1.32	+6.03
Serbia/Yugoslavia	na	+3.87	-0.57
Spain	+0.06	-2.24	-2.81
Latin America	**+2.75**	**+1.20**	**+1.70**
Argentina	+3.06	+5.07	+2.39
Brazil	na	+1.91	+2.84
Chile	+3.60	-2.10	-0.34
Colombia	na	na	+3.83
Mexico	+4.31	-0.04	+2.47
Peru	na	+2.35	+0.48
Uruguay	+0.04	+0.02	+0.24
Middle East	Na	**-2.11**	**+1.21**
Egypt	na	na	-1.57
Turkey	na	-2.11	+2.78
Asia	**-1.36**	**+1.06**	**+2.71**
China			
Shanghai	na	+5.72	+4.90
Mainland	na	na	+3.24
India	-2.72	+0.03	+1.60
Indonesia	-1.78	-2.57	+0.14
Japan	+0.80	+0.40	+3.39
Korea	na	na	+6.29
The Philippines	na	+1.72	+0.42
Taiwan	na	na	+1.71

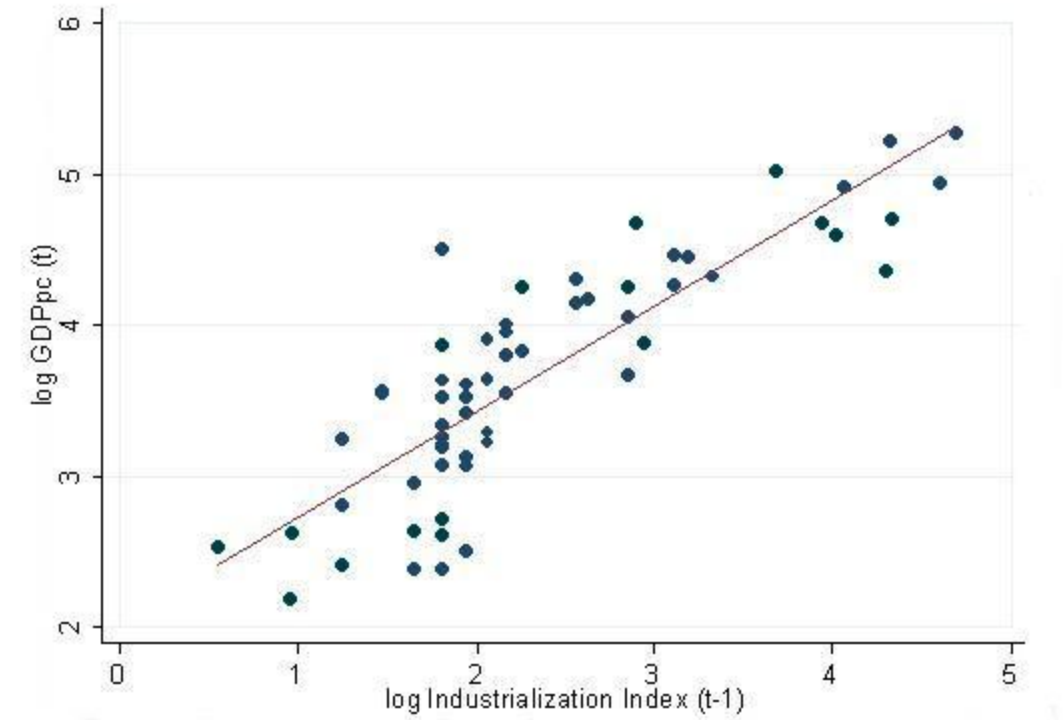
Source: Table 1.

Table 4. Real Exchange Rates in the Poor Periphery 1870-1940

	RER (1913=100)		
Country	**1920-1940**	**1890-1913**	**1870-1890**
Argentina	39.1	84.5	106.0
Austria	na	92.3	81.2
Brazil	45.7	89.9	na
Bulgaria	34.0	na	na
Chile	58.4	72.4	65.4
China	na	111.1	na
Colombia	91.3	(100)	na
Hungary	na	92.3	81.2
India	na	89.4	79.3
Italy	na	95.6	85.5
Japan	100.9	83.3	89.4
Mexico	75.7	82.3	85.7
Portugal	na	97.8	97.6
Russia/USSR	na	91.9	88.6
Spain	na	91.6	108.4
Uruguay	78.7	82.5	110.7
Unweighted Average	65.5	90.5	89.9

Sources and Notes: See Appendix 3. All figures are period averages, except Colombia 1890-1913, which is 1913.

Figure 1 Do Industrial Countries Get Richer?



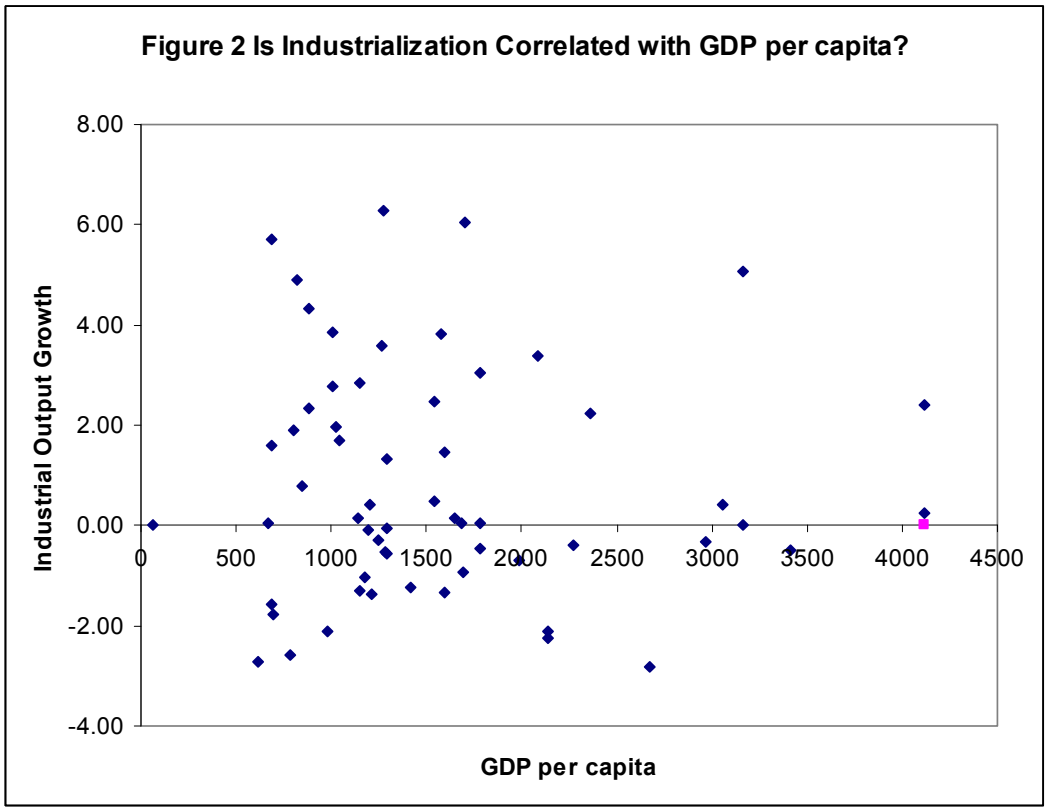


Figure 2 Is Industrialization Correlated with GDP per capita?
Industrial Output Growth
8.00
6.00
4.00
2.00
0.00
-2.00
-4.00
0
500
1000
1500
2000
2500
3000
3500
4000
4500
GDP per capita

Figure 3
Industrial Output vs Productivity Growth 1870-1940

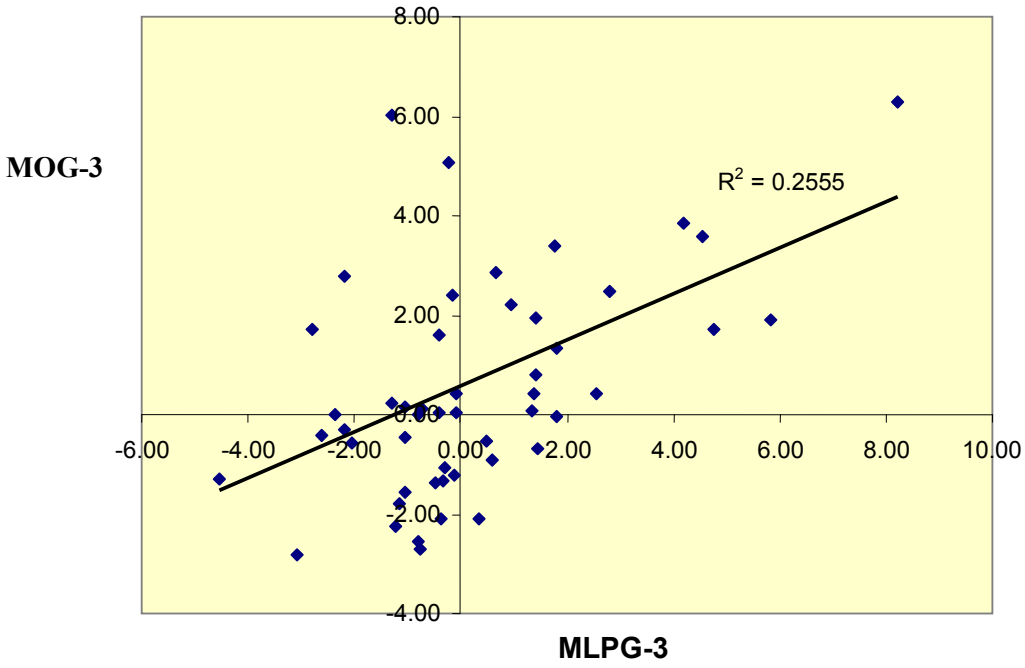
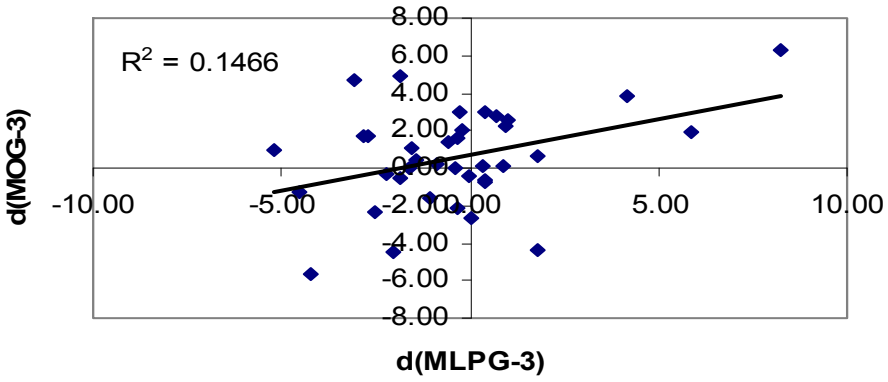


Figure 3b. Changing Industrial Output Growth vs Changing Industrial Productivity Growth



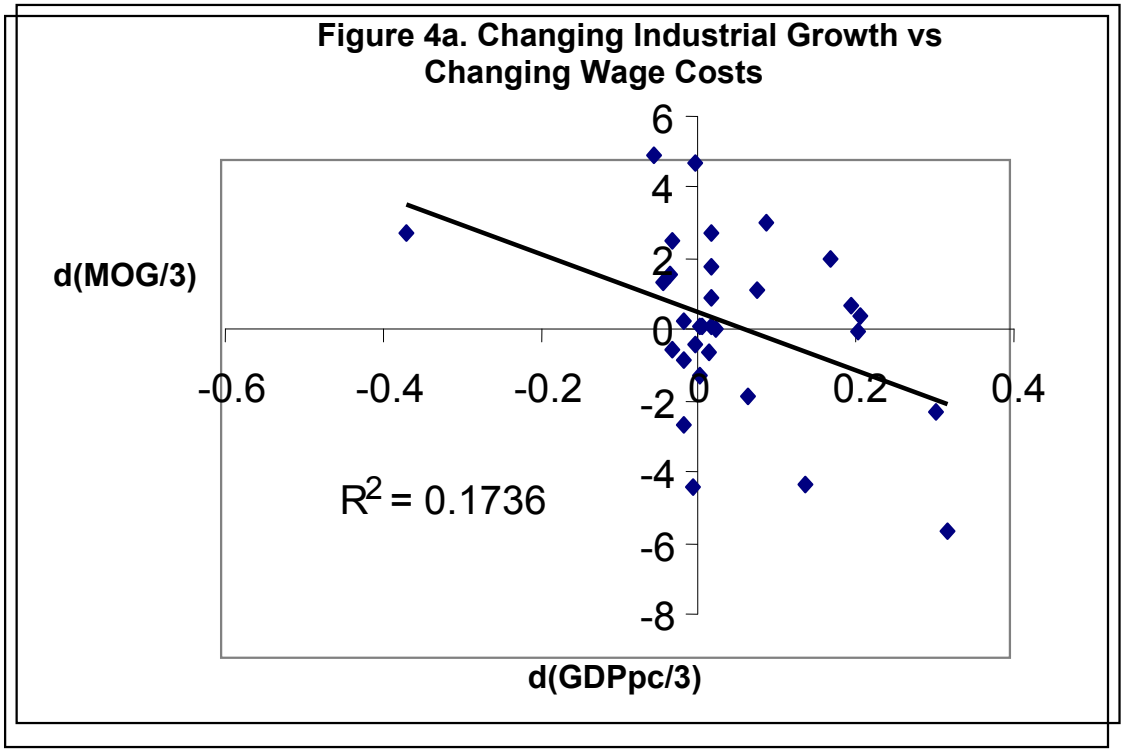


Figure 4a. Changing Industrial Growth vs Changing Wage Costs
d(MOG/3)
6
4
2
0
-2
-4
-6
-8
-0.6
-0.4
-0.2
0
0.2
0.4
R2 = 0.1736
d(GDPpc/3)

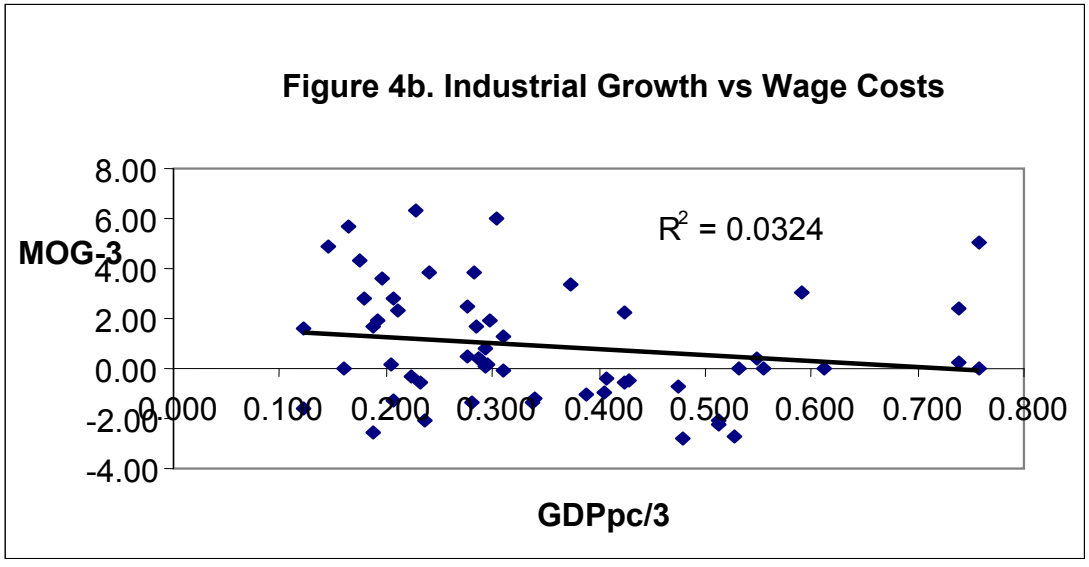
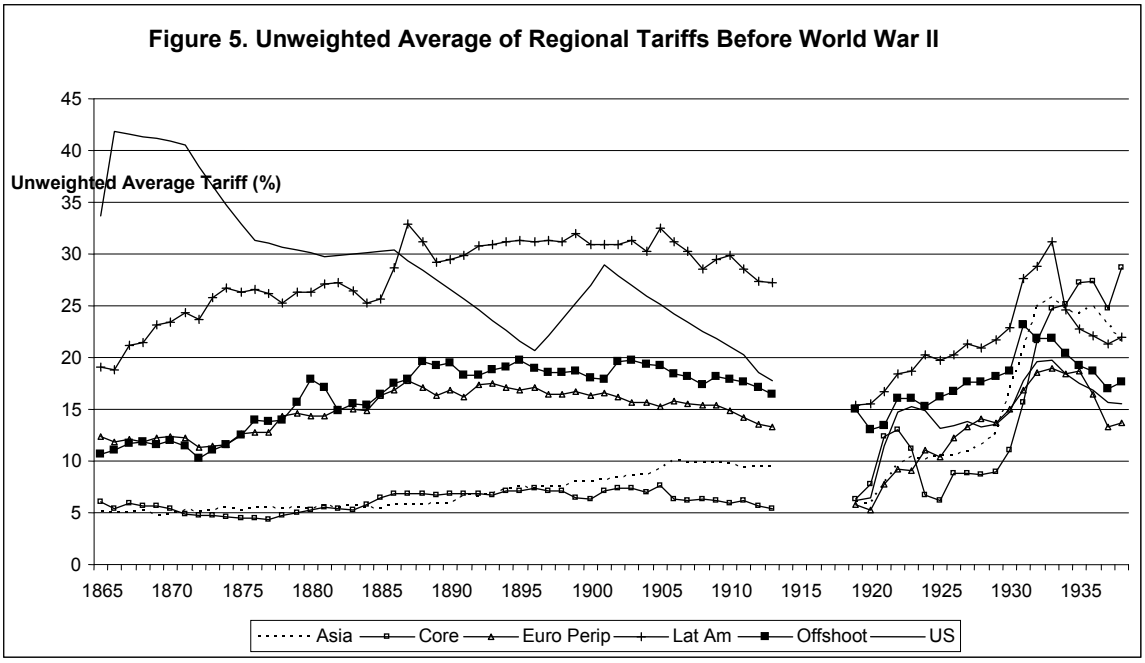


Figure 4b. Industrial Growth vs Wage Costs
MOG-3
8.00
6.00
4.00
2.00
0.00
-2.00
-4.00
0.000
0.100
0.200
0.300
0.400
0.500
0.600
0.700
0.800
R2 = 0.0324
GDPpc/3



Source: Williamson (2011: Figure 13.1).

Figure 6a. Changing Industrial Growth and Changing Tariffs

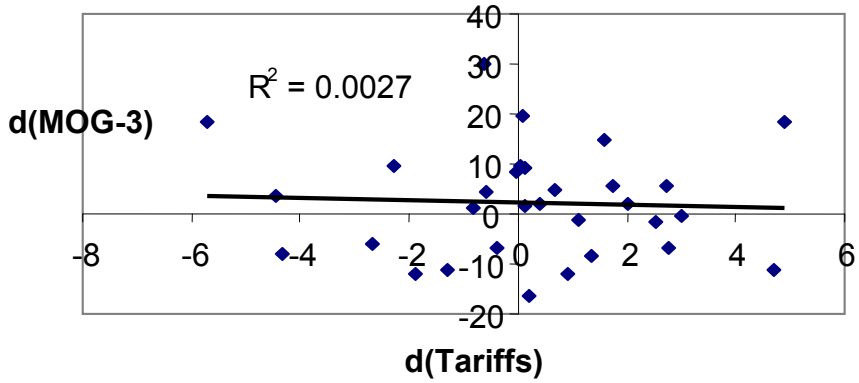
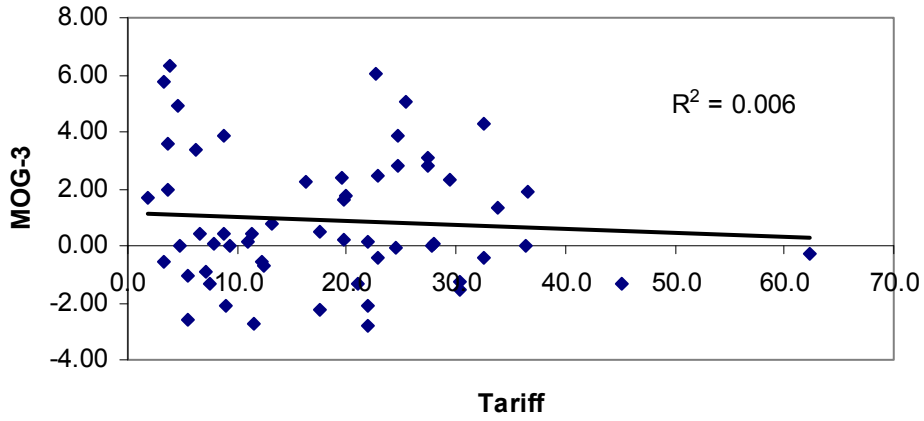


Figure 6b. Industrial Growth vs Tariff Levels



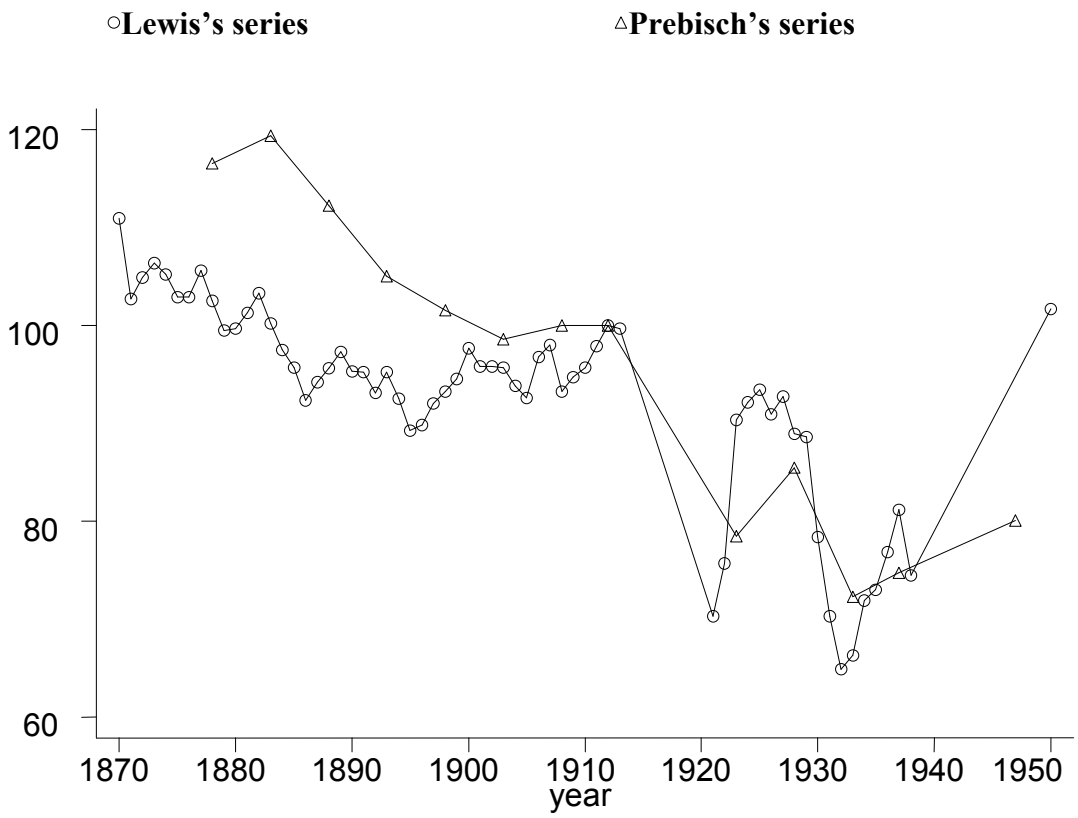


Figure 7. The Relative Price of Primary Products According to Lewis and Prebisch 1870-1950 (1912=100)
Source: Hadass and Williamson (2003; Figure 1, p. 631)