

PRODUCTION DEVELOPMENT

Premature deindustrialization in Latin America

Mario Castillo
Antonio Martins Neto



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Abstract

Defining deindustrialization as a situation of falling share of manufacturing employment and value added in total employment and GDP, respectively, and a rising specialization in primary goods, this paper provides an empirical analysis of the recent (and in some cases historical) path of four Latin American countries (Argentina, Brazil, Chile and Mexico), contributing to the debate on the matter of premature deindustrialization. We argue that Argentina, Brazil and Chile face premature deindustrialization, increasing their specialization in commodities, resource-based manufactures and low productivity services, while Mexico urges a deeper analyze of its structure.

Keywords: Deindustrialization, structural change, economic development.

J.E.L. Classification Codes: L16, J21, O14.

Introduction

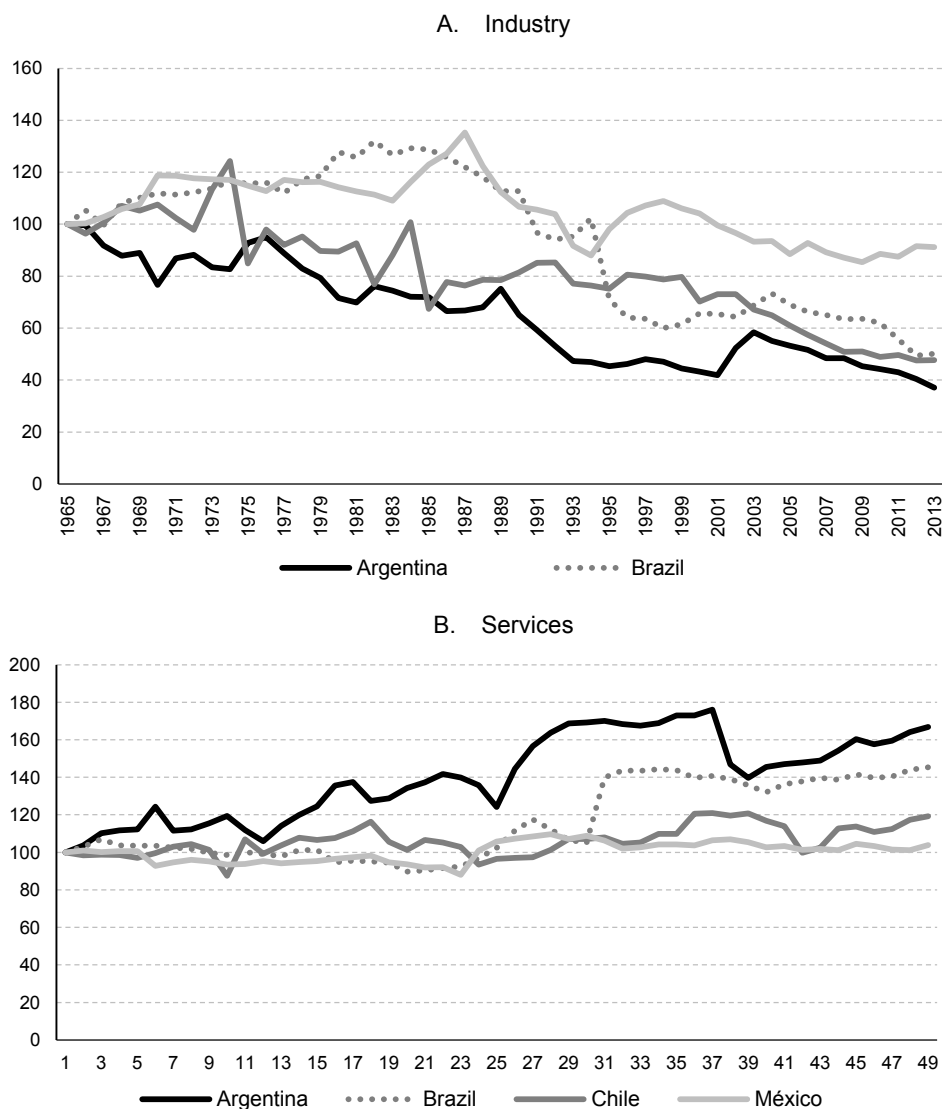
Reducing poverty and fostering development remains a challenge in many countries. One of the main obstacles is to shift from low productivity sectors, such as small agriculture and informal services, towards high productivity ones. This process of transformation is called structural change, a trail experienced for most developed countries, but still a challenge for Latin America.¹

From a Schumpeterian perspective, structural change explains most of the technological gap, since it goes along with technological progress, in which technological capabilities and competitiveness reinforce themselves (CEPAL, 2014). In a Post-Keynesian view, structural change is also important in terms of external constraint and growth. As stated by Thirlwall's law, the long run growth can be approximated by the ratio of the growth of exports to the income elasticity of demand for imports (Thirlwall, 1979). As income elasticity of demand is higher in high technological sectors, the productive structure explains the path of growth in the long run (see Cimoli and Porcile, 2014).

In its simplest version, this transformation is a path of industrialization, which seems to be inverted in Latin America. During the last two decades, a striking evidence of the region's pattern of development is an increasing share of services in total value-added at the expense of industry (see figure 1). This is more evident in the 1990s in the cases of Brazil and Argentina, while Mexico and, mainly, Chile exhibit more fluctuations. However, despite short-run fluctuations, the long-run picture is one of a clear rise in services' share in total value-added and, moreover, a rise in services' share in total employment.

¹ The United States is an example of this kind of pattern. In the 1890s, during the II Industrial Revolution, 35% of total employment was in the industrial sector, while 30% corresponded to services. At the end of the 1960s, on the other hand, employment in industry was up to 40%. Lately, after the irruption of the III Industrial Revolution in the 1970s, industry was responsible for only about 20% of total employment (Leeds, 1917; Gordon, 2014).

Figure 1
Industry and services, value added
(Percentage GDP- index 1965=100)



Source: World Development Indicators, World Bank.

This is frequently seen as a natural process, as it has been the case of several developed countries.² In a first stage, workers move from agriculture toward industry, followed by a shift toward services. In this sense, the share of industry in total employment should display an inverted U-shaped curve. However, this is an extreme simplification, which hides several specificities of each economy or region. For example, what kind of services has being developed in Latin America? Is Latin America creating better jobs? Is Latin America facing premature deindustrialization?

² In some developed economies a falling share of manufacturing value-added is not observed. In these economies, labor productivity growth compensates for the fall in total employment and, consequently, manufacturing value-added remains a constant share of GDP (for instance, USA). In other cases, the inverted U-shaped curve can be observed in the share of both value-added and employment.

This paper provides an empirical analysis of the recent (and in some cases historical) path of four Latin American countries (Argentina, Brazil, Chile and Mexico), contributing to the debate on the matter of premature deindustrialization. These four economies have been chosen because they represent a significant share of Latin America's GDP (76% in 2014³) and illustrate different experiences and characteristics of the region. We focus on several measures, such as the shares of industry in total value-added, total employment and exports (as well as decompositions of sectors), and the decomposition of labor productivity (see Rodrik and McMillan, 2011 and M.P. Timmer, G.J de Vries and K. de Vries, 2014) as a tool to investigate the impact of structural change. We argue that Argentina, Brazil and Chile face premature deindustrialization, as they increased their specialization in commodities, resource-based manufactures and low productivity services. Meanwhile, Mexico urges a deeper analyze of its structure, as deindustrialization lost force in the last two decades. Argentina, on the other hand, appears to be reversing, in the last decade, its process of deindustrialization.

The rest of the paper is organized as follows. chapter II discusses concepts of deindustrialization and the aspects of premature deindustrialization in Latin America. chapter III uses the decomposition of labor productivity to investigate structural change. A final section concludes.

³ Based on ECLACSTAT.

I. Deindustrialization

A. Industry and services

The arguments favoring the key role played by industry in the process of economic development go back at least to Nurkse (1953) and Hirschman (1958), who analyze industry's forward and backward linkages, and Young (1928) and Rosenstein-Rodan (1943), who explores increasing returns in manufacturing. Later, Kaldor (1960) argues that the manufacturing sector is the "engine of growth", a sector which has unique characteristics, with direct and spillover effects over the rest of the economy. For Cornwall (1977), the manufacturing sector offers special opportunities for both embodied and disembodied technological progress. Advance technology originates in the manufacturing and diffuses from there (for an empirical analyze of those arguments, see Szirmai 2012).

Moreover, certain industries in the manufacturing sector have greater income elasticity of demand than agriculture and services. Therefore, as stated by Thirlwall's growth model, the long run growth increases with a raise in the share of manufacture in total exports (see Araujo and Lima, 2007, for a multisector version of Thirlwall's law). Lastly, Rodrik (2013) shows the existence of unconditional convergence in labor productivity in the manufacturing sector, therefore countries with a higher share of manufacturing grow faster.

Additionally, economic development is a history of industrialization, which allowed for the biggest technological and social revolutions of our time. Industrialization changed societies both in terms of their economic capacity and their social structure. As in Rodrik (2015, pg.1), "industrialization shaped the modern world in ways beyond economic. It fostered urbanization and the creation of new social categories and habits".

For most Latin American economies, industrialization is a recent development, which took place in the second half of the last century. These economies moved their labor force from the fields towards the cities, from agriculture towards the industry. New political elites emerged and industrial policy came to assure their aspirations on society (see Robinson (2009) for a political perspective of industrial policy). However, paradoxically, this is old news. Manufacturing sector already achieved its peak in

these countries, both in employment and value added. Latin America is now similar to most developed countries, with a rising importance of services —a premature deindustrialization.⁴

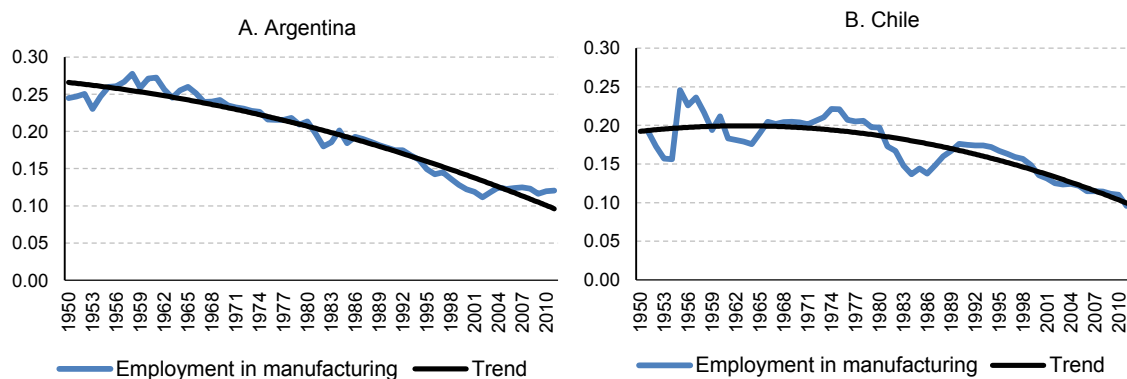
The classic concept of deindustrialization was coined by Rowthorn and Ramaswamy (1999), who define it as a process of falling share of manufacturing employment in total employment. Later, Tregenna (2009) added that, besides the falling share in total employment, deindustrialization is accompanied by a falling share of manufacturing value added in the GDP. Tregenna's concept avoids some possible caveats to Rowthorn and Ramaswamy's definition, while it brings new considerations: i) in some developed economies, while manufacturing employment share was falling, the share of manufacturing value-added in the GDP was kept constant or rising, which can indicate that manufacturing was becoming more productive. In that case, deindustrialization is not a problem; ii) moreover, by using the share of manufacturing value-added, Tregenna indicates that even in a path of a rise in manufacturing production (quantum), an economy is deindustrializing when manufacturing is losing importance in terms of total production and employment creation.

However, deindustrialization has other facades. In an (more and more) integrated world economy, value-chains and offshoring put further pressure in the concepts of deindustrialization. Asia became the manufacture of the world by absorbing labor-intensive (and less technological) manufacture activities from around the globe. As a consequence, while the share of manufacturing employment and/or value-added in total employment and GDP was falling for some countries, some of them were specializing in knowledge-intensive activities. Meanwhile, other economies were doing it in primary goods.

Henceforth, the concept of deindustrialization must be expanded in order to include these cases. In this present paper, we will add the concept of primarization to the concept of Tregenna (2009). Therefore, deindustrialization will be defined as a situation of falling share of manufacturing employment and value-added in total employment and GDP, respectively, and a rising specialization in primary goods (see Oreiro and Feijó (2010) for a brief discussion of deindustrialization and its relationship with the concept of primarization).

As earlier stated, the share of manufacturing in total employment should display an inverted U-shaped curve along an economy's development. Figure 2 shows a U-shaped curve for the manufacturing sector's share in total employment for Argentina, Brazil, Chile and Mexico.⁵ In the case of Argentina we can only observe the period in which the share is falling, as most of its industrialization took place between 1916 and 1930, a period not available in our database.

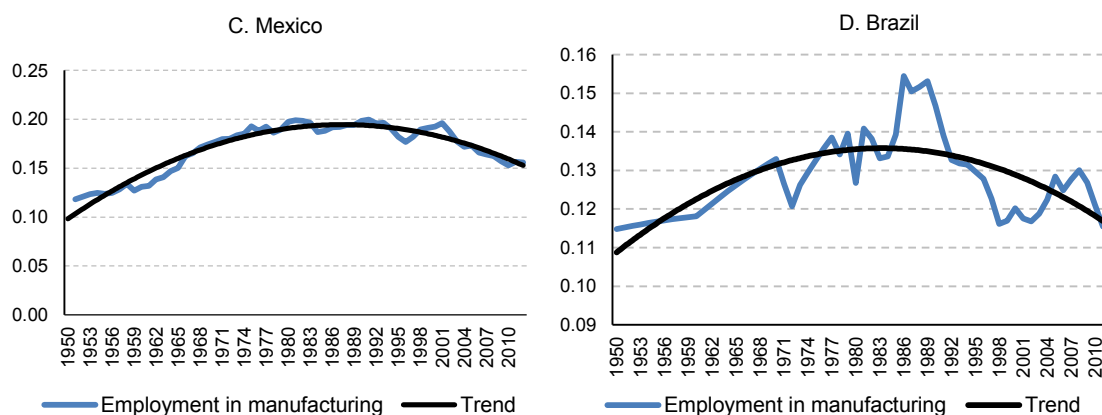
Figure 2
Employment in manufacturing
(Total percentage)



⁴ Premature deindustrialization was used for the first time by Dasgupta and Singh (2006).

⁵ In most of our analysis, we will use employment instead of value-added. As shown in Lavopa and Szirmai (2015), trends in value-added are very sensitive to relative price changes. In fact, the authors observe that global deindustrialization is solely evident when using current prices.

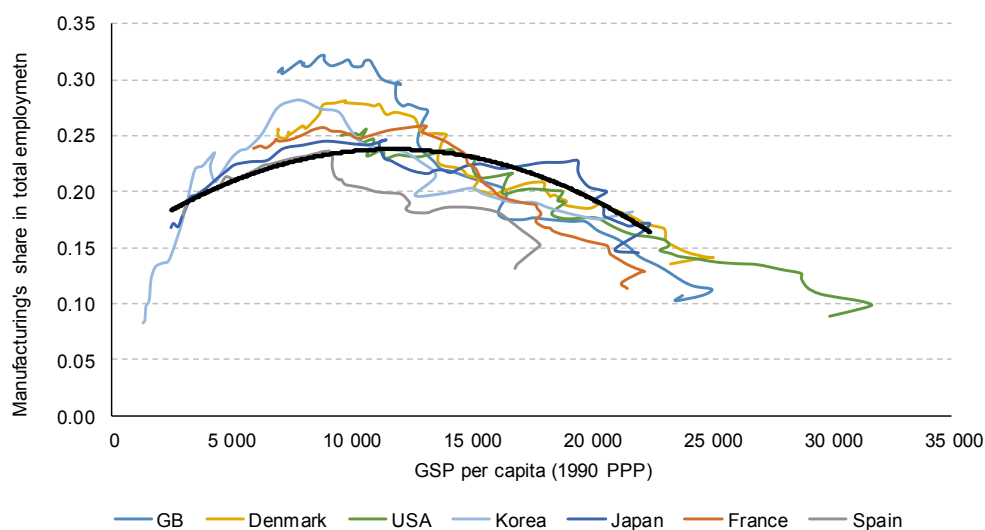
Figure 2 (concluded)



Source: Authors' calculations with data from Timmer and de Vries (2014).

One of the key arguments in favor of the hypothesis of premature deindustrialization relies on the low GDP per capita at the time Latin American countries achieved their peaks in manufacturing's share in total employment. Figure 3 displays GDP per capita and the employment share of manufacturing for eight developed countries. Even though we observe similar patterns, there are significant income disparities, even in the case of late industrialized economies, such as Japan and South Korea⁶. While most of these economies had reached a turning point with GDP per capita around US\$10,000-15,000, the four Latin American countries had reached their peak with a much lower income per capita (Argentina US\$5,461; Brazil US\$5,202; Chile US\$4,392; Mexico US\$7,275)⁷.

Figure 3
Deindustrialization in high-income countries (selected countries)



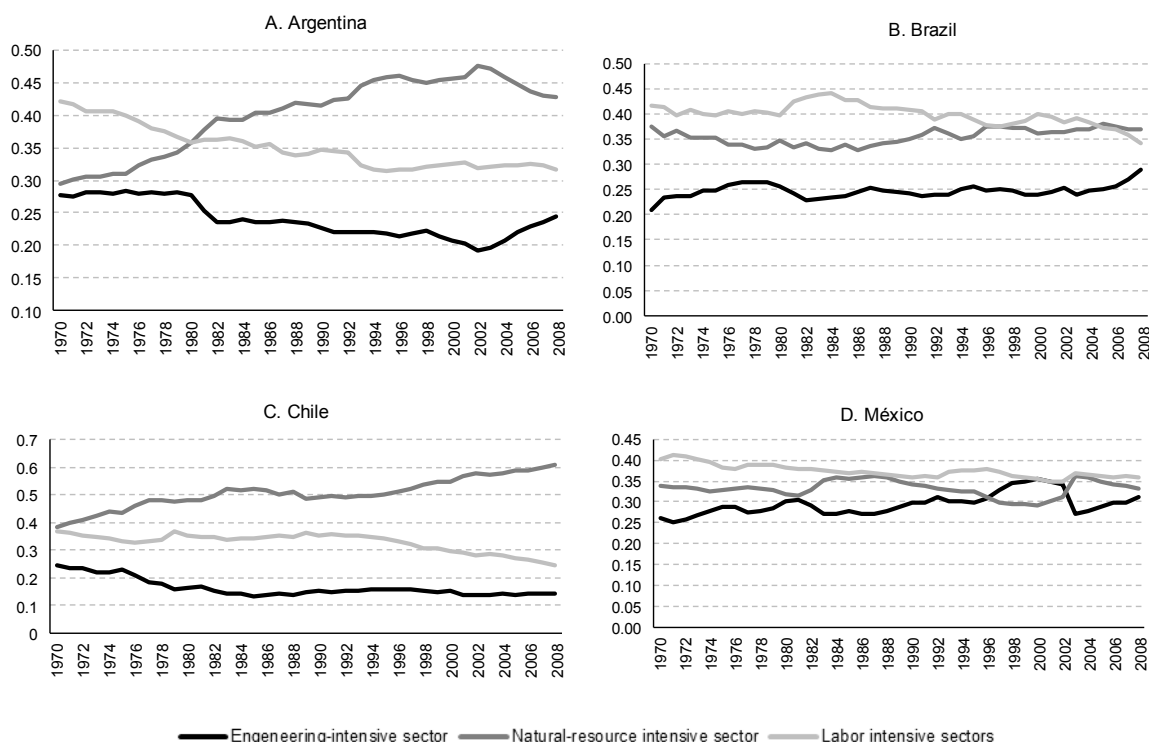
Source: Authors' calculations with data from Timmer and de Vries (2014) and The Maddison-Project.

⁶ Rowthorn (1994) estimates (for a sample of 70 countries) a turning point around US\$12,000 per capita in 1991 international dollars, which most OECD countries had reached by 1970. Rowthorn and Coutts (2004) estimate a turning point around US\$9,500 per capita (1995 PPP).

⁷ We determined the peak by looking to each country individually. All values are in 1990 PPP, using data from Timmer and de Vries (2014) and The Maddison-Project.

engineering-intensive sector decreased at the same pace of the manufacturing sector, while the labor intensive sector decreased faster. Mexico, on the other hand, has a less clear path, even though it is evident that the labor-intensive sector has lost importance since the 1970s. Meanwhile, the engineering-intensive sector increased its share until the late 1990s, followed by an impressive decrease in the 2000s, accompanied by an increase in the natural resources intensive sector. This process, however, seems to be reversing in the last years.

Figure 5
Manufacturing decomposition 1970-2008, Argentina, Brazil, Chile and Mexico
(Percentage of employment in total manufacturing employment)



Source: Authors' calculation based on PADI-CEPAL.

Moreover, note that in the cases of Argentina and Brazil, there is a reverse since the early 2000s, with an increase in engineering-intensive sectors. In Argentina, this process is accompanied by a fall in natural-resource intensive sectors, while in Brazil there is a fall in labor intensive sectors. As explored in the next section, this is also evident in terms of exports in Argentina, with an increase in the share of medium-technology exports in total exports. Brazil, on the other hand, presents a rise in the share of primary goods.

Premature deindustrialization cannot be confirmed yet. Other aspects may be influencing this trend, such as increasing importance of high-technology services, which could be a positive pattern. The importance of the manufacturing sector has been challenged in response to the rise in the so-called service economy and ICTs. It could be argued that Latin American economies are specializing in high-technology services, which would reduce the importance of its premature deindustrialization. It does not seem to be the case.

During the last decades, ICTs have had a positive impact on growth and productivity in developed countries, accelerating the transition towards economies based on advanced-manufacture, the digital industry (telecommunications, hardware and software), and sophisticated services. In Latin America, the

diffusion of new technologies has not yet generated these positive externalities and technological spillovers towards the services sector. LA-KLEMS estimations for 2007 show that the share of the digital industry in the GDP for Argentina, Brazil, Chile and Mexico is, on average, 3.2%. A number far behind the European Union countries (5%), the United States (6.4%) and Japan (6.8%).

Moreover, estimations show that the ICT capital is a marginal factor for economic growth, except for Brazil. In 1995-2008, ICT assets accounted for 14% of the GDP growth in Brazil and 7% in Argentina, Chile and Mexico. For the same period, these assets accounted for 27% of growth in the USA and 18% in European Union countries (ECLAC, 2013).

In terms of employment, the pattern is similar. For instance, Brazil experienced a boom of consumption in the last decade, among others reasons thanks to cash transfer programs and rising real wages. As a result, from 1995 to 2011, according to Timmer et al. (2015), employment share rose mostly in other personal services (2.5%), retail trade (2%), and education (1.5%). Health (1%) and public administration (1.5%) also increased their participation in the period. Moreover, if we take the Brazilian Annual Survey of Services (The Brazilian Institute of Geography and Statistics, 2003 and 2013), from 2003 to 2013, we find that personal services increased their share in services valued-added, while post and telecommunications decreased.

In the case of Mexico, as observed in figure 1, services sectors and manufacture have kept their share quite constant in the past decade. The same happens when we desegregate the service sectors and evaluate employment and value-added shares (for instance, according to Timmer et al. (2015), we observe that education, health, sale, wholesale and retail had solely marginal changes in their shares). Moreover, according to CAC (2011), between 1993 and 2010, services sector's growth (as a share of total value added) in Argentina was led mostly by wholesale, retail and repairs, followed by real estate and rental activities. In the case of Chile, according to Ministerio de Economía, Fomento y Turismo (2014), between 2005 and 2012, service's growth in total employment was led by wholesale, retail and repairs, followed by hotels and restaurants.

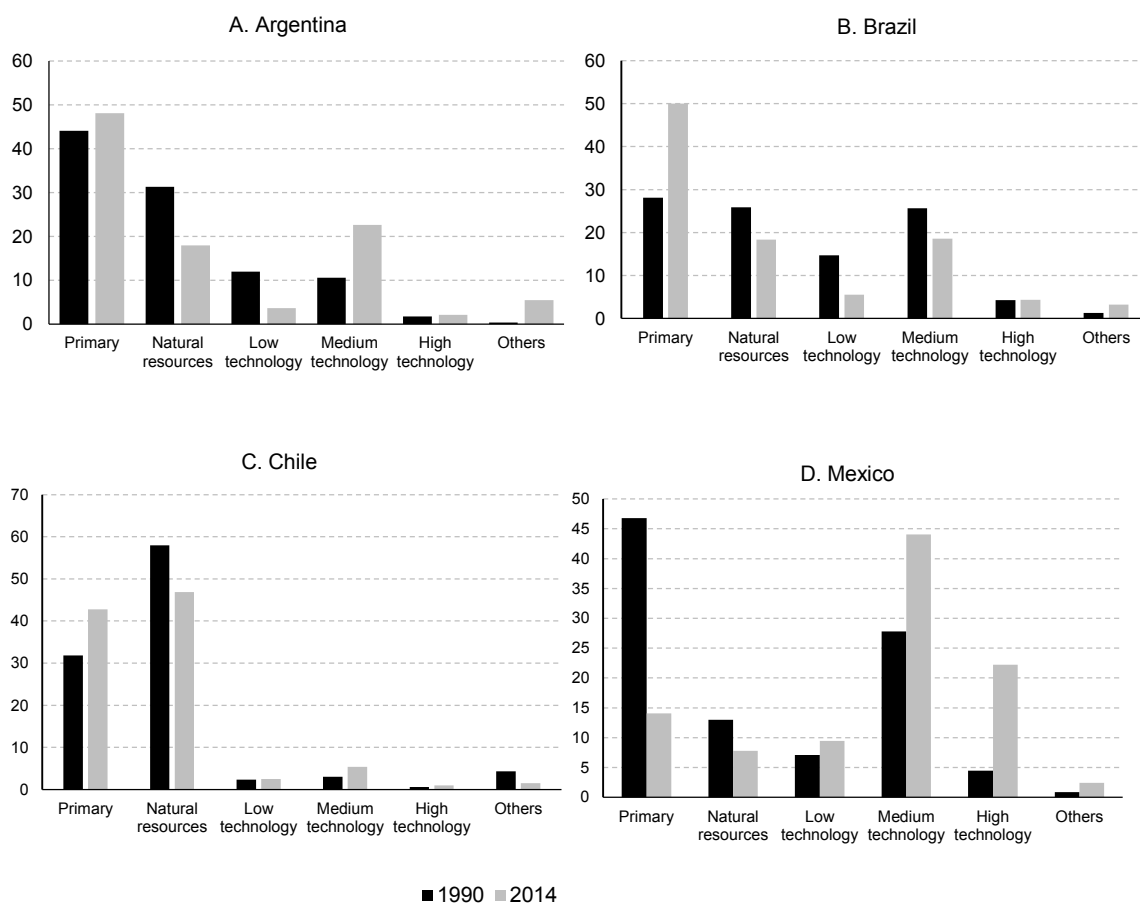
Therefore, the disaggregation of the manufacturing and services sectors reinforce the hypothesis of premature deindustrialization in Argentina, Brazil and Chile, while it casts doubts about the case of Mexico, even though its structure is highly based on maquilas, which reduces technological spillovers (as technological processes, including R&D are kept away from Mexico) and the provision of better jobs.

B. Trade specialization

As became evident, these four economies have been experiencing an increasing participation of services in their total value added and employment. Moreover, as already shown, this movement is accompanied by an increase in low productivity industries, i.e. natural-resources intensive sectors (except Mexico), and low productivity services, such as wholesale, retail and restaurants. However, one aspect has not been analyzed yet. A final concern with Latin America is its pattern of trade specialization. In order to have an overview of this process, we compare the share of exports, grouped by technology intensiveness, in 1990 and 2014.

Figure 6 shows the share of exports grouped by technology (according to Lall, 2000) for each country. From 1990 to 2014, the share of primary goods in Argentina increased from 44% to 48%. Interestingly, this process was followed by a fall in natural resources (from 31% to 18%) and a rise in medium-technology industries (from 10% to 22%). Accompanied by an increase in engineering-intensive sectors (as presented earlier), Argentina seems to be increasing its employment and productivity in more technology-intensive sectors in the last decade, which may indicate a reversal in the process of deindustrialization.

Figure 6
Trade specialization (1990-2014)



Source: Authors' calculation based on UN Comtrade.

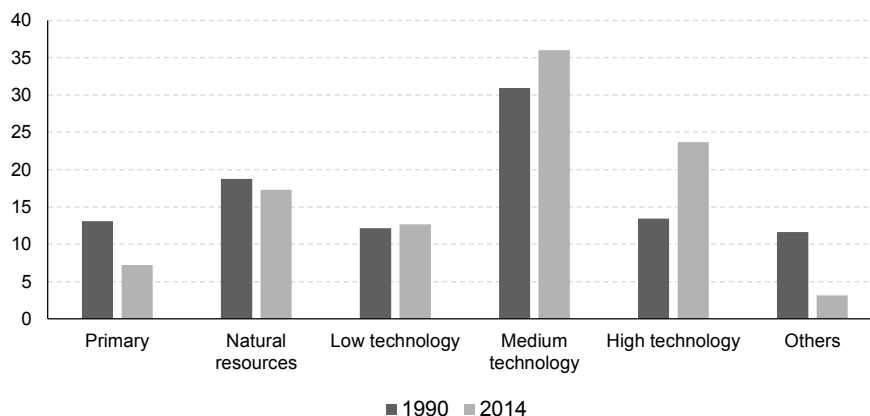
Brazil faces a more problematic situation. In 1990, the share of primary goods was 28% of total exports, while in 2014 it was about 50%. Moreover, the share of medium-technology and low-technology industries fell from 25% to 18% and from 14% to 5%, respectively. Chile, on the other hand, seems to be locked in a pattern of trade specialization since the 1990s. In 1990, the sum of primary and natural resources accounted for 89% of total exports in Chile, while in 2014 it accounted for exactly the same fraction. In fact, the only change in the Chilean economy was an increase in primary exports at the expense of natural resources.

Therefore, in terms of trade specialization, Brazil and Chile are the more problematic cases. In fact, these are the more evident cases of premature deindustrialization, as they lie below the curve in figure 4 (their share of manufacturing in total employment is lower than would be expected for their level of income per capita), present a decreasing share in manufacturing value-added and employment, a specialization in natural-resource intensive sectors and, finally, a specialization in primary and natural resources exports. Moreover, it is worth to mention that differently from Brazil, which faced a large development of its industrial structure during the 1970-80s, Chile's premature deindustrialization started at early stages of industrialization.

Mexico, differently, seems to have changed its trade specialization. In the 1990s, primary exports accounted for 46% of total exports, while in 2014 they only represented 14%. The inverse happens with medium and high-technology exports, which accounted together for 32% of total exports in 1990 and in 2014 represented 66%. Evidently, when analyzing the Mexican economy, one needs to consider the importance of *maquilas* in these results. In fact, a good way of observing it, is to make the same exercise

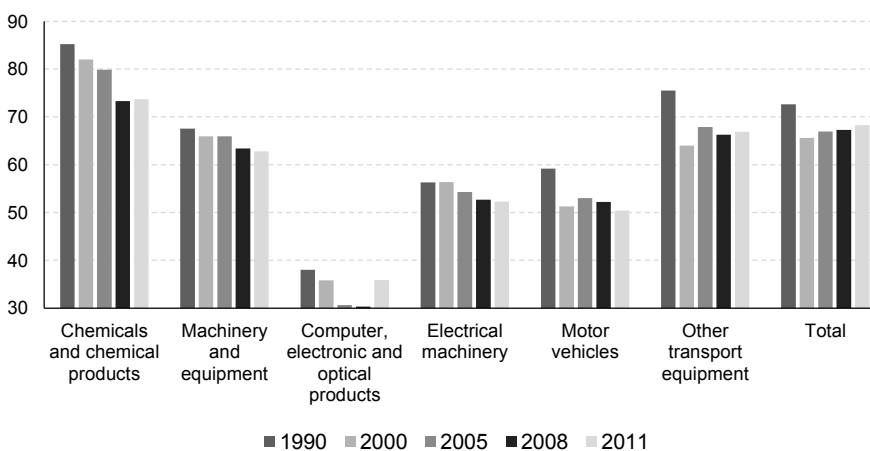
for Mexican imports. Figure 7 plots the share of Mexican imports, grouped by technology intensiveness, in 1990 and 2014. Note that the share of high-technology and medium-technology imports increased from 13% to 23% and 30% to 36%, respectively. Moreover, figure 8 shows the domestic value-added of exports for Mexico, in which the domestic share is lower than 50% for computer, electronic and optical products, and has been falling for chemical, machinery and equipment and electronic machinery. All in all, this indicates the significance of *maquilas* in the Mexican economy.

Figure 7
Mexico imports
(Percentage of total exports)



Source: Authors' calculation based on UN Comtrade.

Figure 8
Mexico domestic value added share of total exports
(Percentage)



Source: Authors' calculation based on Trade in Value Added (TiVA) database.

II. Decomposition of labor productivity

Allocative inefficiency (shift towards low productivity sectors) explains a significant part of the difference between Asia's growth and Latin America's stagnation. Most of these differences can be observed through labor productivity growth using the decomposition of labor productivity (see Rodrik and McMillan, 2011 and M.P. Timmer, G.J de Vries and K. de Vries, 2014). We use the updated and extended Groningen Growth and Development Centre (GGDC) 10-sector database, which includes annual time series of value added and persons employed for ten broad sectors⁸ from 1950 to 2011.⁹

The methodology used to measure the contribution of structural change in the growth of labor productivity is the same used in Rodrik and McMillan (2014). We decompose labor productivity growth between within (the growth within each sector, i.e. the growth in labor productivity as a result of increasing productivity in each sector through capital accumulation, technological change, etc.) and structural change (the growth as a result of a shift of labor share towards more productive sectors). Mathematically, this decomposition can be stated as follow:

$$\Delta Y_t = \sum_{i=n} \theta_{i,t-k} \Delta y_{i,t} + \sum_{i=n} y_{i,t} \Delta \theta_{i,t}$$

Where Y_t and $y_{i,t}$ refer to economy-wide and sectoral labor productivity levels, respectively, and $\theta_{i,t}$ is the share of employment in sector i . The Δ operator denotes the change in productivity or employment shares between $t-k$ and t . The first term in the right-hand side of the above equation is the weighted sum of productivity within each sector, here and after called the within component. The second term is exactly the change in productivity as a result of labor reallocation, here and after structural change. When the economy moves towards sectors with higher productivity, this last term will be positive.

⁸ The ten sectors used in the database are: agriculture; mining; manufacturing; utilities; construction; trade, restaurants and hotels; transport, storage and communication; finance, insurance, real estate and business services; government services; community, social and personal services.

⁹ For the Republic of Korea, we started in 1963, the first year available. For Chile the sector government services is unavailable.

We use a periodization similar to Rodrik and McMillan (2011) and M.P. Timmer, G.J de Vries and K. de Vries (2014) with small changes. We start our investigation in 1950, instead of 1960, and also included the period 2000-2011 to capture a recent change in the structure of Latin American countries as a result of the boom in the commodities prices. Our periodization is, thus, 1950-1975 (except for the Republic of Korea and China), 1975-1990, 1990-2011 and 2000-2011. Our calculations of labor productivity use gross value-added at constant 2005 national prices and persons engaged in each sector. Results are presented in table 1.

Table 1
Shift-share analysis

Period	Labor productivity Compound annual growth (Percentage)	Effect	
		Within (Percentage)	Structural (Percentage)
Argentina			
1950-1975	1.47	1.42	0.04
1975-1990	-1.76	-1.37	-0.38
1990-2011	2.12	2.68	-0.56
2000-2011	1.59	1.73	-0.14
Brazil			
1950-1975	4.25	2.06	2.19
1975-1990	0.48	-0.46	0.94
1990-2011	0.66	0.68	-0.02
2000-2011	0.84	0.52	0.31
Chile			
1950-1975	1.83	2.27	-0.44
1975-1990	0.82	0.15	0.66
1990-2011	2.67	2.79	-0.12
2000-2011	1.65	1.39	0.26
Mexico			
1950-1975	3.31	1.61	1.69
1975-1990	-0.29	-0.93	0.63
1990-2011	-0.22	-0.13	-0.08
2000-2011	-0.23	-0.18	-0.04
Republic of Korea			
1963-1975	3.65	2.59	1.05
1975-1990	4.43	2.27	2.15
1990-2010	3.21	3.82	-0.61
China			
1950-1975	2.42	1.89	0.52
1975-1990	3.86	2.13	1.73
1990-2010	9.70	7.77	1.92
2000-2010	10.0	7.62	2.37
Chile (without mining)			
1950-1975	1.84	1.60	0.23
1975-1990	0.81	0.24	0.56
1990-2011	2.54	2.69	-0.14
2000-2011	1.81	2.29	-0.47

Source: Author's calculation based on Timmer and de Vries (2015).

China and the Republic of Korea are impressive cases of structural change. The rapid transformation of their economies, with increasing participation of technological sectors, was remarkable during 1963-2010, with a combination of rapid within growth along with structural change. For most countries from Latin America, however, the road was different. In most episodes, after a rapid development from 1950 to 1975, these economies suffered a series of crises and decades of low productivity growth.

During the period of Import Substitution Industrialization (1950-1975), Brazil and Mexico experienced rapid productivity growth with structural change as the main factor. This period was characterized by a shift from agriculture towards manufacturing. In the following decades (with the exception of a brief continuity of structural change during the 1980s), Brazil and Mexico ceased their pattern of productivity growth led by structural change and turned to a productive structure typified by low productivity and, moreover, increasing share of services in total employment.

The case of Argentina is quite different, mainly because the country already had a larger share of manufacturing in total value added in the 1950s, so the initial industrialization is not completely represented in this data. However, aside of this distinction in the first period, Argentina exhibited a negative labor productivity growth in 1975-1990, a result of poor within growth and allocative inefficiency. During the last 20 years, even though there is high within growth, the structural change term appears as negative.

The case of Chile is similar to Brazil and Argentina in the last two decades, but can be misleading for the first period of our analysis. From 1950 to 1975 the structural change term appears as negative, even though this period is characterized by reduction in the importance of agriculture. In 1950, the share of agriculture in total employment was of 31%, while in 1975 this share was about 24%. To understand why the case of Chile is misleading, we need to carefully analyze the data. Labor productivity for mining was around four times larger than labor productivity of manufacturing in 1950. This gap between sectors distorts the results, as small changes in mining's share in total employment have a significant negative impact in terms of structural change, as measured by this methodology. The simplest way to revert this problem is to remove the mining sector from the database and recalculate the decomposition. The new results indicates that for the first period (1950-1975) the structural change term appears as positive, which indicates that the previous negative sign was a result of a decreasing share of the mining sector in total employment.

The same exercise was done for the other economies. While Argentina does not change the sign of the decomposition for the period 2000-2011, with small changes in magnitude, Brazil goes from a slightly positive structural change to a negative one, and Mexico significantly reduces the negative impact. What appeared to be a structural change during the 2000s, was only a consequence of the commodity prices boom. For the first period (1950-1975), productivity of the mining sector in Brazil was about the same of manufacturing sector, while in 2000-2011, the mining sector had its productivity five times larger than the manufacturing sector. This increasing gap explains why the sign reverts only for the period 2000-2011. For the period 1990-2011, Mexico changes the structural change sign, which indicates that the negative sign in the first exercise was a result of a fall in the share of the mining sector.

Conclusions

This paper presents an overview of deindustrialization for four Latin American economies, giving particular attention to the shares of manufacturing in total value-added, total employment and exports (as well as decompositions of sectors), and the decomposition of labor productivity. It is suggested that Argentina, Brazil and Chile face premature deindustrialization, as they increased their specialization in commodities, resource-based manufactures and low productivity services. Moreover, their share of manufacturing in total employment is lower than would be expected for their level of income per capita (given our Rowthorn-type regression estimation). This condition, along with the fact that manufacturing employment in total employment is falling in these countries, identify them as premature deindustrialisers. Meanwhile, Mexico urges a deeper analyze of its structure, as deindustrialization lost force in the last two decades. Argentina, on the other hand, appears to be reversing, in the last decade, its process of deindustrialization.

Furthermore, our paper discuss the relationship between premature deindustrialization and labor productivity through the decomposition of the latter. It is shown that these economies presents low productivity growth, with structural change being a negative component of this process. All in all, allocative inefficiency explains a significant part of Latin America's stagnation.

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