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THE INDUSTRIALIZATION OF SOUTH AMERICA REVISITED: EVIDENCE FROM ARGENTINA, BRAZIL, CHILE AND COLOMBIA, 1890-2010

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ABSTRACT

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A data appendix is available at http://www.nber.org/data-appendix/w24345

The Industrialization of South America Revisited:

Evidence from Argentina, Brazil, Chile and Colombia, 1890-2010[1]

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Abstract

We use new manufacturing GDP time series to examine the industrialization in Argentina, Brazil, Chile, and Colombia since the early twentieth century. We uncover variation across countries and over time that the literature on industrialization had overlooked. Rather than providing a single explanation of how specific shocks or policies shaped the industrialization of the region, our argument is that the timing of the industrial take off was linked to initial conditions, while external shocks and macroeconomic and trade policy explain the variation in the rates of industrialization after the 1930s and favorable terms of trade and liberalization explain de-industrialization after 1990.

Introduction

Between the late nineteenth century and the 1970s, the largest economies in South America had one of the most impressive rates of industrial catch up in the world (Bénétrix, et al., 2012; Williamson, 2006). Yet, despite the fact that these South American countries were all commodity exporters, that they shared similar culture, religion, and colonial origin, there was wide variation in the rate at which they industrialized. Not only did they industrialize at different points in time, but also at a different pace.

In this chapter we take a long term view and examine the patterns of industrialization in Argentina, Brazil, Chile, and Colombia. Rather than trying to provide a single explanation of

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how specific shocks or policies shaped the industrialization of the region, we show there is too much heterogeneity for a single theory to work. Thus, we provide alternative explanations of how the differences in initial conditions explain the initial patterns of industrialization, while external shocks and macroeconomic and trade policy, seem to explain the variation in the rates of industrialization after the 1930s.

So far, the history of the industrialization of Latin America, unfortunately, has been examined by specific periods and the data used to study such periods has often been disconnected from period to period, thus leaving us with no readily available long-term series of industrial GDP. Therefore, writing a history of the industrialization of South America required us to put together long-term series of manufacturing value added (i.e., industrial GDP), labor productivity in manufacturing, the size of the labor force, and various macroeconomic and trade series from 1900 to 2010. We did so by merging together series that existed only for certain periods of time and by estimating new figures when the data was missing.

These longer time series allowed us, for the first time, to uncover variation across countries and over time that the literature on industrialization had either ignored or had studied in pieces at the country level. Our main insight is that the patterns of industrialization in South America are by no means homogeneous. For instance, Argentina and Brazil, the largest economies in the region, had rapid catch up before the 1930s, while only Brazil and Colombia had very rapid and sustained catch up with the US, the global leader, in the 1930s. The post-WWII golden age of growth was also experienced in the four countries studied, but only Brazil and Colombia converged faster than the industrial leaders in Europe and Japan. The 1980s and early 1990s slowed down most of the countries in the region except Colombia, but by the first decade of the twenty-first century all major economies started to industrialize again, but not sufficiently fast to catch up to the industrial leaders.

With our new time series at hand, we cannot find evidence to support most of the traditional hypotheses that have tried to explain the industrialization of South America. In our view, there are four basic explanations of the industrialization of Latin America in the literature. First, there is the "adverse shocks" hypothesis (Furtado, 1959; Nations/ECLA, 1951; Prebisch, 1950; Tavares, 1972), which argues that as a consequence of adverse international shocks, such as wars, crises, or shocks to export prices, the relative price of exports increases or the conditions to import worsen (e.g., financing channels are interrupted or there is scarcity of foreign exchange), the terms of trade decline, and the internal demand for imports is gradually substituted by local manufactures. This hypothesis is related to Dutch Disease in the sense that this view posits that Latin America de-industrializes when there are commodity booms (or improvements in terms of trade) and there is Dutch Disease, and, vice versa, the region re-industrializes when there are declining terms of trade.

The second view of the industrialization of Latin America can be characterized as the "endogenous industrialization view," or industrialization as a product of export-led growth (Dean, 1969; Diaz-Alejandro, 1976). In this view, South America industrialized when commodity exports were thriving and there were favorable terms of trade because the export boom facilitated the importation of capital (or increases in asset utilization) and, via an income effect, through growth of the domestic industrial demand. Thus, commodity booms should lead to increases in total manufacturing value added, but also improvements in industrial productivity (Haber, 2006; Lederman, 2005; Williamson, 2011).

A third competing view sees industrialization as the product of import substitution industrialization (ISI), or an explicit policy of industrial support that included tariff protection or exchange controls, special preferences for firms importing capital goods for new industries, preferential import exchange rates for industrial raw materials, and an ample set of industrial policy tools that ranged from subsidies, targeted credit, pressure on foreign companies to

open plants in the region, or the direct establishment of state-owned enterprises (Baer, 1972; Hirschman, 1968). Even though most of these policies were not undertaken simultaneously until after World War II, a modified version of the ISI hypothesis sees the role of government and the high import tariffs before 1930 as playing a fundamental role in the industrialization of South America(Coatsworth and Williamson, 2004; Versiani, 1979). A modified version of the ISI hypothesis argues that even if protectionism may have led to an increase in manufacturing value added, such policies did not provide the right incentives for industrialists to improve productivity over time. Therefore, even if there were increases in manufacturing value added over time, labor productivity in manufacturing stagnated. This "stagnationist" hypothesis sees ISI as a policy with only short to medium term success (Bulmer-Thomas, 2003; Colistete, 2009; Diaz Alejandro, 1970; Haber, 2006; Krueger, 1978; Macario, 1964).

Because our data shows that none of these hypotheses explain all cases for the entire century, we argue that the industrialization of Latin America should not be explained using one single theory. The drivers of industrialization in each country are not the consequence of the adoption of a single set of policies or the consequence of a single shock that affected all countries in the same direction. In fact, what the evidence suggests is that the most important external shocks, such as the First World War (WWI), the Great Depression, the Second World War (WWII), and the 1980s Debt Crisis had heterogeneous effects on the industrialization of Argentina, Brazil, Chile and Colombia. While some countries got negatively affected by some of these shocks others thrived, and vice versa.

That is why our argument has to have two parts. On the one hand, we argue that the cross-sectional variation on the timing of industrial takeoff is very heterogeneous and has more to do with initial conditions and not so much with policies or external shocks. Factors such as the level of urbanization, literacy and infrastructure development at the end of the 19th century accelerated industrialization in Argentina and Chile and delayed it in Brazil and Colombia. On

the other hand, the subsequent variation over time in rates of industrialization and de-industrialization were the consequences of interactions between changes in external conditions and domestic policies. That is, market size, spread of infrastructure, trade policy, and alignment of the main export commodity's market structure and macroeconomic policy (or its misalignment) explain why Brazil and Colombia industrialized rapidly after 1930s while Chile and Argentina slowed down. Finally, we argue that the favorable terms of trade and the economic liberalization of the 1990s explains the relative de-industrialization in South America between 1990 and 2010.

Data

In order to re-asses the history of industrialization in South America we need to have long-term series on industrial performance for Argentina, Brazil, Chile and Colombia and series on manufacturing productivity. Series on manufacturing value added have been produced by researchers and agencies at different times. The most frequently used sources for estimates of industrial output include the World Bank – World Development Indicators (WB) and the Economic Commission for Latin America (ECLA). A project initially based at Oxford University and now at the Universidad de la República, Montevideo, collected and collated substantial ECLA data and has made it easily accessible for free via an internet website named Moxlad (Moxlad, 2014). The data made public on this website is slightly different to data we collected directly from ECLA reports (ECLA, 1966). Still, after careful analysis we decided to use series of manufacturing value added put together by local experts in each country rather than the Moxlad or ECLA data. They are usually longer, they behave relatively similar to the series by ECLA, and they incorporate substantial local knowledge. That is, they adjust the series in a sensible manner and with consistent criteria over the entire period, thus cleaning the series from some of its distortions associated with political manipulation of price indices.

We have included additional adjustments to the manufacturing value added series produced by local experts. For Argentina we use manufacturing output GDP in constant 1960 LCU constructed by local expert Orlando Ferreres for 1875-2012 (Ferreres, 2005). For Brazil we use IPEA's series of industrial value added in current LCU deflated by the GDP deflator for 1908-1970 and extrapolated all the way to 2012 using the growth rates of real industrial value added in LCU (deflated by the industrial GDP deflator growth rates 1971-2012) (IPEA, 2014). For Chile we use the Díaz, Lüders, and Wagner (DLW) manufacturing value added in 1996 constant LCU for Chile for the period 1900-2004, extrapolated to 2005-2012 using real manufacturing GDP growth rates from Banco Central de Chile (Díaz, et al., 2007). Finally, for Colombia we use Colombia's central bank (Banrep) real manufacturing GDP for 1925-2012 (Banco de la República, 1998 (updated)). The four series are converted into indices with 1960 as the base year (1960=100). We had to additionally estimated or gather information on the size of the labor force, the population of the country, openness to trade, exchange rates, terms of trade and other series.

Most of the series try to measure manufacturing activity not related to the simple processing of commodities. In most of our series the data includes industrial establishments of all sizes, different technologies (artisan vs. mechanized), and a wide range of industries. Most of our series, however, are only accurate reflections of manufacturing value added after the industrial census came into place. For instance, for Colombia the data before 1953 is an estimate of the quantum of manufacturing production, and for Brazil the industrial GDP indices are proxies using data on raw materials and statistics on textile production.

The level of the four preferred series identified is not directly comparable. Each one is in a different local currency unit and the series are in index number form to overcome the difficulties of not having common price indexes for all four series within each country. We only compare average growth rates of the manufacturing value added in LCU and

manufacturing labor productivity in LCU. Since we do not have PPP exchange rates for the whole period we prefer to assume that policy induced nominal exchange rate distortions are (eventually) translated into inflation, and therefore accounted for in the series in LCU. Although this is not ideal, estimating century long PPPs for the four countries is beyond the scope of this chapter. Furthermore, the hyperinflation and currency change events in Argentina and Brazil suggest this is probably the best way forward. The local experts have faced and solved the best possible way the important challenges of adjusting prices indices to hyperinflations and currency changes, and the policy induced distortions on exchange rate during the periods before and during hyperinflation effectively translated (at least partially) into inflation and therefore are reflected in the LCU price indices. Thus, average long term growth rates are comparable, although care must be taken on interpretation if important exchange rates or inflationary events take place precisely at the cut-off dates of the periodization.

Industrialization in South America as an Heterogeneous Process

In Table 2 we show the average growth rates of manufacturing value added in South America against the industrial leader over the whole century, the United States, and some key industrial developed countries that experienced rapid industrialization before World War II and rapid catch-up in the post-war period. (the United Kingdom, Germany and Japan). In Table 3 we present only the net growth rates for the South American countries in our sample after we subtract the growth in developed countries. In this sense, positive (net) growth rates mean there is convergence and negative (net) growth rates imply South American nations are diverging from the leaders.

Table 2 Industrial GDP Growth Rates, South America vs. Global Leaders

	Leaders (avg.)	GER	UK	USA	JAP	ARG	BRZ	CHL	COL
1900-1919	3.2	2.7	1.0	5.8		4.8	9.8	2.4	
1920-1930	2.6	1.0	2.9	3.9		6.5	2.6	1.5	3.1
1931-1943	4.9	2.2	2.7	9.9	6.3	3.3	10.0	7.5	8.9
1944-1972	5.6	4.7	4.3	3.1	10.2	5.3	8.7	5.4	6.9
1973-1990	2.2	1.8	0.8	1.7	4.5	-0.6	4.0	1.8	3.9
1991-2009	0.8	0.03	-0.4	2.9	0.4	2.9	2.2	3.6	2.2

Source: See Data Section. Developed country growth rates from Bénétrix et al.(2012)

Table 3 Convergence/Divergence among South American Nations and the Developed Country Leaders

		Growth in Lat Am - growth in leaders				Growth in Lat Am - United States			
	Leaders (avg.)	ARG	BRZ	CHI	COL	ARG	BRZ	CHI	COL
1900-1919	3.2	1.6	6.6	-0.8		-1.0	4.0	-3.4	
1920-1930	2.6	3.9	0.0	-1.1	0.5	2.6	-1.3	-2.4	-0.8
1931-1943	4.9	-1.6	5.1	2.6	4.0	-6.6	0.1	-2.4	-1.0
1944-1972	5.6	-0.3	3.1	-0.2	1.3	2.2	5.6	2.3	3.8
1973-1990	2.2	-2.8	1.8	-0.4	1.7	-2.3	2.3	0.1	2.2
1991-2007	0.8	2.2	1.5	2.9	1.5	0.0	-0.7	0.7	-0.7

Source: See Data Section. Developed country growth rates from Bénétrix et al.(2012)

Table 4 Average labor productivity growth rate Argentina, Brazil, Chile, Colombia and the United States

	Argentina	Brazil	Chile	Colombia	US
1900-1919	1.4	4.8	3.9		1.0
1920-1930	5.4	6.1	0.4	-2.5	4.4
1931-1943	-1.4	5.6	4.3	5.5	3.5
1944-1972	3.5	4.0	3.8	3.7	2.1
1973-1990	1.6	3.7	-0.5	2.7	2.6
1990-2009	1.3	2.6	3.5	1.1	3.9

Source: See Data Section.

The Pre-1920 Industrialization in Latin America

The period before 1920 has always been considered the "Belle Époque" of growth and industrialization in Latin America. Yet, the Belle Époque refers to the performance of Latin

America against itself in other periods rather than about the relative performance of Latin America and the developed world. When we look at industrialization in South America against that of the industrial leaders, only Brazil and Argentina have an outstanding performance. Once we compare South America's performance before 1920 against the industrial performance of the United States (on the right hand side of Table 3) we can see that only Brazil fares favorably. Thus, the Belle Époque is indeed an important period for the initial take off of industrialization in Argentina and Brazil, but it was a period of rapid catch-up only for Brazil.

Argentina was the front-runner in the process of industrialization in the first part of the twentieth century, despite the fact it was experiencing a sustained export-boom based on primary products. Our estimate of the decade-long average industrial growth rate was always higher than 6 percent and at times close to 11 percent before WWI. This was an endogenous, private-sector-led process correlated with the dynamism of the export economy. For instance, the industrial boom was tightly linked to the development of agriculture, which being more labor intensive than cattle rising, produced forward and backward linkages accelerating urbanization rates and giving rise to a new consumer class that demanded manufactured goods. The initial industrial boom, in fact, was dominated by the processing of food, beverages, textiles, wool and leather, tobacco, and glass, with some important firms competing successfully with consumer goods imports. It was the beginning of an "easy" import substitution process. During this first phase, the production of consumer goods represented 72 percent of total manufacturing output. However, there were some natural resource obstacles to develop a competitive "heavy" industry; such as the scarcity of coal, iron and other minerals. This scarcity of important resources precluded the development of machinery and metallurgical firms in large scale. Therefore firms relied heavily on imported

intermediate and capital inputs (Barbero and Rocchi, 2003; Diaz-Alejandro, 1970; Rocchi, 2005)

The industrialization process of Brazil, Chile, and Colombia began later (much later for Colombia). In the 1910s Chile's industrial output was growing a modest average 3 percent, while Brazil's was growing at 14 percent per year. The fast industrial take off in Brazil seems to have started at the beginning of the twentieth century. Textile and industrial firms enjoyed a rapid growth in internal demand associated with the coffee booms (and coffee valorization programs), while they also had easy access to equity and debt finance between 1905 and 1914, helping firms finance machinery imports. The result was a rapid spurt in industrialization during the fifteen years before WWI (Haber, 1991; Musacchio, 2009; Suzigan, 1986). Cano (1977) highlighted the importance of the almost forced import substitution during WWI, when the disruption in shipping and financial flows led to a shortage of foreign exchange and imported goods that created the conditions for domestic producers to substitute imports. Others have argued that this brief spurt may have been just an increase in capacity utilization, rather than an increase in industrial productive capacity (Suzigan, 1986).

In Chile, Palma (2000) argues that in spite of a virtual world monopoly of sodium nitrate exports, the Chilean economy avoided Dutch Disease and started to industrialize in the 1890s. According to this author Chile had an active policy of manufacturing protection, increases in export tariffs and stable real exchange rate that propelled the local industry.

We do not have data on industrial GDP growth for Colombia in this initial period, but we know that there were two coffee booms, following the valorization programs in Brazil (in 1906 and on and off in the 1920s). The coffee booms combined with increased protection to manufacturing induced creation for the first time of a long-lasting non-durable consumer products industry and a few less lasting coffee machinery producers. Moreover, it was during the second coffee boom that the manufacturing sector could also take advantage of a nascent

financial and transportation infrastructure in Colombia(Arango, 1977; Bell, 1921; McGreevy, 1971; Palacios, 1980).

Labor productivity growth in the four countries in our sample and the US is presented in Table 4. In Argentina and Brazil labor productivity growth was faster than that in the US during this period. Thus, labor productivity data strengthens the evidence supporting the argument that Argentina and Brazil experienced endogenous industrialization with significant improvements in productivity (Haber 2006).

Initial conditions

How can we explain the fast start of Argentina and slow of Colombia? It is unlikely that we can explain the heterogeneous timing of industrial take-off with any of the specific industrialization hypothesis presented above. Instead, we want to argue that we should move away from these theories that try to explain industrialization for the entire region, into detailed research exploiting the heterogeneity in initial conditions, external conditions, policy, and outcomes. We suggest that perhaps the variation in industrialization outcomes may be better explained by first focusing on understanding variation in the initial conditions. That is, we argue that the heterogeneous initial conditions affecting the speed of technology adoption processes (absorptive capacity and market demand) may explain better the timing of industrial take-off than any of the theories presented above.

The rest of this section focuses on the initial conditions determining the timing of industrial take-off: human capital and agglomeration economies facilitating absorption of new ideas and machines, and population size, urbanization and low transport costs integrating the local economy influencing the size and growth of market demand for manufactures.

By 1900, Argentina, Brazil, Chile and Colombia had consolidated their status as independent countries and only Colombia still waged a civil war that soon would finish and open a long

period of relative peace. The inflow of migrants and capital from Europe was at its peak, contributing, to differing degrees to the four countries, to expand domestic productive capacity and integration to the world economy increased substantially (O'Rourke and Williamson, 1999; Obstfeld and Taylor, 2004; Stone, 1999; Williamson, 2011).

A casual inspection of the demographic and education data in Table 5 shows that initial conditions (at the beginning of the twentieth century) were very different across the countries we study. Argentina and Chile were closer to achieving European levels of literacy, while Brazil and Colombia lagged behind. As Sokoloff and Engerman (2000) remind us, the relative failure in accelerating literacy rates retarded economic growth and might have been a crucial obstacle that postponed the take-off of the industrialization process. The adoption of new technologies and the capacity to innovate is partly dependent on a critical mass of citizens that could learn new techniques. Recently, some authors sustain that the type of education imparted might also have been a deterrent to the adoption of sophisticated technologies: For example, (Maloney, 2002) shows that for most of the nineteenth century these countries failed to establish technical education. Comparing to other resource-rich country he claims that "By 1926, Australia had twenty-seven times more graduates of technical schools per capita than Argentina, perhaps the most educated country in Latin America." If this was the case, for some time the genius to industrialize [2]might have been driven by migrants who came with embodied technical skills. For Argentina, still in 1914, the industrial initiatives were propelled by foreigners. More than 65% of firms in Argentina were initiated and owned by first generation migrants (Diaz Alejandro, 1970). Literacy and higher order human capital rates may be good predictor for the increase of per capita income levels, but they most likely are an insufficient condition to drive a sustained process of manufacturing. Faute de mieux, literacy and engineering rates alone would have led us to predict—ceteris paribus—that Argentina

[2] To develop a native aeronautics industry, ITA worked closely with the Brazilian Airforce and the state-owned airplane manufacturer Embraer, which adopted key technologies from foreign firms.

and Chile, instead of Brazil, would be the industrial leaders by the mid-twentieth century (see Table 5 and Maloney, 2002).

Yet, that did not happen. Brazil took the lead in terms of industrial sophistication, and sheer size, in the second half of the twentieth century. It started as a laggard because, as Musacchio, et al. (2014) show, the initial industrialization of Brazil, between 1890 and 1930, did not have the kind of skill-biased technologies associated with the second industrial revolution (Goldin and Katz, 1996). Therefore, Brazil started with labor-intensive industrialization, with capital that did not required skilled labor in a large scale and that was good to substitute simple imported manufactures. As a consequence, the industrialization levels in 1920 and 1940 are not correlated with say education levels for Brazilian states. The Brazilian government did not introduce the kind of technical education necessary for the development of more sophisticated industries until the 1950s. The National Council for Research (known as CNPq), a Brazilian version of the National Science Foundation, and the Technological Institute for Aeronautics (ITA) were launched in 1950, the National Institute of Applied Math (IMPA) in 1951, and the State University of Campinas—a university with a strong emphasis on engineering—was not founded until the early 1960s. The expansion of national labs and research centers continued in the 1970s and coincided with the dramatic changes in the manufacturing industry presented in Table 6, and with the rise of Brazil as a leader in innovation in areas such as agricultural research (e.g., with the creation of the Brazilian National Agricultural Research Company, known as Embrapa in 1973) and aeronautics.

What about urbanization? It is well known that urbanization is closely associated with increases in per capita income. Several studies even suggest that an increasingly urban economy is related to industrial growth (the benefits of agglomeration effects). However, the increases in rents experienced by an increasingly productive natural resources sector can generate two types of urban employment: in the tradable and in the non-tradable or service

sectors. South America's leading urbanization process was probably of a hybrid nature; Buenos Aires, Santiago, Sao Paulo, Bogotá, Medellín, and Rio de Janeiro were hybrid consumption and production cities. Initially, the development of an incipient industry relied much more on the spurt of internal demand and exports than on a natural industrial-led push. Firms located in urban enclaves dealt with the processing of primary sector goods and later with the substitution of imports for domestic purposes. Brazil and Colombia's urbanization process came much later though, and their industrial catch-up was extremely fast. After 1940, the story of the acceleration of urbanization might have been caused by an industrial led-process due to the artificial change in relative prices favorable to manufacturing. This was certainly the case for Argentina and Chile, and in the Southeast of Brazil.

Table 5 Population (In Millions), Urbanization Rates (%) And Illiteracy Rates (%) For Argentina, Brazil, Chile And Colombia, 1900-2000

	ARG					BRAZ				
	POP	Urbaniz. rate	Illiteracy	Railway kms x million pop	Road '000 kms x million pop	POP	Urbaniz. rate	Illiteracy	Railway kms x million pop	Road '000 kms x million pop
1900	4.7	41	40	3572.8	n.a.	18.0	n.a.	65	851.6	n.a.
1920	8.9	54	32	3981.7	n.a.	27.4	n.a.	65	1041.3	n.a.
1930	11.9	57	25	3192.5	17.8	33.6	n.a.	61	967.5	3.6
1940	14.2	60	18	2913.6	28.7	41.1	31	56	833.1	5.1
1950	17.2	64	12	2499.4	4.2	53.4	36	51	686.4	n.a.
1960	20.3	72	9	2164.8	3.8	69.6	45	40	550.3	7.1
1970	24.0	79	7	1665.3	8.4	95.7	56	32	332.8	11.9
1980	28.4	83	5,6	1201.2	n.a.	123.0	66	25	241.1	n.a.
1990	33.0	87	4,3	1082.2	n.a.	151.2	75	19	200.6	n.a.
2000	37.3	89	3,2	957.6	5.8	176.3	81	15	172.4	11.2

	CHI					COL				
	POP	Urbaniz. rate	Illiteracy	Railway kms x million pop	Road '000 kms x million pop	POP	Urbaniz. rate	Illiteracy	Railway kms x million pop	Road '000 kms x million pop
1900	3.0	43	47	1471.4	n.a.	4.0	n.a.	61	142.1	n.a.
1920	3.7	47	37	2205.5	n.a.	6.2	n.a.	56	216.8	n.a.
1930	4.3	49	25	2094.9	8.4	7.9	n.a.	48	329.7	3.0
1940	5.1	60	27	1702.9	7.1	9.2	29	43	363.5	2.5

1950	6.1	61	21	1396.0	n.a.	11.6	43	38	304.2	n.a.
1960	7.4	68	16	1137.2	7.4	15.4	48	30	204.6	n.a.
1970	9.4	75	12	883.9	6.8	21.4	57	22	160.3	2.3
1980	11.1	81	8	568.1	n.a.	26.6	64	16	127.8	n.a.
1990	13.1	83	6	521.9	n.a.	33.0	70	11	64.1	n.a.
2000	15.2	85	4	324.8	5.3	39.8	75	8	53.1	2.7

Source: MOxLAD (2014)

In Colombia urban concentration of the scale found in our other countries came much later. By 1912 there were two important urban centers, Bogotá and Medellín. The former was the the political capital of Colombia, with 120,000 inhabitants in 1912, and focused on the production of foods. Medellín, with 70,000 inhabitants, had basic manufacturing activity focused on food and beverages and textiles (Melo, 1987), while Buenos Aires had 1.2 million in 1910, Santiago 390,000 in 1900 and Sao Paulo 240,000 in 1900.

Moreover, the actual market potential for manufactured goods was not only determined by urbanization, but also by transportation costs (to sell manufactured goods and to import raw materials) (Krugman, 1993). In that regard, Buenos Aires and Santiago, the key initial industrial hubs in Argentina and Chile, had the initial advantage of being close to the coast, thus facing lower transportation costs for raw materials and having easier access to internal and external markets (by boat). In contrast, Sao Paulo, Bogotá and Medellín had, initially, more difficult access from the coast. In Sao Paulo, until the early part of the twentieth century, the railway lines connecting the coast to the interior plateau of the state were not fully developed. In Bogotá and Medellín, the location of main urban settlements on top of the Andes probably made it harder to trade with the rest of the world and within Colombia than for any of the other three countries in our sample.

One way to gauge the transportation challenges of Colombia and Brazil is to look at the railway and road density they had during the take-off period (Herranz-Loncán, 2014). In Table 5 we present our estimates of railway and road kilometers per million people and it is clear that Chile and Argentina had an initial advantage. Thus, Brazil, with scattered population

and a large market was at a disadvantage and its infrastructure network did not really compare to that of Argentina and Chile, on a per capita basis, until after WWII. In Colombia, the poor rail and road infrastructure and the challenging topography complicated market integration until the second half of the twentieth century when the large urban centers provided markets big enough for domestic industries to develop at a large scale. The road network of Colombia even in the year 2000 was still small in relative terms; comparable only to the density of roads Brazil had at the turn of the century.

We believe population size may be another factor determining the extent of specialization and diversification in manufacturing in the countries we study. Murphy, Shleifer and Vishny (1989) described the benefits of size in models of "take-off" or "big push" industrialization, where the take-off phase is characterized by a transition from a slow growth, constant returns to scale technology to an endogenous growth and an increasing returns to scale technology. Size might enhance growth because it allows for product market competition. Thus, size increases the chances for a balanced industrialization.

As we can see from Table 5 the Argentine economy had a size advantage when it came to its major urban center (Buenos Aires). The country was more urbanized than any other country in the region and most of the population lived in the larger Buenos Aires area. That may explain the initial take off of Argentina and its initial leadership as early industrializer in South America. Brazil, despite its larger population, was a much more rural country and before 1900 most of the population centers were scattered around the country, with extremely poor communication and road networks.

Now, the rapid population growth and urbanization in Brazil and Colombia after 1940 may explain their positive and sustained industrial performance and catch-up with Argentina's manufacturing value added per capita. In contrast, Argentina and Chile's population growth

does not keep pace with Brazil and Colombia and they also suffer more macro distortions after 1940 that complicate their industrialization.

Industrial Performance During the Roaring Twenties

Performance during the roaring twenties seems to have been varied across South America. Argentina, Brazil and Chile experienced growth spurts during the first half of the decade, and then average growth rates declined. For Argentina, the 1920s were the period of most rapid convergence in the period we are studying. Industry grew at an average annual rate of 6.5 percent induced by growing manufacturing demand derived from exports facing positive terms of trade. Incumbent firms experienced important capacity expansion and structural transformation in the "traditional" sectors (food, beverages, tobacco, meatpacking houses, sugar mills, and tanning firms) and new sectors developed, such as rubber products, chemicals, pharmaceuticals, machinery and electrical equipment. The "front-runner" was expected to enter into a second phase of industrialization. The new sectors, altogether, doubled their share in manufacturing industry increasing from 13 percent in 1920 to 21 percent in 1930. This process took place well before an attempt to have an explicit state-led import-substitution strategy (Pineda, 2009). The case of Argentina during the 1920s supports the hypothesis of endogenous industrialization.

In Chile, in the 1920s, the decline in the nitrate industry due to the improvement in the production of synthetic nitrates in the core countries was a first blow to Chilean exports. The decade started with a 50% nominal devaluation rate and an increased degree of protection which produced a transitory spurt in manufacturing. Yet, with the still very high terms of trade, the real exchange rate appreciated substantially and the rate of manufacturing growth diminished and even became negative in some years (Muñoz, 1968; Palma, 2000). Thus, the

1920s decade proved to be the weakest in terms of manufacturing growth for Chile, with no convergence, until the 1930s.

In Brazil the 1920s were a period of rapid industrial growth, driven to a large extent by the rapid advance of coffee exports and the improvements in national income. Despite some brief recessions, the decade saw favorable terms of trade, rapid importation of machinery for manufacturing, and a rapid expansion in coffee exports toward the end of the decade. According to Stein (1957) and Musacchio (2009), textiles continued to expand rapidly during this decade. By the end of the 1920s the government of Brazil instituted a coffee valorization program and a fixed exchange rate (to prevent the rapid appreciation of the nominal exchange once coffee exports expanded). These measures not only provided an impetus to industrialization in the second half of the decade, but also kept Brazil's terms of trade favorable during the Great Depression (Furtado, 1959; Suzigan, 1986).

In Colombia, the 1920s represent a period of volatile manufacturing expansion fueled by coffee booms, American reparations and large inflows of international capital once the Central Bank was setup in 1923. During this period incumbent firms expanded capacity and adopted modern management techniques. Foreign direct investment also helped to diversify the industrial sector by expanding oil manufactures. The development of the railroad network during the second half of the decade reduced the cost of transportation and the cost of capital, and its construction also increased the demand for manufactures (Duran and Bucheli, 2017; Echavarría, 1993; Meisel-Roca, et al., 2016). Although little data to assess overall manufacturing growth exists, qualitative evidence suggests a mild process of endogenous industrialization was taking place in Colombia, aided with moderate protection

The Great Depression and its Effects on Industrialization

In the 1930s, the growth rates of the four countries are positive. Brazil, Chile and Colombia's industrial output grew at an average 11 percent during the 1930s, catching-up with Europe and Japan, but maintaining differences with the US. In contrast, Argentina, the regional leader, had industrial growth rates of over 3 percent, making it the only country diverging from the industrial leaders.

Brazil and Colombia were not as hard hit by the depression thanks to the rapid recovery of terms of trade, largely due to their coffee valorization programs. In fact, our late comer, Colombia, experienced rates of growth almost 9 percent during 1930s and WWII, to a large extent because of the combination of increasing coffee exports, a large depreciation of the exchange rate, protectionist policies and the improvement in transportation infrastructure set up in the 1920s, which paid off in the 1930s. This industrial growth spurt focused mostly on consumer non-durable industries (Echavarría, 1993; Ocampo and Montenegro, 2007).

Chile was probably the country that suffered the most during the Great Depression: exports declined in 1929-1932 by 50%, imports by 83% and the terms of trade declined by more than 50%. Chile needed to pursue another model and the policy reaction was immediate. The government engineered a devaluation rate of more than 300% between 1932 and 1935 resulting in a depreciation of real exchange rates and an increase of the real cost of imports of about 100%. The result was an acceleration in the industrial output average annual growth of 7.5% (Muñoz, 1968). In fact, during this period, manufacturing started experiencing an important structural transformation. In 1927 the manufacturing industries producing consumption goods still represented 83% of the total. Chile was unambiguously in its first phase of industrialization. The share of intermediate, heavy and capital goods industries relative to total manufacturing production went from 7.7 percent in the early 1930s to 12.8 percent of total manufacturing by 1950, almost doubling. That is, the Great Depression

accelerated the process towards import-substitution of more sophisticated manufactures in Chile. At the same time, government policy promoted explicitly an ISI model. In 1938 state development financial agency CORFO (Corporacion de Fomento) was created to develop strategic plans for agriculture, industry and mining and develop domestic technology research (Ffrench-Davis, et al., 2000).

The adverse shocks hypothesis, which sees negative shocks in the core countries (and the consequent policy reaction) as opportunities for industrialization in Latin America finds some support during this period in Brazil, Chile and Colombia. Not only industrial output grew fast in these countries, but labor productivity also did. The WWI and 1920s saw industrial capacity to expand, and during the 1930s, facing less international competition, capacity utilization increased and there was also some new substitution of industries in the region. The only exception is Argentina, which suffers a terrible blow to its terms of trade and has, overall, negative labor productivity growth in the decade.

Speculation about why the Great Depression was an additional obstacle for Argentina while it acted as a boost for the remaining countries is that the front-runner was already attempting its second industrial revolution by the 1920s and needed either to recover access to foreign markets or/and a continuous inflow of foreign capital to finance the structural change. It is well known that the post-depression years proved to be a fatal blow for temperate climate crops prices and that international capital flows were almost nil, thus the reason why Argentina has such a different path in the aftermath of the Great Depression from Brazil or Colombia had more to do with bad luck than bad policy.

World War II and Import Substitution Industrialization

This is the golden era of import substitution industrialization (1944-1973), when governments in the region implemented explicit policies to protect and promote the

substitution of consumer goods, and to some extent intermediate goods in Brazil (Leff, 1968). Additionally, this period of rapid industrial growth coincided (or caused) the rapid urbanization of these countries and led manufacturing to surpass agriculture as the most important employer, with the exception for Argentina, which underwent this process earlier in the century (Baer, 2008; Baer, 1972; Hirschman, 1968).

While Colombia, Chile and Brazil continued deepening their industrialization in the 1930s, expanding their textile sectors and beginning to develop other industries (Lederman, 2005; Stein, 1957), Argentina seemed to have missed an opportunity to deepen its industrial base. Diaz Alejandro (1970) argues that by mid 1930s there was a missed opportunity to implement a targeted industrial policy that would have enabled Argentina to follow a smooth transition through sequential industrialization phases. According to this author, unless there was another export boom in sight, which Argentina did not experience ever again (e.g., its terms of trade in the post-WWII period were much lower than those of the 1900-1930 period), the endogenous industry phase turned into one in which from having current account surpluses, the country faced recurrent current account deficits and external disequilibria. For Diaz Alejandro, after the 1930s Argentina experienced a long period of drifting away from the front runners in Latin America (Taylor, 1998).

Although Argentina's terms of trade continued to decline and it would not experience endogenous industrialization again, after WWII, it exhibited a relatively stable industrial growth rate ranging between 4 percent and 6 percent. Brazil had an unstable but high growth rate ranging between 7 and 11 percent. Chile's industrial growth rate was over 5 percent while Colombia's one decreased to a still highly respectable average of almost 7 percent. The four countries caught-up to the world leader, the US, but only Brazil and Colombia managed to keep converging to the UK, Germany and Japan.

Protectionism and Industrialization

Beyond offering protection to industrialize the country, students of ISI in Latin America highlight that such policies intended to promote industrialization in stages. That is, governments, at least in theory, followed a series of policies to sequentially promote new industries with higher value added and more technological complexity. Initially governments were supposed to promote the consumer goods and basic building materials industries because of their simple technology and their low capital requirements. Then, governments supported more complex consumer goods industries, which required more sophisticated technologies and higher capital requirements. Finally, governments were to target more complex consumer durables, industrial inputs such as steel, engineering and chemical products, and other heavy industries (e.g., Brazil and Argentina ventured into aerospace) (Baer, 1972; Love, 2005). In theory this sequencing could include as a final link the development of a domestic capital goods sector or a complex sector of industrial raw materials. In practice some of the less capital intensive industries could lobby governments not to develop intermediate goods that could lead to expensive inputs(Baer, 1972).

Certainly, the golden years of the ISI for Argentina were the 1950s up to the early 1970s. The Peron administration (1946-1955) opted –by default—for an inward-looking industrialization model that accelerated under the leadership of Arturo Frondizi (1958-1962) an advocated the so-called "desarrollismo" (the "developmentalist" approach). Already in 1960, state-owned enterprises controlled basic sectors of the economy such as iron, steel and petroleum, energy generation, telecommunications and transport. Multinational corporations were engaged in the production of vehicles, pharmaceuticals, petrochemicals, tobacco, agricultural equipment and food processing (Katz and Kosacoff, 200). The industrial structural change was significant between 1950 and 1970. During this two decades, the share of heavy goods manufacturing to total manufacturing went from 20.5 percent to 32.4 percent,

while the share of capital goods manufacturing jumped from 9,7 to 22 percent. The relative participation of consumer goods production went down by a third from a value of 61.4 percent in 1950. By the mid-60s a domestic ISI model was in place; the question was then whether the battery of protectionist and fiscal policies to support it were sustainable overtime.

In Table 6 we depict the change in industrial structure in Brazil during the post-WWII period. We separate the manufacturing industries from the extractive industries into groups that broadly represent the stages the import substitution industrialization hypothesis would expect to see as protectionist policies were implemented. Brazil is the country that has the largest leap in industrial sophistication in the post-WWII period. The manufacturing industries producing consumer goods (associated with the first stage of import substitution) represented close to 60 percent of the total by 1939 and ended up representing less than 30 percent of the total by the 1970s. In contrast, heavier industries producing metals, chemicals, plastics, and pharmaceuticals (which we associate with the second stage of sophistication of import substitution) almost doubled their importance between 1939 and 1980, going from 17 to 30 percent of total manufacturing. The rapid increase in these stage II industries that took place in the 1960s and 1970s is associated with the explicit development plans of the military government to promote heavy industries. Finally, industries we would associate with Stage III of import substitution, such as mechanical industries, electrical and telecommunications equipment, and transportation equipment (automobiles & airplanes), gain momentum after the 1950s and reach 24 percent of total manufactures by 1980. This is the heyday of industrial policy in Brazil, when the military government (1964-1985), through policy stability and excessive external indebtedness, provided subsidized financing and put in place some of the infrastructure and raw materials needed to develop some of the most sophisticated industries in the country. The role of state-owned enterprises was key in providing cheap raw materials,

subsidized credit, and cooperating with the private sector to develop the airplane industry, the large petrochemical sector, and the electricity and telecommunications sector in the country (Musacchio and Lazzarini, 2014).

According to Leff (1968), by 1949 the local capital goods industry provided over 60 percent of the domestic demand for industrial equipment. This development is even more impressive if we consider that the nascent capital goods industry developed despite the competition from foreign imports until at least the 1960s, when imports of machinery had preferential exchange rate treatment and duty-free importation. In fact, Leff (1968) argues, the development of the Brazilian capital goods industry was so impressive, that the "domestic supply coefficient [for capital goods] was more than three times larger than in Argentina during the same years" (p. 8).

In Colombia the ISI policies also involved the development of industrial banks and creative exchange rate devaluation mechanisms to reduce the chance of recurrent foreign exchange crisis (Berry and Thoumi, 1989, Brando, 2012). Manufacturing industry had a significant transformation between 1955 and 1970 (see Table 6). The production of durables and intermediate goods had a rapid increase, going from 4.6 and 16 percent of manufacturing value added, to 14 and 39 percent, respectively, in that period. These shares would then remain constant for most of the twentieth century.

An additional important fact about the post-World War II period is that our "front-runner," Argentina, lags behind, at least relative to Brazil, Colombia and to itself. Krugman (1993) argues that the inward orientation is a partial explanation for a performance well below its growth potential because external contestability was not a threat for domestic producers. But most importantly for Argentina, the ISI was an "incomplete model" as the inadequate growth of industrial exports during this whole period was still an obstacle to the industrialization

process. Furthermore, the Argentine government attempts to develop a large-scale, heavy industry required a continuous injection of public subsidies.

During the ISI golden age Chile caught up with the US but lost the opportunity to catch-up faster, as UK, Germany, Japan, Brazil and Colombia did. In the 1950-1972 period, during the heyday of the ISI period, the manufacturing industry was still growing at 5 % in a context of very high monetary instability—as in Argentina—and stop and go macroeconomic policies that resulted in sudden swings in relative prices. This instability was also combined with unstable rules of the game in the design of trade policies. Hence, the literature on Chile argues there was not a smooth ISI strategy with stellar results in Chile (Cortes Douglas, et al., 1981; Ffrench-Davis, et al., 2000; Muñoz, 1968).

Table 6 Industrial Value Added by Type of Industry, South America, 1940-1995

	c. 1940	c. 1955	c. 1970	c. 1980	c. 1990	c. 1995
Brazil						
Transformation of natural resources:	14	15	13	11		
Consumer products (durables and non-durables)	59	41	34	28		
Heavy industry and industrial inputs	17	24	27	30		
Capital goods and high technology products	5	15	20	24		
Others	1	2	2	4		
Colombia						
Consumer products (non-durables)	n.a.	66.3	30	32	31	33
Consumer products (durables)	n.a.	4.6	14	15	16	18
Intermediate godos	n.a.	16	39	34	36	34
Capital godos	n.a.	12	9	10	9	8
Transportation equipment	n.a.	n.a.	7	9	8	7

Source: Brazil, compiled from IBGE (1990), p. 386. Colombia from ECLA (1957) p. 274; Garay (1998) p. 463

After describing the policy context and industrial performance in these four countries, we can focus more close on the heated debates over the nature, causes and limits of industrialization in Latin America during the ISI period. At least two important issues need to be highlighted.

First, the measurement of actual protection to domestic industrial producers is complex, and its correlation with industrial growth is debated. Second, there is still a heated debate with regards to what is the right counterfactual for Latin America in the post-WWII period. Did Latin America industrialize rapidly because of ISI policies or despite of them? That is, there is still debate about whether industrial growth rates could have been higher if another set of policies had been implemented.

ISI policies overall effect and industrialization

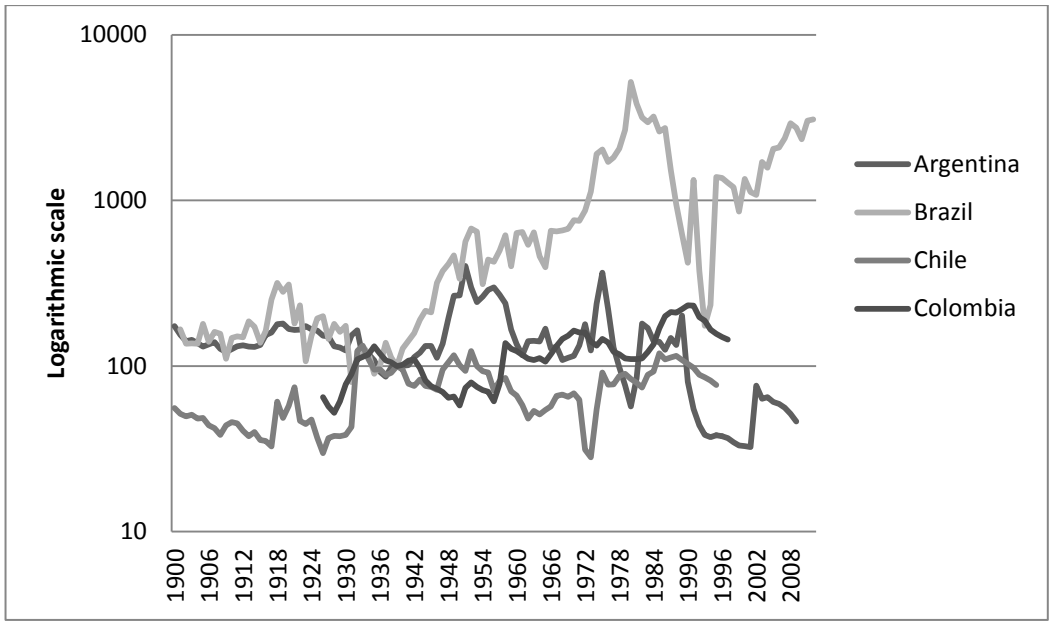
The contrasting performance between Brazil and Colombia, on the one hand, and Argentina and Chile on the other raises an interesting puzzle. In order to shed some light on this puzzle in Figure 1 we show what we call the real distorted import price indices for the four countries. These are the prices that local producers would observe for competing imports. The index is the ratio of import prices in the domestic market (in domestic currency) over the domestic prices. Import prices are calculated by multiplying import prices by the average tariff and the nominal exchange rate. Domestic prices are measured by the domestic price index for industrial goods (or the industrial GDP deflator). If the index is higher than 100, local producers face a protected environment. If the index is below 100, local producers face high competition from imports (and, during the ISI, macro and trade policies are miss-aligned and generate more intense competition rather than protection). The index is a useful but incomplete measure because it considers the effects of quantitative trade restrictions of the real distorted price index only via its effects over the domestic industrial price index.

Figure 1 shows the log scale of the real distorted import price index. That is, we focus on the trends rather than on the levels to interpret the evolution of the index for each country. In Brazil the price distortions induced by macro and trade policies generated increasing protection to domestic producers up to 1980. In Colombia protection was roughly increasing between 1950 and 1990. In Argentina it increased up to 1950, and declined thereafter. In

Chile, the index declined between 1948 and 1972 and increased thereafter. It is surprising that the Pinochet government seems to have implemented a set of policies that, although included substantial trade liberalization, overall tended to protect domestic industrial producers.

The trends in Figure 1 suggest two important directions for future research. First, to understand the overall effects of ISI policies it is important to derive synthetic indexes. The different macro and trade policies implemented during the ISI period generated complex effects on the economy and it is even possible that the overall effect of these policies was higher import competition rather than protection. The point is even more important considering the complex and influential political economy that underlined ISI policies (influence of trade unions, shifts from left to right, dictatorships, etc.). Second, in our small sample, when a country sustained more aligned macro and trade policies delivering industrial protection (as measured by our experimental, albeit limited indicator) for a long period , it also experienced higher industrial growth rates. Thus, there seems to be suggestive evidence that increasing protection was indeed associated with increasing industrialization. For instance, the 1940s-1970s were characterized by convergence in industrial output and productivity growth and even if not all four countries in our sample experienced faster industrial output growth than the US, they all had almost twice the U.S. labor productivity growth.

Figure 1. Real distorted import price index for Argentina, Brazil, Chile and Colombia, 1900-2012 (1939=100)



Note: The real distorted import prices = ((1+ avg. tariff) * nominal exchange rate * import price index) / domestic industrial price index. We then index this series taking 1939 as the base year (1939=100).

Source: as in appendix.

The Post-WWII Period as a Missed Opportunity

What is not clear to us, however, is if increasing protection led to the highest possible industrial growth rates or if there were lost opportunities available that South American countries did not take, but that other countries in similar stages of development took. The results depicted in Figure 1 above suggest that more distortions are correlated with faster industrialization in Colombia and Brazil, and to a lesser extent in the case of Chile. Moreover, convergence to the US could be considered a clear indication of the success of ISI policies. But how good performance during the golden age of ISI was, and the role that macro and trade policies played in this performance, is a matter of heated debate.

In East Asia the policy mix during their equivalent of ISI included more incentives for domestic producers to export and compete in global markets and more targeted tariff protection. For instance, in South Korea, even if tariff protections were spread around the

same sectors as in Argentina or Colombia, they were lower on average—for a shorter time—and more targeted to promote specific industries or companies (Wade, 1990). The result of these policies was rapid industrial growth at levels higher than those of the United States. In fact, manufacturing value added in South Korea grew at an average of 11.2 percent in the post-WWII period, and continued at an accelerated pace in the 1980s (above 12 percent per year) and in the post 1990 period (7.7 percent p.a.).

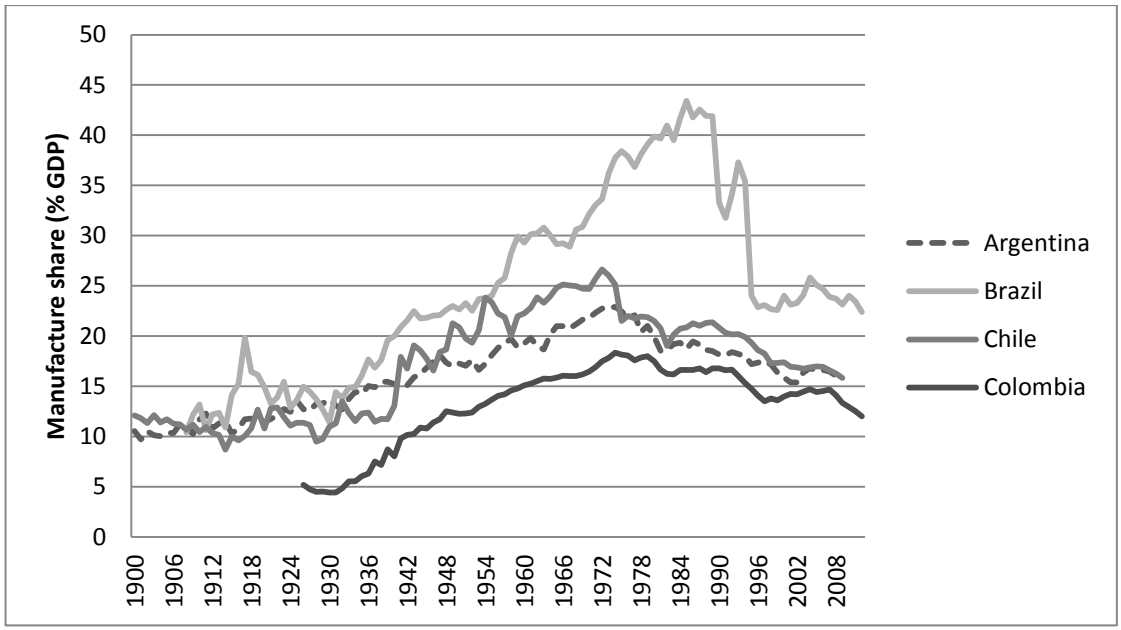
Comparisons with South Korea suggest we need to improve our knowledge on at least two directions to understand better Latin America's experience during ISI. First, part of the debate is about deciding what the right counterfactual is for Latin America. More precisely, is convergence to the US enough, or should we develop a measure of potential convergence speed to judge our countries performance during this period. Convergence to the world industrial leader may mask slower convergence than potential convergence. The fact that industrial output in Europe's industrial leaders, Japan, and South East Asian economies was growing faster than in Argentina and Chile, in addition to the fact all four countries in our sample exhibited faster productivity growth in the 1930s than during the golden age of ISI (except for Argentina), seems to suggest the potential for faster convergence was there but was not achieved. If this conjecture is correct, our evidence may support the ISI stagnationist hypothesis. A creative and convincing measure of industrial output and productivity growth is one of the key inputs to improve our understanding of this period, characterized by one of the most fascinating policy interventions in Latin America's history.

Second, there is debate about what was the role played by macro and trade policies in the observed industrial performance of the four countries in our sample. Using Asia as a counterfactual would make us question the importance of protectionist policies to promote industrialization in Latin America. We know that the distorted prices depicted in Figure 1 were high for Brazil and Colombia, and that high protection is correlated with faster

industrialization rates. But it is not clear whether in relative terms that made a big difference. In particular, we know that industry over GDP was larger during this period but, thanks to the protectionism there were large rents in the protected industries. Thus, value added and our productivity figures may be inflated by the presence of such rents. With distortions such as tariff protections come high internal prices that make value added seem higher than if prices were set in international markets.

Moreover, the distortions governments in South America introduced also affected the capacity they had for promoting a regional market for manufactures. That is, in contrast with East Asia where some manufactured products had to be competitive in international markets, the prices for manufactured goods in Latin America were not competitive in world markets and could not be exported to neighboring countries because they also wanted to develop its own industries using a similar policy mix. Thus, according to Badia-Miró, et al. (2014) Latin America missed important opportunities to spur interregional trade because low productivity and high trade barriers became major obstacles, especially for intra-regional manufacturing trade. Interregional integration and industrialization did not progress, despite efforts such as the 1940 Pinedo Plan, the John Hopkins report of 1944 on the "Cooperación para la promoción del Intercambio in Argentina," which proposed the creation of a regional free trade area, or the Andean Pact between Bolivia, Chile, Colombia, Ecuador, Peru and Venezuela.

Figure 10 Manufacturing as a Percent of GDP in Argentina, Brazil, Chile and Colombia, 1900-2012



Source: Calculated by the authors using the local series of manufacturing value added described in the text and GDP series in the Data Section.

All in all, until the 1960s, maybe with the exception of Brazil, South American manufacturing production was mostly destined to satisfy domestic demand. The manufacturing sector in the region was a net importer, requiring foreign exchange continuously; a situation that cyclically produced balance of payments crises. But the exclusively inward looking characteristic of the industry started to change by 1970, when the participation of manufacturing in total exports increased, governments lowered average tariffs and removed some quantitative restrictions. Additionally, the creation of the free trade areas of ALADI (1980), to which all four countries joined, and MERCOSUR (1990), which changed export profile in Argentina and Brazil, and to a lesser extent Chile, also allowed the region to increase manufacturing exports.

Finally, the timing of de-industrialization also questions the hypothesis that ISI policies led to a successful industrialization in the region. In the 1970s, all four countries experienced a deceleration of the industrial average growth rate from four to two percent. That means that

de-industrialization, measured as declining share of manufacturing in total GDP, starts for most countries *before* their governments dismissed ISI policies and *before* the crisis of the 1980s. That is, de-industrialization happens not as a consequence of the demise of ISI, but during the ISI period. De-industrialization starts in Chile in 1971 (while Salvador Allende was still in power, and before any major change to the ISI policies), and in Argentina and Colombia by 1975, also before any important departure from ISI programs. Brazil did not do any major liberalization until the late 1980s and early 1990s. In sum, many of these facts point to a fussy relationship between protectionism and industrialization.

The 1980s Debt Crisis and its Impact in South America

The 1980s crisis, which started with the spike in interest rates in the United States and the debt default of Mexico, hit Brazil and Argentina like no other shock in the twentieth century. During this decade, industrial GDP growth rates decreased across the board, and despite rapid exchange rate depreciations, domestic industry suffered because of the contraction in domestic demand and the sudden stop in capital inflows (Frieden, 1991). With low terms of trade, a sequencing of real devaluations and real appreciations of exchange rates, the reversal was unavoidable (Berlinski, 2003; Gerchunoff and Llach, 1998). Argentina and Brazil, in fact, ended up running hyperinflationary policies in the late 1980s, which end up forcing their governments to open up and to establish fixed exchange rate regimes (in order to anchor prices). In contrast, Chile and Colombia went through the crisis relatively unscathed, with moderate macroeconomic imbalances.

Yet, independently of the macroeconomic performance of the country, or the different policies pursued, manufacturing declined. In all four countries manufacturing output and productivity growth rates slowed substantially, and manufacturing as a share of GDP accelerated its decline. Simultaneously, the world leader, the US, and the close followers, the UK, Germany

and Japan, all experienced industrial output and productivity growth deceleration. Therefore, in relative terms Brazil and Colombia managed to catch-up with these industrial leaders, while Argentina and Chile did not lose as much ground as they could have lost under other circumstances.

In any case, the 1980s were a turning point for the region. For most countries, the scarcity of foreign exchange in the early 1980s demonstrated the need for a new development model, with less balance of payments constraints and with exchange rate stability. That is why, as a response to the balance of payments crisis and the acceleration of inflation in the region, governments responded with a drastic liberalization of their economies.

The 1990s and Beyond

The 1990s were a period of rapid structural change, liberalization, and deregulation in our four countries, with Chile forging ahead with reforms, and Argentina, Brazil, and Colombia following. Under liberalization we actually observe a rebound from the dismal 1980s, but with extremely modest rates of growth. The industrial complex in Argentina and Brazil maintained average growth rates close to two percent, while Chile's industrial performance improved substantially, reaching average growth rates of seven percent. The success of Chile in the 1990s stems from the fact that its manufacturing sector gained international competitiveness, mostly in the so-called extractive industries, but also in some of the medium and high technology content industries. According to our estimates, the Chilean manufacturing sector is the best performer of the 1990s and 2000s with an average annual rate of growth of close to 4 percent per year. This may be related to the fact that terms of trade for Chile substantially improved since 1995, when the government ran a nominal exchange rate crawling peg to avoid sharp swings in the real exchange rate (Huelva and Núñez, 2010).

In the 1990s, Argentina and Brazil institute one-to-one pegs with the dollar. In Argentina, in fact, the government introduced a currency board to tie the hands of the central bank to avoid further inflation. In Brazil, the government attempted several stabilization plans between 1985 and 1994, until President Fernando Henrique Cardoso committed to sticking to the Real Plan, with a new currency and with a series of measures to open up the economy. Despite the stabilization, both Brazil and Argentina have a slow industrial performance in the 1990s, partly because the appreciated exchange rate and flat terms of trade.

Colombia experiences its worst decade of the twentieth century in terms industrial growth, with just over 2% average growth per annum in the 1990s. In this country, while trade and capital market reform advanced, the oil sector slowly replaced coffee as the main export and terms of trade improved, and, there was a cycle of appreciation-depreciation-appreciation of the exchange rate(Clavijo, et al., 2013; Echavarría and Villamizar, 2006).

Finally, during the first decade of the twenty-first century, Brazil, Chile and Colombia experienced modest average manufacturing growth while Argentina's output exhibited a sharp decline and a sharp rebound after 2005. During this period the industrial growth rates in Chile indicate industrial output catching up with both the US and the group of close industrial follower countries, while Argentina, Brazil and Colombia do not lose too much ground with the US and catch-up with the US industrial close followers (see Table 3).

As Table 4 shows, the post 1990s period were not associated with an acceleration of productivity in the region. Among the countries we study only Chile accelerates productivity growth, while Argentina, Brazil and Colombia slow down. In fact, when we compare the growth in labor productivity to that of the United States, we find that South America lagged behind the industrial leaders during this period. This evidence is supportive of the idea that there the improvement in terms of trade for the region was actually associated with some form of Dutch Disease.

In contrast to the endogenous industrialization period before World War I, the favorable terms of trade South America experience in the 2000s, overall the period 1990-2012 period is not one of rapid industrial convergence. Brazil, Argentina, and Colombia actually underperform the United States between 1991 and 2007, despite having favorable terms of trade thanks to high commodity prices booms (especially after 2003). Brazil and Argentina enjoyed rapid growth in agribusiness-related industries, but only Argentina managed to convert such favorable terms of trade into rapid manufacturing growth. Brazil, in fact, had a mediocre industrial performance.

SUMMARY DISCUSSION

In this paper we have compiled and constructed new long-run series of industrial GDP growth, labor productivity and a set of variables related to initial conditions, international trade, and macroeconomic policy. In this first attempt we examine what we think are the best industrial GDP growth series to test qualitatively if these are consistent with hypothesis of 1) industrialization promoted endogenously by exports via an income effect on the domestic economy, 2) industrialization under adverse shocks that induce policies promoting industrialization, 3) import substitution industrialization inducing fast manufacturing productivity or 4) import substitution industrialization promoting domestic uncompetitive firms.

Industrial GDP growth series indicate convergence did take place. But convergence was not experienced during the whole period and its pace was uneven through time and between countries compared to the world industrial leader, the US, and a group of close followers, the UK, Germany and Japan.

The initial conditions these countries faced by 1900 were varied and had an important role in their industrial development along the twentieth century. The Argentine economy was

characterized by higher human capital, urbanization and transportation advantages, compared to the other three countries, and had begun its industrial development earlier. Brazil's size was not an advantage at this time. It did not export the diverse raw materials it was endowed with and the large population was still poor, illiterate and located sparsely and far from water transport. Strong industrial development only started at the turn of the 20th century. Chile had access to high human capital and low transport costs, but it was a small and moderately urbanized economy that industrialized slowly. Colombia's population was relatively illiterate, poor, located sparsely and far from water transport. It is the industrial late comer of this group of countries.

The 1900-1920s was led by Brazil's strong convergence to the US and its close followers, while Argentina experienced fast industrial growth but only converged to the industrial close followers. Although the initial human capital, urbanization, and transport costs favored Argentina, Brazil performed better. However, in both countries it is likely export growth led to machinery imports and an income effect that favored industrial growth: endogenous industrialization. Chile did not catch-up and very likely Colombia experienced similar performance. The experience of Chile and Colombia contrasts with that of Brazil and Argentina, even though Chile experienced high exports and favorable initial conditions, while Colombia also experienced export growth but unfavorable initial conditions.

The roaring twenties were more volatile. Export growth, machinery imports and industrial growth proceeded at a faster rate in Argentina that caught-up with both the US and the close industrial followers, but at a slower rate in Brazil that lost ground to the US. Again, it looks like Argentina and Brazil experienced endogenous industrialization. Chile and Colombia continued with their sluggish industrial performance, while Colombia invested in railroads and reduced its disadvantageous initial conditions.

The Great Depression was a period of fast industrial growth. The US forged ahead; Brazil, Chile and Colombia converged to the US followers; and Argentina lost ground. Brazil, Chile and Colombia performed an initial policy adjustment to the new international conditions, protecting their own industries. But by mid 1930s, by chance or monopoly policy, saw their exports grow fast, providing foreign exchange for machinery imports and an income effect benefiting industrialization. Argentina followed similar policy adjustments, but was unlucky and did not see exports rise. A combination of adverse shock protective policies with luck or market power in the international market seems to explain better the fast industrialization of Brazil, Chile and Colombia.

The ISI period, 1944-1972, saw the four Latin American countries catch-up with the US. Brazil and Colombia also catch-up with the US close industrial followers, but the four economies failed to catch-up as fast as south-east Asian industrializing economies like South Korea. The Latin American economies learned from their experience during the Great Depression and developed ISI policies. Brazil performed the deepest and longest interventions, while its population became increasingly literate, urban and richer. Argentina, Chile and Colombia developed uneven and less distortive policies. Colombians also became increasingly literate, urban and richer, reducing further the initial disadvantage they faced. ISI policies promoted further industrialization in all four countries. However, the evidence examined in this chapter does allow speculating that ISI policies on their own did not have the potential to promote full catch-up. First, at the beginning of this period Brazil's industrial GDP per capita signaled it had as much industrial convergence potential as Argentina and far lower than Chile, but Brazil performed better than both. The case of Brazil highlights that to implement ISI deeply and for a long period it is beneficial to have a large domestic market, reduce initial conditions disadvantages, and be lucky to have export market power and booms. Second, Colombia's lower industrial GDP per capita signaled higher convergence potential. Under weaker ISI

interventions than Argentina and similar to those of Chile, Colombia grew faster, supported on important interventions to reduce initial disadvantages, and high coffee prices. Both these points suggest that at least Argentina possibly developed ISI stagnationinst policies, inadequate for the unlucky export performance and small capital goods sector that characterized its economy during this period. Third, the ISI policies seem to have hit their limit during the late 1960s for Argentina, Chile and Colombia. The manufacturing share of GDP started declining in all three countries, even before ISI policies had been dismounted – Brazil kept industrializing and developing more sophisticated manufacturing industries, probably sheltered under its large market size. Even though evidence tilts to suggest ISI on its own was not enough to promote industrialization at convergence potential, it is fair to acknowledge that to assess the role of ISI in industrialization it is necessary to develop counterfactuals beyond the scope of this chapter.

A period of remarkable industrial and more general instability for Latin America started with the oil shock and continued during the debt crisis. At differing degrees, all four countries faced foreign exchange restrictions derived from a large price increase in a key input (oil) or from a macro crisis (external debt crisis). Industrial growth declined compared to previous periods, but was not that bad compared to the industrial world leaders. Brazil, Chile and Colombia converged to the US, and Brazil and Colombia catch-up to the US close industrial followers. Argentina, however, lost ground to both the US and its followers. But during this period the manufacturing share of GDP declined in all four countries. De-industrialization continued. The trend is not unique to these four countries, but it is none the less significant.

The 1990 and 2000s were a period of transitions and export booms. Chile started dismounting ISI and opening the economy in the late 1970s and the other three countries followed in the 1990s. Chile enjoyed relative stability during this period and was the only country to catch-up with the US and its close industrial followers, while Argentina, Brazil and

Colombia catch-up with the US followers. The 2000s export booms eased the severe foreign exchange restrictions of the 1970s, 1980s and 1990s, and under a more open trade environment and policy in these countries weak convergence was experienced, suggesting that endogenous industrialization was again in place.

Examination of the industrial GDP growth series uncovers important heterogeneity in stimulus to industrialization along time, across countries within each period, and in response to policies adopted. Brazil's experience highlights the various stimuli that have played a role in its industrialization: strong endogenous industrialization (1900-1930), adverse shock and export boom (1930-1944), ISI (1944-1980), and weak endogenous industrialization (1991-2010). Chile's failure to catch-up to the US and its close industrial followers in the early stages of the twentieth century highlights that industrialization by exporting was not automatic even if many initial conditions had been already achieved. Argentina's failure to converge during the decade of fastest convergence in Latin America, the Great Depression, points out that even if most countries adopt similar policies, some are lucky to export and industrialize, while others are not. And Colombia's fast Great Depression and ISI industrial performance highlights the importance of combining protectionist policies with interventions to reduce initial conditions disadvantages. This chapter, thus, highlights the importance of considering the international context, internal policies, initial conditions and the nature of the country's export products to understand better industrialization. The point is particularly important for the literature on Latin America's industrialization, as it has emphasized analysis of policies while the importance of these other factors and the heterogeneity between the region countries' experience has been downplayed.

Finally, we document a U-shaped curve when it comes to the importance of manufacturing to GDP in South America. The relative importance of the industrial sector increased rapidly after the Great Depression, peaking in the 1970s, and then followed a path of relative de-

industrialization. According to what we show, industrialization in most countries required protectionism and, with a few exceptions, there was a large retrenchment from manufacturing once the economies of South America started opening up to the world economy and to trade after the 1990s. We do not argue that the policies that promoted industrialization before 1980 should be tried again. On the contrary, our estimates show the de-industrialization of South America started before the demise of ISIS. Whatever Latin America tried before 1970, had short-term success across the board and only in some industries did the region develop long-term comparative advantage.

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