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Jeffrey G Williamson, Harvard University, University of Wisconsin and CEPR

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Centre for Economic Policy Research
77 Bastwick Street, London EC1V 3PZ, UK
Tel: (44 20) 7183 8801, Fax: (44 20) 7183 8820
Email: cepr@cepr.org, Website: www.cepr.org

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ABSTRACT

Industrial Catching Up in the Poor Periphery 1870-1975*

This paper documents industrial output and labor productivity growth around the poor periphery 1870-1975 (Latin America, the European periphery, the Middle East, South Asia, Southeast Asia and East Asia). Intensive and extensive industrial growth accelerated there over this critical century. The precocious poor periphery leaders underwent a surge and more poor countries joined their club. Furthermore, by the interwar the majority were catching up on Germany, the US and the UK, a process that accelerated even more up to 1950-1975. What explains the spread of the industrial revolution world-wide and this catching up? Productivity growth certainly made their industries more competitive in home and foreign markets, but other forces mattered as well. A falling terms of trade raised the relative price of manufactures in domestic markets, as did real exchange rate depreciation. In addition, increasingly cheap fuel and non-fuel intermediates from globally integrating markets seems to have taken resource advantages away from the European and North American leaders, and integrating world financial markets also reduced the cheap capital advantage of the leaders. However, ever-cheaper labor was not a serious cause of industrial catch up, offering little support for the Krugman-Venables (1995) model. Furthermore, tariffs did not foster industrial catch up either, but rather poor industry performance fostered high tariffs. Markets and policies mattered, not just institutions.

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Jeffrey G Williamson
350 South Hamilton Street
Unit 1002
Madison, WI 53703
USA

Email: jwilliam@fas.harvard.edu

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1. Motivation

In some parts of the poor periphery¹, 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. Between 1950 and 1975, the catching up accelerated¹ and came to include almost every member of the poor periphery in Asia, Latin America, and backward eastern and southern Europe.

Why did industrialization in the poor periphery start in the half century 1870-1913 (long before the Third World growth miracles of the mid-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? Why was industrial catching up so pronounced in the quarter century 1950-1975, and how much was independent of the pro-industrial policies pursued? In short, what were the main forces driving the diffusion of modern industry from the rich industrial core to the poor periphery?

¹ I use the term poor periphery to distinguish poor late comers in the periphery from the successful English-speaking offshoots. The Third World is, of course, a subset, but the poor periphery also includes backward eastern and southern Europe, as well as European-settled Latin America.

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. On these grounds alone, the poor periphery should have become 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 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 a world transport revolution made it possible to deliver those intermediates at ever-cheaper prices to fuel-scarce economies in the poor periphery. 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?² 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

² 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.

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 services.³ 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, displaces competing foreign goods, 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.

³ Although modern endogenous growth rarely cites them, they were anticipated in the 1950s and 1960s by two-sector or dualistic growth models.

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 (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 century 1870-1975. It does it in four parts, roughly two decades each: 1870-1890, 1890-1913, 1920-1939, and 1950-1975. It also compares the poor periphery 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.⁴ 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.⁵

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

The Data

⁴ This, of course, is the language of my mentor Moses Abramovitz in his seminal writings. Note, however, that Table 1 (Abramovitz 1986: 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. Thus, he was not speaking to poor periphery catching up at all.

⁵ 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 1870-1975.

Secondary sources have allowed me to document constant price ‘industrial’ output for 29 members of the poor periphery for 1920-1939, the last of my three pre-WW2 periods: Argentina, Austria, Brazil, Bulgaria, Czechoslovakia, Chile, China, Colombia, Egypt, Greece, Hungary, India, Indonesia, Italy, Japan, Korea, Mexico, Peru, the Philippines, Poland, Portugal, Romania, South Africa, Spain, Taiwan, Turkey, Uruguay, the USSR, and Yugoslavia. The sample swells to 35 in 1950-1975, with the addition of Ecuador, El Salvador, Guatemala, Nicaragua, Panama, and Venezuela. Of course, the same definition of ‘industry’ is not always used in all country studies: based on their primary sources for the interwar period, some scholars restrict the industry definition to manufacturing alone (15); 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.⁶

Not surprisingly, the sample shrinks a bit as we move back in time: while there are 29 countries in the 1920-1939 sample, ten disappear when moving back to 1890-1913, leaving 19; and the sample shrinks still further in 1870-1890 to 13. While I am still

⁶ 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.

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 industrial 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 34 for 1950-1975, 28 for 1920-1939, 16 for 1890-1913, and 10 for 1870-1890.

Appendices 1-3 report the sources of the output and labor productivity growth rate Estimates.

I need to offer a final word before pressing on with this preliminary analysis. Presumably, the spread of industrial activity behaves the same way that new products and new technologies do, tracing out some diffusion S-curve (Basu and Weil 1998). Thus, even successful industrialization should exhibit growth rates which start slow, accelerate to a peak, retard, and then become negative as the rich economy de-industrializes while shifting to sophisticated service activities. A future version of this paper with Michael Clemens will adjust all the growth figures reported here using an estimated S-curve diffusion metric. Until then, we shall have to be content with what follows.

Rising Industrial Catching Up before WW2

Table 1 reports industrial output growth – always in constant prices – for the three leaders (again, Germany, the US, and the UK) and the poor periphery. The first fact to emerge is that the rate of industrial output growth rose throughout the century 1870-1975; it was not simply an ISI-induced boom that awaited post-WW2 policy. Between 1870 and 1890, the average industrial growth rate for the poor periphery was 3.85 per annum,

greater than that of the three leaders (3.49 percent per annum), and thus already achieving some catching up. The fastest industrializing region by far was Latin America (6.24 percent per annum), led by Argentina, Chile and Mexico. The two other industrialization hot spots were Russia (5.45 percent per annum) in the European periphery and Japan (4.29 percent per annum) 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 fast industrializing club expanded: 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 1939, the club got much bigger with the addition of Colombia, Czechoslovakia, Greece, Italy, colonial Korea, colonial Manchuria, colonial Philippines, the new republics of Poland and Turkey, and colonial Taiwan. Furthermore, the average rate of industrial growth in the poor periphery increased to 4.72 percent per annum during the interwar decades, well above the three leaders (3.17 percent per annum).

Two morals follow. First, colonial status and 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 1920-1939, by 0.12 percentage points.⁷ Second, the spread of

⁷ 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 century unfolded, reaching an impressive crescendo in the post-WW2 quarter century following 1950.

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 behind⁸). Between the pre-1913 and interwar period, the average rate of catching up in the poor periphery had increased by four times, to 1.55 percent per annum. Furthermore, more than two thirds (an impressive 22 out of 30⁹) 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 1920-1939).

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.

⁸ 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.

⁹ Or 23 out of 31, if Manchuria is added as a separate observation.

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 with the three leaders. In any case, between the periods before and after WW1, the biggest industrial catch up surge 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. Although the 1890-1913 rates are unavailable for Colombia, China (only Shanghai), Korea, Taiwan, and South Africa, their growth rates for the interwar are so high that they are almost certain to have belonged in the big-catching-up-surge club.

The Spectacular Post-WW2 Catching Up

The postwar poor periphery catch up after 1950 was truly spectacular, even by the standards of the so-called west European miracle. The average rate of industrial output growth was 7.88 percent per annum (Table 1), which meant a catching up rate of 3.29 percent per annum (Table 3). Thus, the poor periphery added more than 3 percentage points to its already-impressive interwar industrial growth (4.72 percent per annum) and catching up performance (1.55 percent per annum). Furthermore, industrialization in the poor periphery was ubiquitous: only four countries, all in Latin America, recorded industrial per annum growth rates below the poor periphery interwar average: Brazil 1.80, Chile 4.38, Colombia 1.57, and Uruguay 2.43. Everywhere else in the poor periphery rates even greater than the “growth miracle” achieved in western Europe (Crafts and Toniolo 1996) were common. In every region, the previous precocious emerging

industrial leaders were joined by many others: in the European periphery, Austria, Bulgaria, Czechoslovakia, Greece, Hungary, Italy, Poland, Portugal, Romania, and Spain all joined the interwar industrial hot spots, Russia and Yugoslavia; in Latin America, Colombia, Ecuador, El Salvador, Guatemala, Nicaragua, Panama, Peru, and Venezuela all joined the long-standing emerging leaders, Brazil and Mexico; in the Middle East, Egypt joined Turkey; and in Asia, Indonesia and the Philippines joined India and the East Asian interwar emerging leaders (some of whom came to be called the Gang of Four by postwar observers).

In short, the rate of industrial catching up surged in that postwar quarter century after 1950 (*intensive* industrialization), and it also spread from the emerging leaders to the regional followers (*extensive* industrialization), big time! But it is important to remember that the catch up surge had its source in the interwar years and even before.

What about Persistence?

Brazil, Japan, Mexico, Russia, and Shanghai province were emerging industrial leaders pretty much from the start in the 1870s, but was historical persistence more general than that illustrated by these famous five? Apparently not, since the evidence on historical persistence is mixed at best. Figure 2 reports the simple correlation between industrial catching up in some current period relative to the previous one. The correlation is strongest between 1920-39 and 1890-1913, $R^2 = 0.21$, but even here that correlation left much scope for newcomers arriving on the scene and old leaders disappearing from it. The correlation is even weaker between 1890-1913 and 1870-1890, $R^2 = 0.15$, and, most surprising, it *completely* disappears between 1950-1975 and 1920-1939, $R^2 = 0.01$!

Persistence was *not* a strong feature of industrial catching up around the poor periphery over the century 1870-1975. The implication is important since it suggests that getting the fundamentals right – culture, geography and institutions – did very little to guarantee successful (or unsuccessful) industrialization over the century. Other forces must have been at work, whether world markets, domestic markets or policy.

3. How to Identify the Sources of Industrialization

Manufacturing output growth (relative to the three leaders) was not correlated with GDP per capita between 1870 and 1939 ($R^2 = 0.002$). 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?

I think 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 subscripts t = time period (1870-1890, 1890-1913, 1920-1939, 1950-1975) and j = country both suppressed in the notation:

$$\pi = p - \{w_l + u_k + p_m m + p_f f\} \quad (1)$$

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 four periods 1870-1890, 1890-1913, 1920-1939, and 1950-1975, 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 1870-1939 (or even 1950-1975) 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:
 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.¹⁰ Three forces would have served to raise the relative domestic price of manufactures: a 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 tariff and non-tariff barrier to manufactured imports.

φ_{lw}^* : 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 (Bourguignon and Morrisson 2002), 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. Whether they were able to exploit the cheap labor advantage depended, of course, on other determinants of profitability and competitiveness.

φ_{ku}^* : 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 (Obstfeld and Taylor 2004; Mauro *et al.* 2006), 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 (De Long and Summers 1991; De Long 1992; Collins and Williamson 2001).

¹⁰ 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, India with its jute, or Egypt with its cotton. To repeat, none of them were large enough to influence the world price of manufactures.

$\varphi_m p_m^*$ 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 1939. Manufacturing in natural resource scarce countries in the poor periphery must have benefited by global market integration much more than did the resource-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 must have almost evaporated for any poor periphery country without coal or oil reserves in the more global world of 1939 when they could import the stuff cheaply. Certainly φ_m was big enough to matter, and recent writings suggest the same must have been true of φ_f in steam-powered manufacturing (Balderston 2010).

$\text{tfpg} = \{\varphi_l l^* + \varphi_k k^* + \varphi_m m^* + \varphi_f f^*\}$: Fast total factor productivity growth (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 four 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? A Research Agenda

This section is labeled a ‘research agenda’ 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. Still, we can report some interesting initial findings as well as lay out an agenda.

Three That Clearly Mattered

Productivity Growth

Let me start with the reminder that labor productivity growth is being used as a proxy for total factor productivity growth. Figure 3 reports the correlation between

manufacturing catching up, output growth less that of the three leaders (MOG-3), and manufacturing labor productivity growth less that of the three leaders (LPG-3), both in percent per annum averaged over each of the four periods. While the correlation in the four decades up to 1913 is certainly positive and significant ($R^2 = 0.38$), it still leaves two thirds more to be explained, presumably by adding a role for world markets and transport costs, domestic tariffs, and domestic exchange rate policy.¹¹ This is even more true when *changing* MOG-3 between any two periods is correlated with *changing* LPG-3 (not shown, but $R^2 = 0.15$). Productivity growth catch-up contributed powerfully to output growth catch-up between 1870 and 1913, but other forces affecting output price and input costs appear to have mattered even more. The results are much the same for the interwar decades ($R^2 = 0.42$), even though the elasticity of output growth to productivity declined sharply (not shown in Figure 3: 1870-1913 $\varepsilon = 3.389$, 1920-1939 $\varepsilon = 0.161$). But the big surprise is the impressive rise in the correlation in the ISI period between 1970 and 1975, when $R^2 = 0.73$. Given how the traditional literature has stressed the role of ISI policy – a policy that fostered industrialization by raising industrial output prices and lowering input costs, it appears the forces driving productivity were far more important over the quarter century after 1950 than over the seven decades before WW2.

Terms of Trade and the Relative Price of Manufactures at Home

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 4 replicates the

¹¹ 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 cross-border technological transfer rises with openness (Parente and Prescott 2002; Lucas 1993, 2009).

Lewis-Prebisch-Singer finding, where the steepest decline was 1913-1939, followed by 1870-1890, with 1890-1913 bringing up the rear. 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 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, especially in the interwar years: 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 health' during the terms of trade bust from the 1870s to the 1930s. Figure 5 confirms the prediction: while the correlation is hardly perfect ($R^2 = 0.03$), the relationship is steep and the elasticity large.

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 1870-1939?

The standard view is that real exchange rates were stable during the gold standard era up to World War I. But this standard view is based on Euro-centric evidence. In contrast, there was real appreciation in the poor periphery¹²: in our sample, the real exchange rate rose 11 percent 1870-1890 and by 10 percent 1890-1913, hardly a stimulus for industrial catching up. But between 1920 and 1939, on average the real exchange rate fell by 8 percent in the poor periphery, for a total turn around of 18 percent in favor of domestic manufacturing.¹³ Of course, there was considerable variance in the behavior of the real exchange rate (REER) across countries, not just over time, and Figure 6 reveals that real exchange depreciation (appreciation) was indeed associated with fast (slow) industrial catching up ($R^2 = 0.034$).

One Big Correlate, but Reverse Causality: Endogenous Tariffs

Over the past two decades, the literature exploring the openness-growth connection has boomed (typically using tariffs as the measure of non-openness), no doubt because the results are very relevant to current policy formation in the Third World. The

¹² 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 others.

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.

vast majority of that 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* correlation between tariff heights 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 protection-growth correlation switched sign and became *negative* for the century 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) again (like Bairoch) reports a *positive* protection-growth correlation for Latin America 1900-2004, also with controls.

What's missing from this ambiguous literature is, of course, an explicit assessment of the channel of impact leading to the macro GDP per capita growth effects and an assessment of the alleged recipient of the protection in poor countries – industry.¹⁴ Why correlate industrial protection with GDP growth in the poor periphery if the policy target was industrialization?

High average tariffs in the poor periphery meant even higher tariffs on finished manufactures, perhaps two or three times higher.¹⁵ And as Figure 7 shows they were very high indeed in autonomous Latin America and the European Periphery (see also Coatsworth and Williamson 2004; Williamson 2006). But if high tariffs were to foster

¹⁴ 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.

¹⁵ 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.

industrialization in Asia before 1939, it had to wait for the interwar. While tariffs in Latin America and the European Periphery between 1870-1890 and 1890-1913 were very high and even rose, they remained very low in Asia. Between 1890-1913 and 1920-1939, average tariffs fell or remained the same everywhere in the poor periphery except Asia, where they started rising in the 1920s and then shot up in the 1930s. Thus, protection may have fostered industrialization in Latin America and the European Periphery up to WW1, but it wasn't until the interwar decades that it could have done the same for Asia.

So much for the theory and the timing of tariff policy. What about the correlations with industrial catching up? When we turn our attention from GDP per capita growth to industrial catching up, do we then find the positive correlation between protection and growth first found for Europe by Bairoch (1989), rather than the negative correlation found by Vamvakidis (2002) and Clemens and Williamson (2004) for the world as a whole, at least after 1914? Figures 8a and 8b reveal some surprises. For the full period 1870-1939, tariff policy did not contribute to industrial catching up (Figure 8a). Indeed, the correlation, though weak, is negative between protection and industrial growth. The big surprise lies with Figure 8b, which covers only the interwar period: there the negative correlation persists, and this time it is even highly significant! These are, of course, only bi-variate correlations, but they certainly suggest that poor industrial growth fostered protection, not *vice versa*. Of course, Eichengreen and Irwin (2009) have shown how countries who depreciated their real exchange rates were much less likely to have raised tariffs in the interwar, so the negative protection-growth correlation in Figure 8b could possibly be overturned when future work explores the industrial catching up issue using multi-variate analysis.

In any case, after WW2 the results may be very different since the poor periphery used many and even more effective tools to protect and stimulate domestic industry – quotas, exchange controls, pro-industrial domestic policies, and, as in the 1930s, exchange rate depreciation (Diaz-Alejandro 1984; Corbo 1992; Taylor 1998). Still, if tariffs were correlated with non-tariff barriers and pro-industrial policies, we should see a significant correlation between them and industrial catching up. But we do not see it in the pre-1939 decades.

One Which Mattered Even Less, and Two On Which the Jury Is Still Out

Cheap Labor in Labor-Intensive Manufacturing

Cheap labor is central to one elegant and famous growth model offered by Paul Krugman and Tony Venables (1995) fifteen years ago. In their economic geography model, eventually transport costs drop to such an extent that the advantages of cheap southern wages swamp any advantages of proximity to markets (since the advantages of being close to one's suppliers or customers diminishes as transport becomes cheaper), and industries locate in the South, which grows at the expense of the North. Can we find evidence of cheap labor effects in our data base?

Many forces were at work over the century 1870-1975, but we should see some positive correlation between high industrial growth rates and low labor costs per unit of output, both relative to the leaders. Alternatively, we should see a negative correlation between relative industrial growth and relative GDP per capita, our proxy for cheap labor. Figure 9a confirms the correlation, but it is very low ($R^2 = 0.03$), suggesting that cheap labor played only a marginal role in the catching up sweepstakes, and that the next

phase the analysis must control simultaneously for the remaining (major) forces. To the extent that the focus is country-specific timing of industrialization rather than who leads, then perhaps country fixed effects is the best way to identify how ever-cheaper labor played a part in any explanation of the timing of industrialization in the poor periphery before 1975. Yet, even that result is unlikely to be forthcoming since first differences -- changing labor costs, $d(\text{wage proxy})$, and changing rates of catching up, $d(\text{MOG-3})$ -- are not correlated at all in Figure 9b.

So far, support for the Krugman-Venables model is weak at best.

Cost of Fuel and Manufacturing Intermediates

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 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 1939. 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 almost no data yet documenting the relative price of fuel and manufacturing intermediates (that is, relative to 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 big intermediate cost shares cannot be in doubt: for example, in the 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 in the Mexican interior.¹⁶ 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 much smaller for fuels than for 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, more than five times the Lancashire price. And this big range was just for Europe.

We know coal prices converged between the 1870s and the 1930s, so this wide price spread reported above for the early-mid 1880s must have diminished over time. For example, a quarter of a century later, in 1907, the mean for a sample of 48 world seaports (almost half outside Europe) was 25.83 £/ton, but the average for the three leaders was 25 percent less, 19.43 £/ton (based on data underlying Clark 2007, Figure 15.1, p. 310). Coal was very expensive in much of the poor periphery, including the following: Pernambuco (Brazil), 49.50 £/ton, 155 percent above the three industrial leaders; Buenos Aires (Argentina), 39 £/ton, 101 percent above; Manila (Philippines), 33.55 £/ton, 72.7 percent above; or Colombo (Ceylon), 34.35 £/ton, 76.7 percent above. Thus, there is no doubt that fuel costs still ranged widely across the globe as late as 1907, even when the comparison is limited to seaports; if the comparison included inland cities, presumably

¹⁶ In the 1870s, Mexico had a tariff on raw cotton to protect local producers (Gómez Galvarriato and Williamson 2009).

the range would be even greater (e.g. there are no observations yet for inland Russia, India, the Balkans, Colombia, Peru, or Mexico). In addition, while we know the coal price spread was greater in 1870 and less in 1939, but we do not yet have the data to document the magnitudes. Even the cited data for our sole observation, 1907, is crude, and thus we do not know whether the *inverse* correlation between 1907 coal costs and industrial output growth in Figure 10 (MOG-3 *rises* with fuel costs) is signaling limited evidence, that 1907 was a bad benchmark for assessing impact on industrial growth over the half century 1890-1939, that local fuel costs were driven up by successful growth, or that they were simply correlated with something else.

The User Cost of Capital

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 et al. 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 accumulation and industrial growth in the poor periphery 1870-1975.¹⁷ How much awaits the data documenting the cost of financial capital and capital goods, by poor periphery country over time.

¹⁷ There is, of course, no shortage of theoretical literature making the price of capital goods and accumulation connection. See, for example, Jones (1994).

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.

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**Appendix 1 Data Sources for the Williamson Project on
Industrialization in the Poor Periphery:
Output Growth 1870-1939**

(Note: All output indices in constant prices. Date: December 27, 2010)

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 (12)

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 1904-1912 from M. C. Kaser and E. A. Radice (eds.), *The Economic History of Eastern Europe 1919-1975* (Oxford: Clarendon Press 1985), Table 5.4, p. 230. Industrial production 1920-1929 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.

Czechoslovakia: Annual index of manufacturing production (1925-29 = 100), from League of Nations, *Industrialization and Foreign Trade* (New York: League of Nations 1945): Table VI, p. 142.

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), 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.

Poland: Annual index of manufacturing production (1925-29 = 100), from League of Nations, *Industrialization and Foreign Trade* (New York: League of Nations 1945): Table VI, p. 142.

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 históricas de España: Volume 1: Siglos XIX-XX* (Madrid: Fundacion BBVA 1989), Cuadro 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. The US BLS reports much lower output growth 1913-1937, but it includes the wartime slump.

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: Pontificia 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 observations 1850-1889 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, *Crecimiento Económico en el Perú: 1896-1995: Nuevas Evidencias Estadísticas* (Lima: Universidad del Pacífico, 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 Estadística, 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 output 1895-1936 from Xinwu Xu and Hanming Huang, *Shanghai Jindai Gongyeshi* (1998), p. 342, cited in Debin Ma, "Economic Growth in the Lower Yangtze 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.

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.

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 2010), 294-309, Table A1, 304-6.

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 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. Sang-Chul Suh, *Growth and Structural Changes in the Korean Economy 1910-*

1940 (Cambridge, Mass.: Harvard University Press, 1978), Table A-12, p. 171 reports 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. We favor the more recent Kim and Park 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.

Africa (1)

Union of South Africa: 1916-1948 Gross value of output in manufacturing from Charles H. Feinstein, *An Economic History of South Africa: Conquest, Discrimination and Development* (Cambridge, Cambridge University Press, 2005), Table 6.2, p. 122 is preferred to, but almost the same as, the annual index of manufacturing production in League of Nations, *Industrialization and Foreign Trade* (New York: League of Nations 1945): Table VI, p. 143. 1948-1971 Gross value of output in manufacturing from Feinstein (2005), Table 8.5, p. 186.

**Appendix 2 Data Sources for the Williamson Project on
Industrialization in the Poor Periphery:
Employment and Productivity for Industrial Labor Productivity Growth 1870-1939**

(Note: All productivity indices in constant prices. Date: December 27, 2010)

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: 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 output per laborer 1904-1912 from M. C. Kaser and E. A. Radice (eds.), *The Economic History of Eastern Europe 1919-1975* (Oxford: Clarendon Press 1985), p. 277. Industrial labor force 1920-1930 from Lampe and Jackson (1982), Table 10.4, p. 336 and 1930-1938 from Lampe and Jackson (1982), Table 11.12, pp. 419-20, and Table 12.15, p. 485.

Czechoslovakia: Industrial labor force 1920-1939 from Kaser and Radice (1985), Table 5.11, p. 245.

Greece: Industrial employment in manufacturing and construction from Brian R. Mitchell, *International Historical Statistics: Europe 1750-1993, 4th ed.* (New York: Stockton Press, 1998), Table D1, p. 421.

Hungary: 1869-1913 employment in manufacturing and construction from Mitchell (1998), Table B1, p. 151; 1913-1938 manufacturing employment from Gyorgy Ranki, "Problems of the Development of Hungarian Industry, 1900-1944," *Journal of Economic History* 24, 2 (June 1964), Tables 1 and 2, p. 214.

Italy: Employment 1870-1940 based on census "active population" in industry, from Vittorio Daniele and Paolo Malanima, "Labour Force in Italy 1861-2001: Structural Change and Regional Disparities," working paper (2010), Appendix, Table 5.

Poland: Industrial labor force 1920-1939 from Kaser and Radice (1985), Table 5.11, p. 245.

Portugal: Industrial (including manufacturing, mining, electricity, water and construction) employment (males) from Pedro Lains, "Growth in a Protected Environment: Portugal, 1850-1950, *Research in Economic History*, Volume 24 (2006), Table 8, p. 138.

Romania: Industrial employment 1919-1938 from Lampe and Jackson (1982), Table 11.12, pp. 419-20, and Table 12.15, p. 485.

Russia/USSR: Employment in mining and manufacturing from Brian R. Mitchell, *International Historical Statistics: Europe 1750-1988* 3rd ed. (New York: Stockton Press, 1992), p. 152.

Serbia/Yugoslavia: Manufacturing employment 1918-1938 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 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).

Note: Employment and productivity data are unavailable for Czechoslovakia and Poland.

Latin America (6)

Argentina: Manufacturing employment 1895-1914 from Vicente Vazquez-Presedo, *Estadísticas Históricas Argentinas (Comparadas): Primera Parte 1875-1914* (Buenos Aires: Ediciones Macchi, 1971), Table III-9, pp. 60-1; employment in mining, manufacturing and construction 1915-25 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. The US BLS reports much lower labor productivity growth 1913-1937, but it includes the wartime slump.

Brazil: 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 labor force from Juan Braun *et al.*, *Economía Chilena 1810-1995: Estadísticas Históricas* (Santiago: Pontificia Universidad Católica de Chile, 2000), Table 7.2, pp. 219-220.

Colombia: Manufacturing employment 1925-1940 from United Nations, *Economic Commission for Latin America* (1966), Table I-1, p. 1 and I-13, p. 13.

Mexico: Employment in manufacturing and construction from Brian R. Mitchell, *International Historical Statistics: The Americas and Australasia* (Detroit, Mich.: Gale Research Co., 1983), p. 393.

Uruguay: Industrial employment 1925-1940 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-16, p. 16.

Note: Employment and productivity data are unavailable for Peru.

Middle East (2)

Ottoman Empire/Turkey: Non-agricultural output and 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), Tables 2 and 3: pp. 399 and 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 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 net domestic product and 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, 4.2, and 4.3A, 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 2010), 294-309, Table A2, 307-8.

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. 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 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. The employment growth rates in 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 are much slower implying implausible rates of productivity advance (6.29 % p. a.), so we use the more recent Kim and Park estimates.

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: Value of gross output and 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.

Note: Employment and productivity data are unavailable for China.

Africa (1)

Union of South Africa: 1916-1948 manufacturing employment from Charles H. Feinstein, *An Economic History of South Africa: Conquest, Discrimination and Development* (Cambridge, Cambridge University Press, 2005), Table 6.2, p. 122. 1948-1971 manufacturing employment from Feinstein (2005), Table 8.5, p. 186.

**Appendix 3 Data Sources for the Williamson Project on
Industrialization in the Poor Periphery:
Output and Labor Productivity Growth 1950-1975**

(Note: All output indices in constant prices. Date: December 27, 2010)

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 and employment in manufacturing from SNB, Appendix Table A3.1(a), pp. 42-44.

United Kingdom: Output and employment in manufacturing (1929=100), SNB, Appendix Table A3.1(a), pp. 42-44.

United States: Output and employment in manufacturing (1929=100), SNB, Appendix Table A3.1(a), pp. 42-44.

European Periphery (12)

Unless otherwise noted below, industrial output and employment from Brian R. Mitchell, *International Historical Statistics: Europe 1750-2000* (New York: Macmillan Palgrave, 2003, hereafter *Europe* (2003)).

Austria: *Europe* (2003), pp. 145 and 425.

Bulgaria: *Europe* (2003), pp. 146 and 425.

Czechoslovakia: *Europe* (2003), pp. 147 and 425.

Greece: *Europe* (2003), pp. 151 and 425.

Hungary: *Europe* (2003), pp. 151 and 425.

Italy: *Europe* (2003), pp. 153 and 426.

Poland: *Europe* (2003), pp. 145 and 425

Portugal: *Europe* (2003), pp. 155 and 426.

Romania: *Europe* (2003), pp. 156 and 426.

USSR: *Europe* (2003), pp. 156 and 426.

Yugoslavia: *Europe* (2003), pp. 160 and 426.

Spain: Prados index of industrial production from Albert Carreras and Xavier Tafunell (eds.), *Estadísticas históricas de España: Volume I: Siglos XIX-XX* (Madrid: Fundacion BBVA1989), Caudro 5.11, pp. 396-8. Labor force (000) in manufacturing 1950-1970 linked to manufacturing plus mining 1970-1980: Carreras and Tafunell (1989), Caudro 2.27, p. 149.

Latin America (13)

Unless otherwise note below:

1950-1963: Industrial production and employment from ECLA, *The Process of Industrialization in Latin America: Statistical Annex* (Santiago, Chile: March 1966), Tables I-1 and I-13, pp. 1,2 and 13;

1963-1975: Industrial production and employment from Brian R. Mitchell, *International Historical Statistics: The Americas 1750-2000* (New York: Palgrave Macmillan, 2003), hereafter *The Americas* (2003).

Argentina: Data underlying I. Brambilla, S. Galiani, and G. Porto, "Argentine Trade Policies in the XX Century: 60 Years of Solitude, in E. Glaeser and R. Di Tella (eds.), *Argentine Exceptionalism* (forthcoming).

Brazil: *The Americas* (2003), pp. 108 and 310.

Chile: Juan Braun *et al.*, *Economía Chilena 1810-1995: Estadísticas Históricas* (Santiago: Pontificia Universidad Católica de Chile, 2000), Table 1.2, pp. 28-29 and Table 7.2, p. 220.

Colombia: *The Americas* (2003), pp. 109 and 310.

Ecuador: *The Americas* (2003), pp. 109 and 310.

El Salvador: *The Americas* (2003), pp. 103 and 308.

Guatemala: *The Americas* (2003), pp. 103 and 308.

Mexico: *The Americas* (2003), pp. 105 and 308.

Nicaragua: *The Americas* (2003), pp. 106 and 308.

Panama: *The Americas* (2003), pp. 106 and 308.

Peru: PBI for the "secondary sector" from Bruno Seminario and Arlette Beltran, *Crecimiento Económico en el Perú: 1896-1995: Nuevas Evidencias Estadísticas* (Lima: Universidad del Pacífico, 2000), Cuadro X.8, pp. 285-7. Manufacturing employment from *The Americas* (2003), p. 110.

Uruguay: *The Americas* (2003), pp. 110 and 310.

Venezuela: *The Americas* (2003), pp. 110 and 310.

Middle East (2)

Turkey: Industrial production and manufacturing and construction employment from Brian R. Mitchell, *International Historical Statistics: Africa, Asia and Oceania, 1750-2000* (New York: Palgrave Macmillan 2003), pp. 102, 347-9, hereafter *Africa, Asia and Oceania* (2008).

Egypt: Industrial production and manufacturing and construction employment from *Africa, Asia and Oceania* (2008), pp. 91, 345-6.

Asia (7)

China: Gross value added in manufacturing from Harry X. Wu and Xinming Yue, "Reconstructing the Post-War Chinese Industrial GDP with a Laspeyres' Quantity Index Approach: A Further Inquiry," in *Constructing a Historical Macroeconomic Database for Trans-Asian Regions*, ed. K. Odaka, Y. Kiyokawa and M. Kuboniwa (Tokyo: Hitotsubashi Institute, March 2000), Appendix Table, p. 106.

India: Gross domestic product total manufacturing from S. Sivasubramonian, *The National Income of India in the Twentieth Century* (New Delhi: Oxford University Press, 2000), Appendix Table 8(b), pp. 538-40. Labor productivity for secondary sector from Sivasubramonian (2000), Table 9.32, p. 620.

Indonesia: 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 2010), Table A1, 304-6. Manufacturing employment from *Africa, Asia and Oceania* (2003), p. 97.

Japan: 1950-1970: value of production and employment in manufacturing from Kazushi Ohkawa and Miyoehei Shinohara with Larry Meissner, *Patterns of Japanese Economic Development: A Quantitative Appraisal* (New Haven, Conn.: Yale University Press, 1979), pp. 305-6, 395. 1970-75: UN Index numbers of industrial production and manufacturing employment from *Africa, Asia and Oceania* (2003), p. 98.

Korea: GDP and employment in secondary sector from Hak Pyo, "Economic Growth in Korea: Long-term Trends and Perspectives," in *Constructing a Historical Macroeconomic Database* (2000), Table 27, p. 210.

The Philippines: Industrial production and employment in manufacturing from *Africa, Asia and Oceania* (2003), pp. 100, 347-8.

Taiwan: GDP in secondary sector from Toshiyuki Mizoguchi, "Long-term National Accounts Data Base of Japan, Taiwan and Korea," in *Constructing a Historical Macroeconomic Database* (2000), Table TW 2, p. 159.

Africa (1)

Union of South Africa: Manufacturing output and employment from Charles H. Feinstein, *An Economic History of South Africa: Conquest, Discrimination and Development* (Cambridge, Cambridge University Press, 2005), Table 8.5, p. 186.

**Appendix 4: (Incomplete) Data Sources for
Explanatory Variables 1870-1939 in the Poor Periphery Industrialization
1870-1940 Project**

(Date: February 3, 2011)

The explanatory variables used thus far in the project are: average tariffs rates, the net barter terms of trade, relative wage cost proxies, the real exchange rate, and policy autonomy. The data base for some of these are incomplete, and they have not yet been collected for others (e.g. the user cost of capital, fuel prices, and other intermediate prices). The rest are taken from my earlier projects and the sources listed.

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 and thus they are augmented by Heinrich Liepmann, *Tariff Levels and the Economic Unity of Europe* (London: Allen and Unwin, 1938), Table A1, pp. 392-99.

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). The GDP per capita data are from Maddison <http://www.ggdc.net/Maddison/content.shtml> (last accessed June 10, 2010). Three absent observations were filled as follows. 1900: the Philippines uses its 1902 figure, and Turkey is estimated by multiplying the Turkey/Asia 1913 ratio times the 1900 Asia estimate. 1929: Egypt is estimated applying India's 1929-60 growth rate to the Egyptian 1960 figure.

Real Exchange Rates: 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. These will be used relative to local manufacturing prices.

Relative Fuel Prices (1913=100): Not collected thus far. These will be used relative to local manufacturing prices.

Table 1
A Century of Poor Periphery Industrial Output Growth 1870-1975
 (% per annum)

	1870-1890	1890-1913	1920-1939	1950-1975
Three Leaders	3.49	3.84	3.17	4.59
Germany	3.19	3.87	3.37	6.68
UK	2.35	3.27	3.39	3.68
US	4.92	4.39	2.75	3.41
European Periphery	3.11	3.79	4.23	8.97
Austria	2.44	2.91	2.67	5.94
Bulgaria	Na	na	2.87	12.34
Czechoslovakia	Na	na	3.43	8.01
Greece	Na	na	5.39	8.54
Hungary	2.95	3.39	2.77	8.03
Italy	2.14	3.16	3.59	6.73
Poland	Na	na	3.87	10.61
Portugal	2.13	2.61	3.30	7.22
Romania	Na	na	1.87	12.23
Russia/USSR	5.45	5.16	9.20	9.48
Serbia/Yugoslavia	Na	7.71	2.60	8.11
Spain	3.55	1.60	0.36	10.37
Latin America	6.24	5.04	4.82	6.14
Argentina	6.55	8.91	5.56	1.80
Brazil	Na	5.75	5.65	4.38
Chile	7.09	1.74	2.83	1.57
Colombia	Na	na	7.00	6.76
Ecuador	Na	na	na	9.49
El Salvador	Na	na	na	7.70
Guatemala	Na	na	na	5.01
Mexico	7.80	3.80	5.64	7.53
Nicaragua	Na	na	na	8.45
Panama	Na	na	na	8.35
Peru	Na	6.19	3.65	7.77
Uruguay	3.53	3.86	3.41	2.43
Venezuela	Na	na	na	8.63
Middle East		1.73	3.78	6.74
Egypt	Na	na	1.60	8.70
Turkey	Na	1.73	5.95	4.77
Asia	2.13	4.90	5.88	9.65
China	Na	na	6.41	10.33
Shanghai	Na	9.56	8.07	na

India	0.77	3.87	4.77	5.18
Indonesia	1.33	1.27	3.31	6.14
Japan	4.29	4.24	6.56	13.27
Korea	Na	na	9.46	13.18
The Philippines	Na	5.56	3.59	7.01
Taiwan	Na	na	4.88	12.44
Africa			7.84	7.20
Union of South Africa	Na	na	7.84	7.20
Poor Periphery	3.85	4.28	4.72	7.88
Observations	13	19	29	35

Note: The regional and poor periphery averages are unweighted. Also, the reported number of observations does not double count interwar China.

Source: Appendices 1-

**Table 2. Policy Status and Industrial Growth (Relative to the Leaders)
in the Poor Periphery 1870-1939**
(percent per annum)

Country	1870-1890 Autonomy?		Country	1890-1913 Autonomy?		Country	1920-1939 Autonomy?	
	Yes	No		Yes	No		Yes	No
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	3.24	
			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	
						Czech.	0.26	
						Colombia	3.83	
						Egypt		-1.57
						Greece	2.22	
						Korea		6.29
						Poland	0.70	
						Romania	-1.30	
						So. Africa	4.67	
						Taiwan		1.71
Average	1.03	-1.06	Average	0.11	0.89	Average	1.31	1.43

Source: Policy status from Clemens and Williamson (2010; Table 1, p. 28). Within period changes were: China 1929, taken as autonomous 1920-1939; 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. Growth rates from Table 3.

Table 3
A Century of Catching Up:
Poor Periphery Industrial Output Growth Relative to Leaders 1870-1975
 (% per annum)

	1870-1890	1890-1913	1920-1939	1950-1975
<i>European Periphery</i>	-0.38	-0.05	1.06	4.38
Austria	-1.05	-0.93	-0.50	1.35
Bulgaria	Na	na	-0.30	7.75
Czechoslovakia	Na	na	0.26	3.42
Greece	Na	na	2.22	3.95
Hungary	-0.54	-0.45	-0.40	3.44
Italy	-1.35	-0.68	0.42	2.14
Poland	Na	na	0.70	6.02
Portugal	-1.36	-1.23	0.13	2.63
Romania	Na	na	-1.30	7.64
Russia/USSR	1.96	1.32	6.03	4.89
Serbia/Yugoslavia	Na	3.87	-0.57	3.52
Spain	0.06	-2.24	-2.81	5.78
<i>Latin America</i>	2.75	1.20	1.70	1.55
Argentina	3.06	5.07	2.39	-2.79
Brazil	Na	1.91	2.84	-0.21
Chile	3.60	-2.10	-0.34	-3.02
Colombia	Na	na	3.83	2.17
Ecuador	Na	na	na	4.90
El Salvador	Na	na	na	3.11
Guatemala	Na	na	na	0.42
Mexico	4.31	-0.04	2.47	2.94
Nicaragua	Na	na	na	3.86
Panama	Na	na	na	3.76
Peru	Na	2.35	0.48	3.18
Uruguay	0.04	0.02	0.24	-2.16
Venezuela	Na	na	na	4.04
<i>Middle East</i>		-2.11	+1.21	2.15
Egypt	Na	na	-1.57	4.11
Turkey	Na	-2.11	2.78	0.18
<i>Asia</i>	-1.36	1.06	2.71	5.06
China	Na	na	3.24	5.74
Shanghai	Na	5.72	4.90	na
India	-2.72	0.03	1.60	0.59
Indonesia	-1.78	-2.57	0.14	1.55
Japan	0.80	0.40	3.39	8.68
Korea	Na	na	6.29	8.59
The Philippines	Na	1.72	0.42	2.42
Taiwan	Na	na	1.71	7.85
<i>Africa</i>			4.67	2.61
Union of South Africa	Na	na	4.67	2.61
<i>Poor Periphery</i>	0.36	0.44	1.55	3.29

Notes: The growth rates are the country per annum rates less that of the three leaders.

Source: Table 1.

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

Country	1920-1940	RER (1913=100)	
		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?

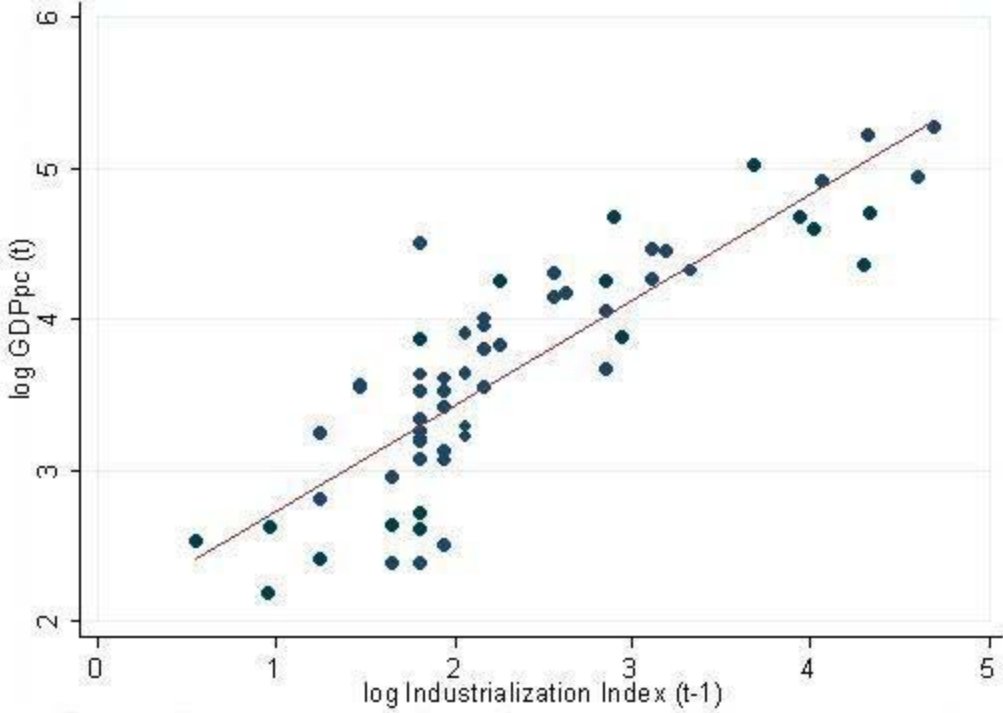


Figure 2 Industrial Catch-Up Persistence?

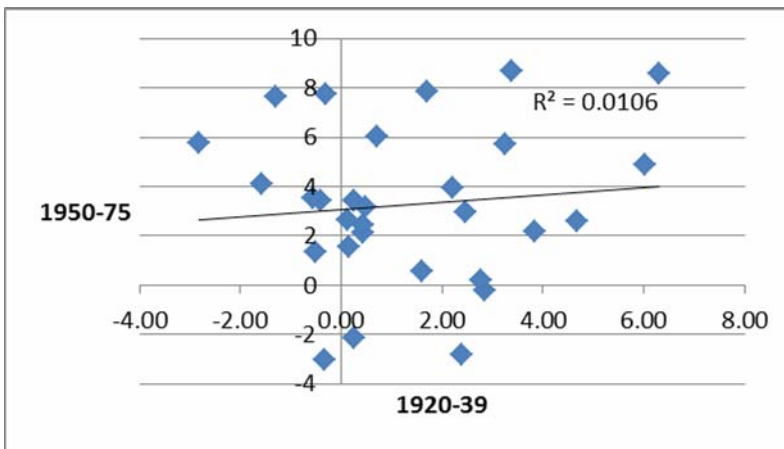
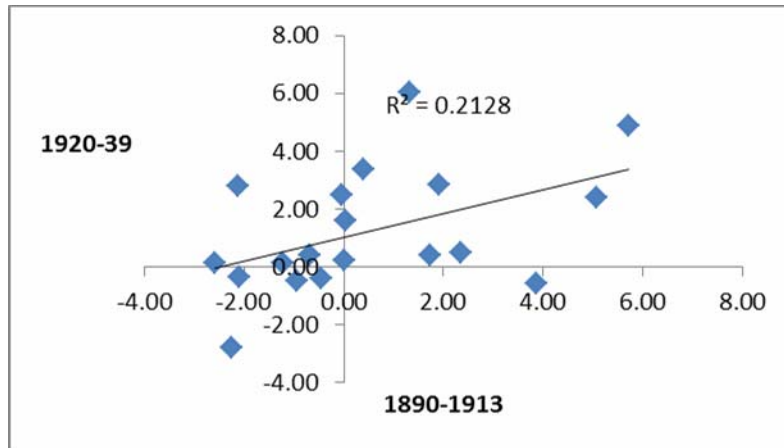
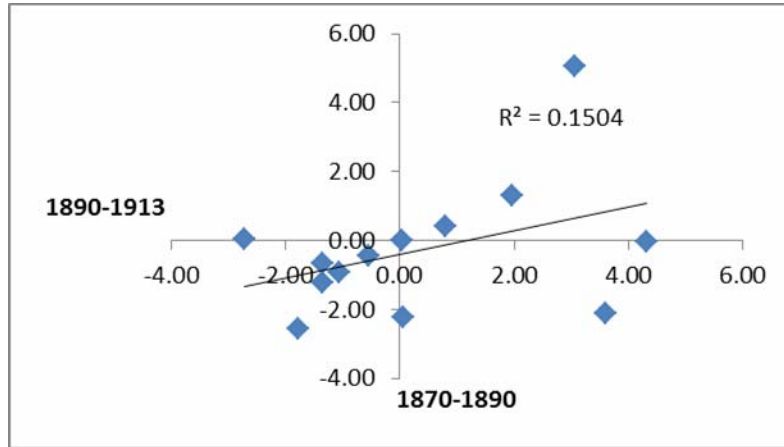
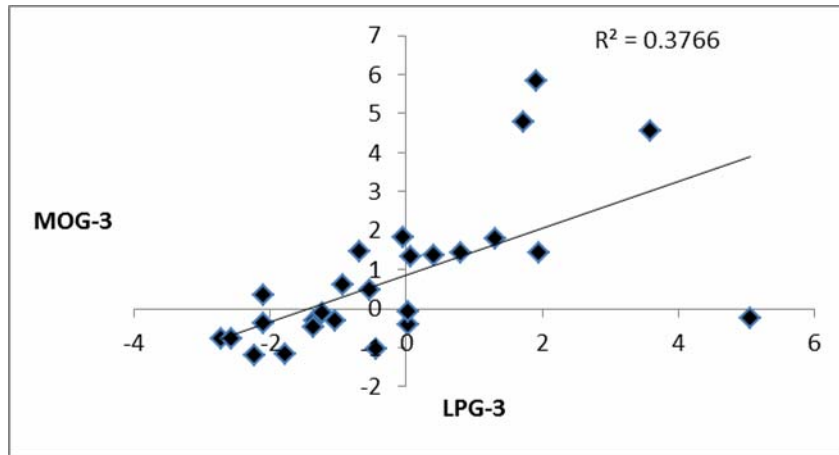
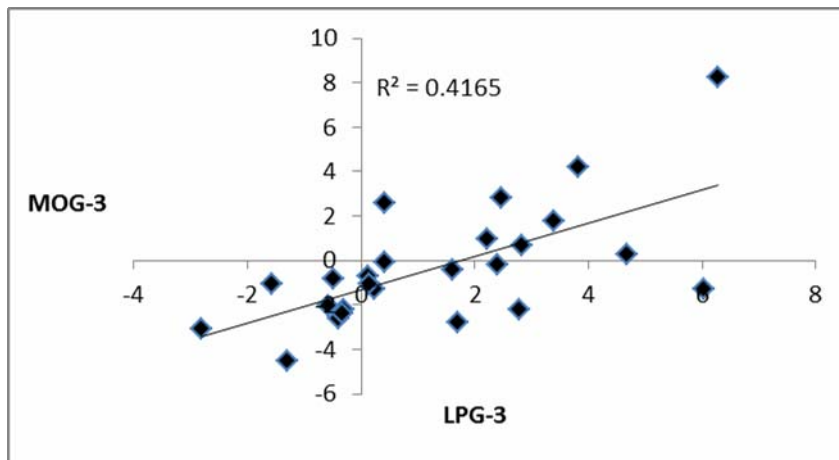


Figure 3 Industrial Output (MOG-3) vs Productivity Growth (LPG-3) 1870-1975

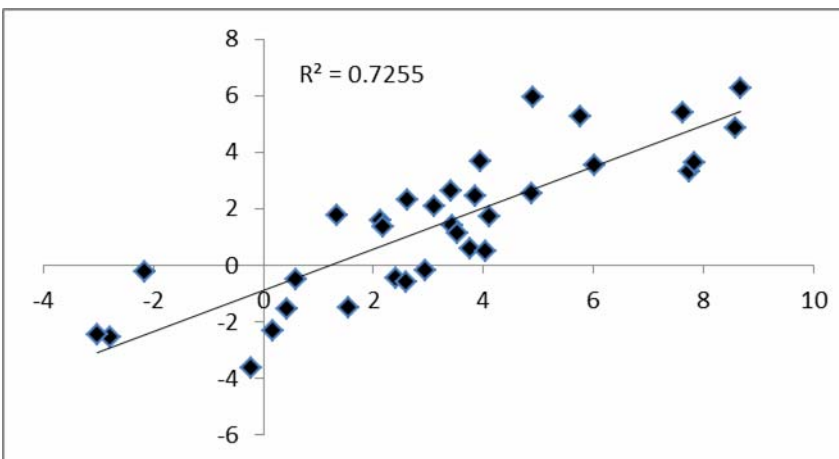
1870-1913



1920-1939



1950-1975



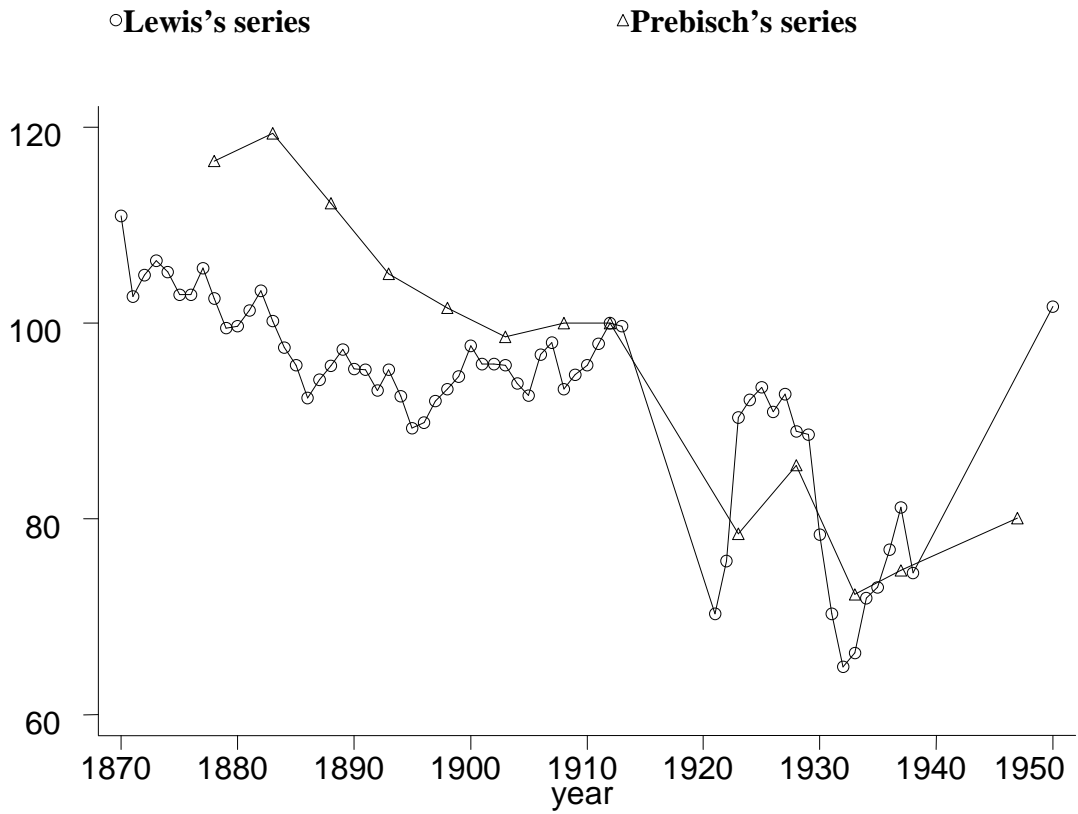


Figure 4. The Relative Price of Primary Products According to Lewis and Prebisch 1870-1950 (1912=100)
Source: Hadass and Williamson (2003; Figure 1, p. 631)

Figure 5 Impact of Terms of Trade Change on Catching Up 1870-1939

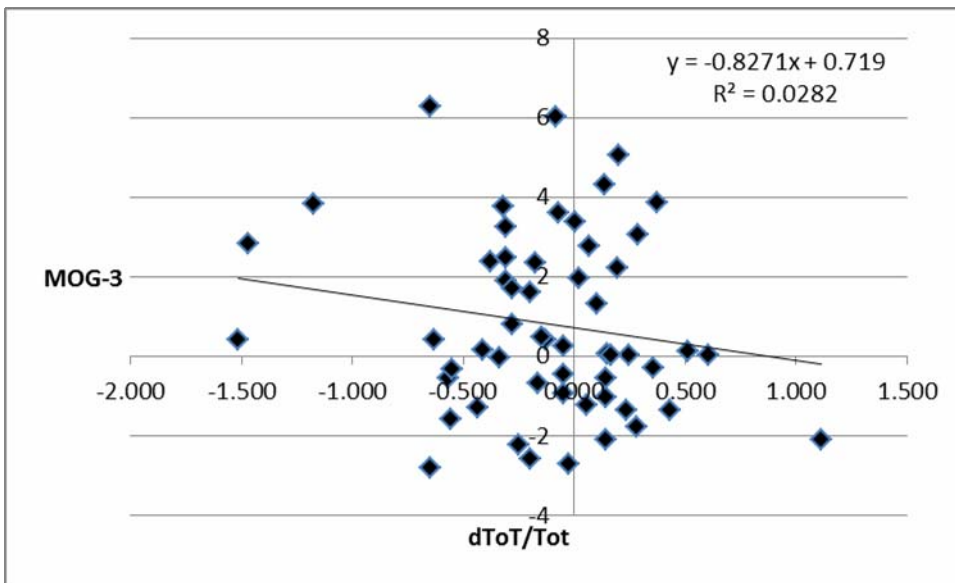
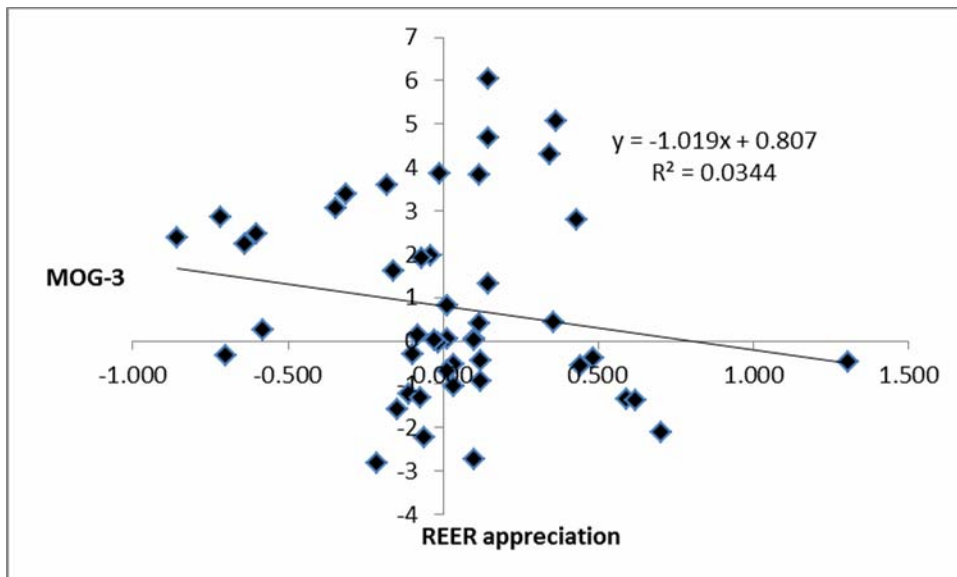
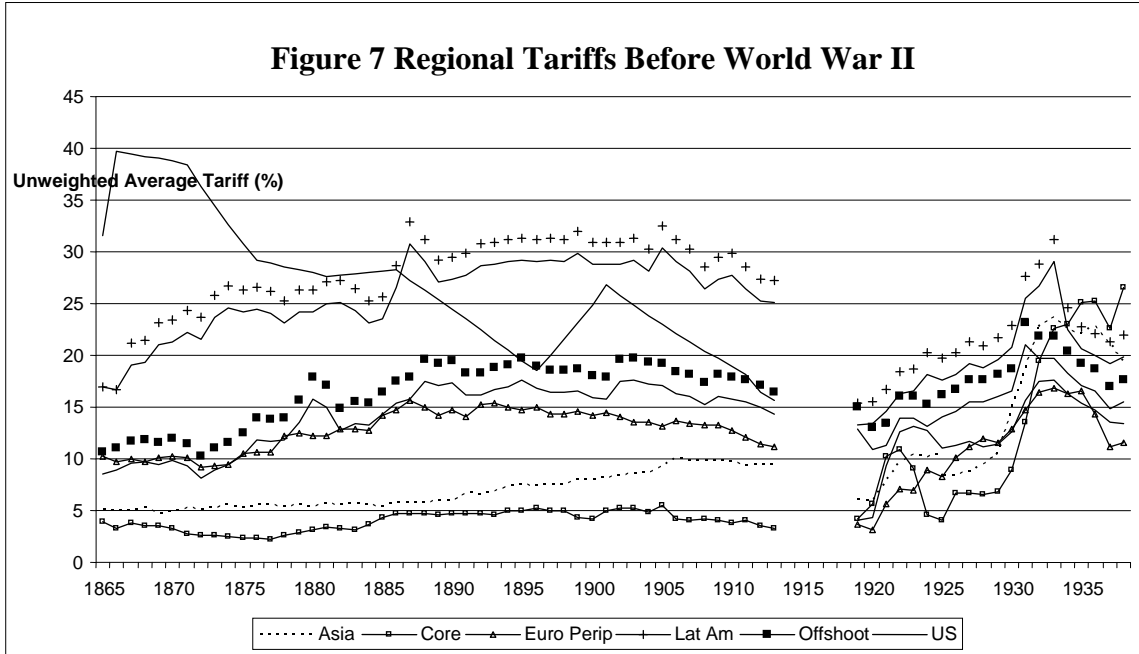


Figure 6 Real Exchange Rate Appreciation and Industrial Catching Up 1870-1939





Source: Williamson (2011: Figure 13.1).

Figure 8a Tariff Levels and Industrial Catching Up 1870-1939

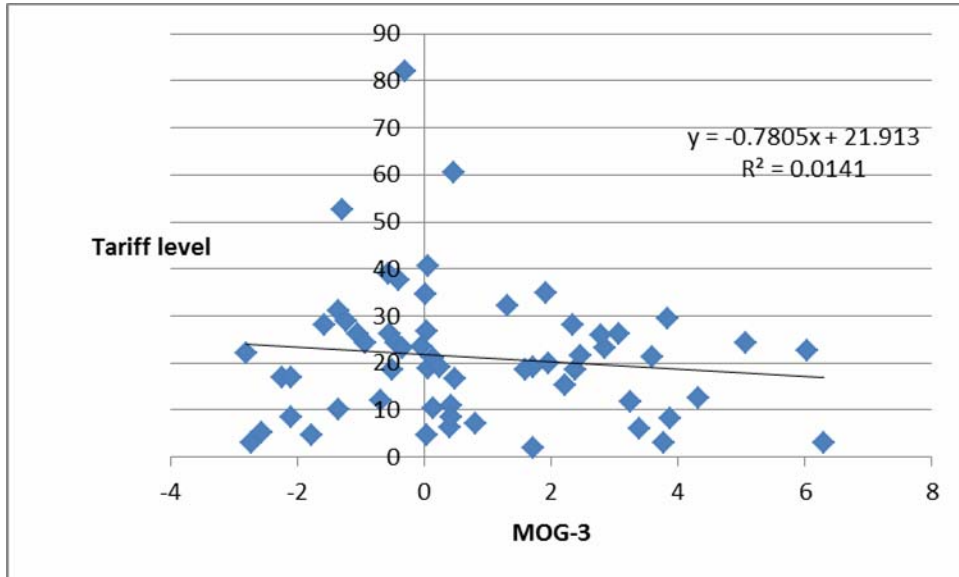


Figure 8b Tariff Levels and Industrial Catching Up 1920-1939

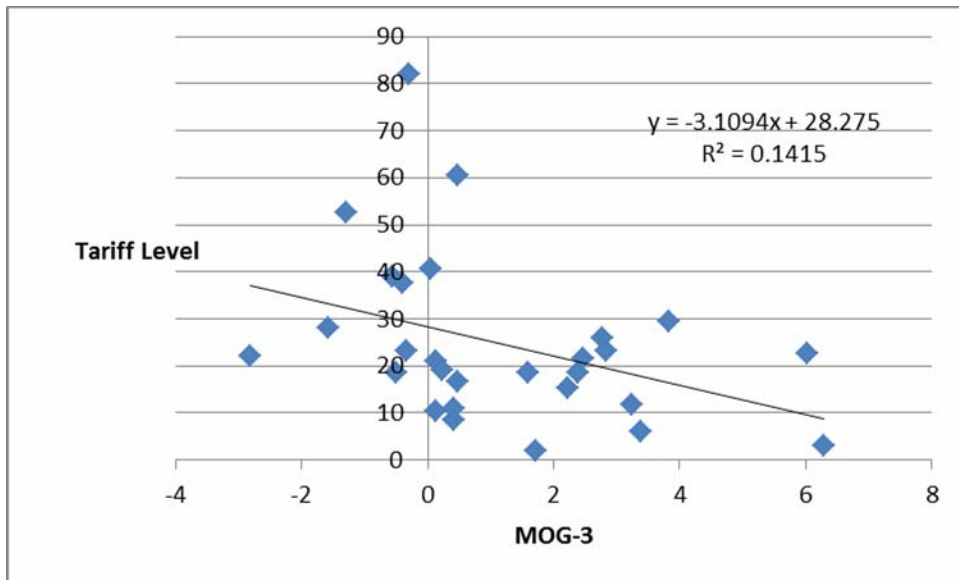


Figure 9a Industrial Catching Up vs Wage Costs

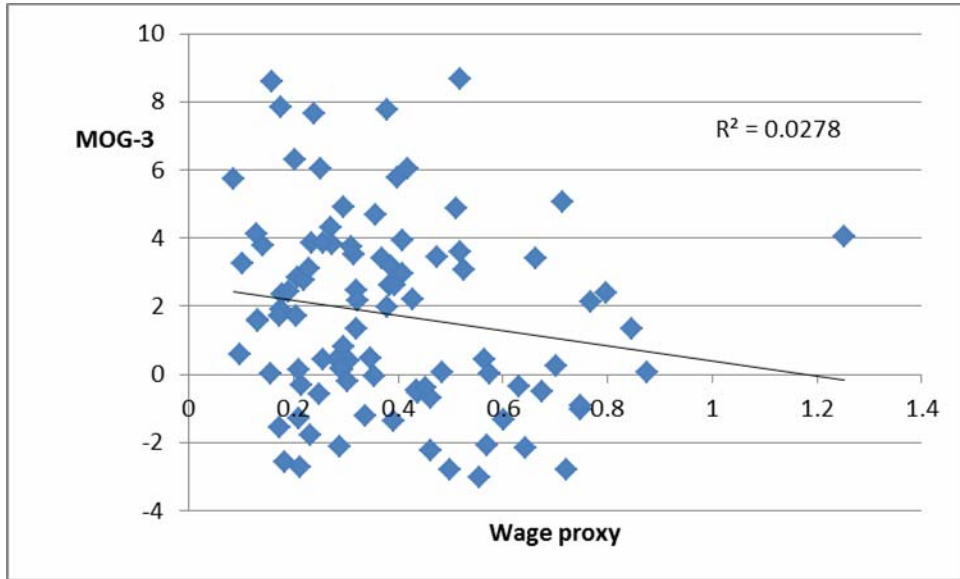


Figure 9b Changing Industrial Catching Up vs Changing Wage Costs

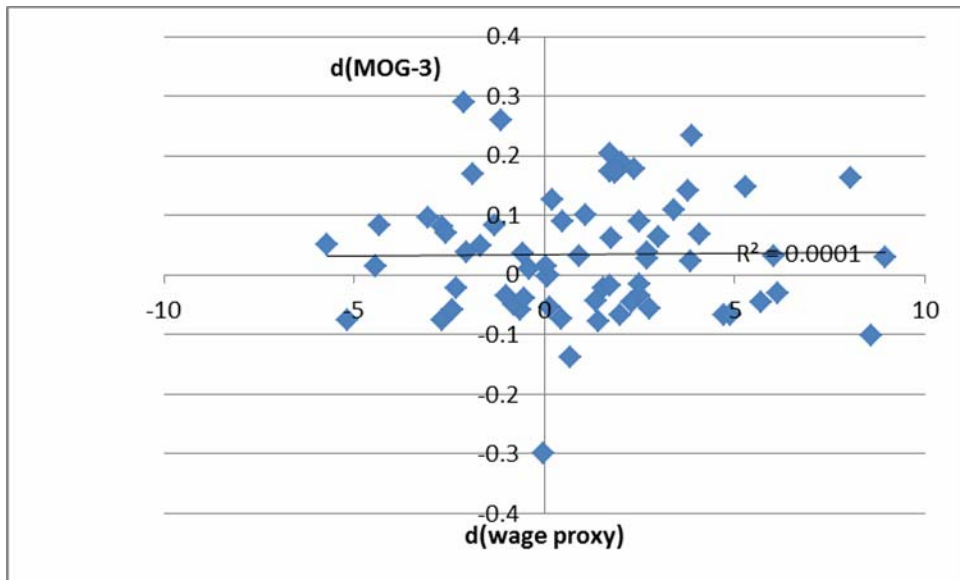
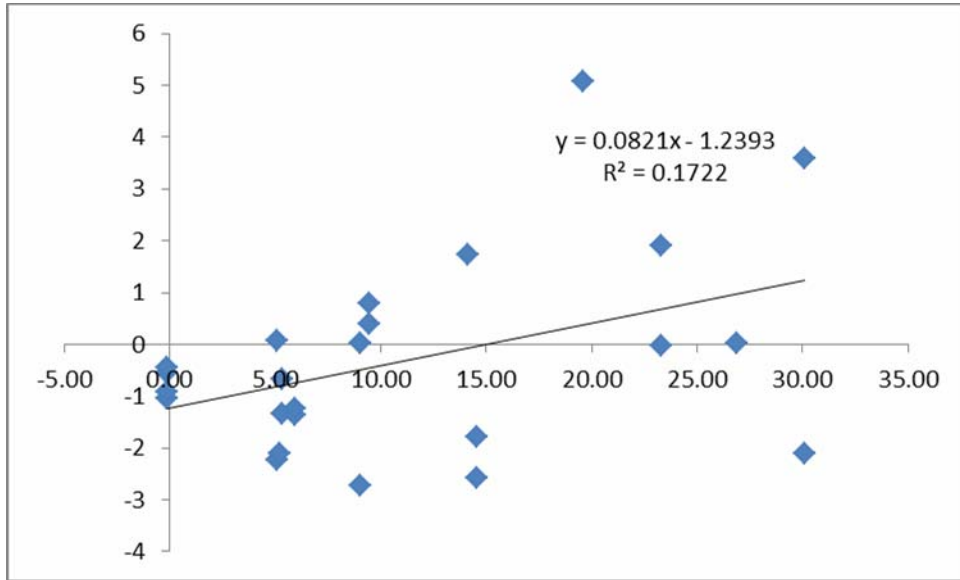


Figure 10. Coal Costs 1907 and Industrial Catching Up

MOG-3 1870-1913 vs Coal Price 1907



MOG-3 1890-1939 vs Coal Price 1907

