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Article

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An investigation into shapes and determinants of deindustrialization processes: Theory and evidence for developed and developing countries (1970–2017)

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ABSTRACT

This paper theoretically and empirically investigates deindustrialization in a group of selected countries, from 1970 to 2017, viewing it as a process of varied and complex causes, sensitive to the degree of economic development. Supported by the theoretical framework on the centrality of the manufacturing industry for economic growth and the contextualization of recent trends in global industry, we seek to understand empirically the main determinants of deindustrialization through an econometric model of panel data analysis. The main objective, which is also the main contribution of this research, is to empirically investigate the determinants of deindustrialization considering the degree of development of the countries and with the understanding that the causes of this process can differ substantially. Our main results, in general, were aligned with the theoretical and empirical literature on the topic, while corroborating the hypothesis that certain variables are dependent on the level of economic development. In less developed countries, the exchange rate (depreciation) is correlated positively with the value added of the manufacturing sector, as is trade openness but in a negative way. In advanced countries, on the other hand, the relocation of physical production and the degree of financialization are highlighted as factors that negatively affect the manufacturing value added, while trade openness is positive. In view of these results, a more critical analysis on the causes and costs of deindustrialization is considered important, especially in developing countries.

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1. Introduction

Unlike the neoclassical-inspired models, post-Keynesian literature (Kaldor, 1966; Thirlwall, 1979) and other heterodox approaches, such as Latin American structuralists (Prebisch, 1949) and neo-Schumpeterians (Freeman and Soete, 1997; Nelson and Winter, 1982), have long emphasized the role of structural change and technological advancement in economic

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growth. Despite the centrality of industrial activity, recognized in the aforementioned literature, a declining trend has been observed both in the share of value added of the manufacturing sector in total value added and of the share of its employment in total employment.

Between 1970 and 2017, the relative share of the manufacturing sector in developed countries declined, in constant prices, from 17.2% to 15%, while employment share fell from 28.5% to 12.9%. In developing countries, although the relative share of value added fell overall from 14.7% to 12.1% in the period 1970–2017, their individual trajectories varied: in Asian economies the relative share increased considerably, rising on average from 11.9% to 14.5%, but in most other developing countries it declined, with a notable drop from 18.6% to 13.9% in Latin America. The countries' employment trajectories, however, were more similar: although, on average, employment share remained between 12% and 13% in the period 1970–2017, it rose in Asia from 11.9% to 14.5% and decreased from 15.5% to 11.9% in Latin America, for example.

In many countries, particularly in the advanced ones, a reduction in the share of the manufacturing sector in the economy might be a natural consequence of the development process itself. However, more recently, it has been noted that this has become associated with the advance of financial and productive globalization. In fact, the phenomenon has triggered a real revolution in the financial, productive and business structure, leading to a reorganization in practices at the level of firms: an expansion and migration of the manufacturing industry from developed economies to developing countries, or to whole regions with notoriously lower wages, devalued exchange rates and high labor productivity – the so-called relocation phenomenon. This has led to a change in the global and regional geography of production and international trade, significantly affecting the productive structure in advanced countries like the United States, Europe and even Japan. In developing economies, though, the trajectory has evidently been different (Pisano and Shi, 2009).

This process of deindustrialization can also be explained by other means. For instances, macroeconomic policies, by interfering in the trajectory of key prices such as interest rates and the exchange rate, can determine the performance of the industrial sector, especially in developing countries where the degree and form of economic openness may be among the drivers of structural change. Such policies can generate another form of deindustrialization – a Dutch disease kind of phenomenon, whereby an increase in exports of basic products (such as agricultural commodities or extractive minerals) replace exports of industrial products. Deindustrialization, then, results from inadequate external integration policies that stimulate the financialization of the economy to the detriment of the real sector (Bresser-Pereira et al., 2014; Palma, 2005).

In light of the above, this paper aims to analyze theoretically and empirically the deindustrialization underway in recent decades, particularly with regard to the share of the manufacturing sector in total output. We seek to identify the basic determinants in both developed and developing economies. With a view to test the main arguments in the literature and capture the determinants of the value added share of the manufacturing sector, the empirical part of our research estimates a panel data model with 60 developed and developing countries, between 1970 and 2017. The main contribution of this research, therefore, consists in empirically investigating the determinants of deindustrialization, while taking into consideration the degree of development of the countries and, at the same time, understanding that the causes of the process may be different in each of them.

Our research hypothesis is that, in the context of market liberalization, greater integration and financialization has impacted economies differently, due to their distinct abilities to deal with macroeconomic instability and to implement domestic policies (among them, relatively independent industrial policies). This has mitigated the tendency towards the stagnation of demand, which reinforces the worldwide trend of deindustrialization, as well as the capacity to generate trajectories of endogenization of technological progress and active external integration.

Based on that, the remainder of this paper is divided into four sections. Section 2 reviews the key role of the manufacturing industry in economic growth. Section 3 briefly examines the recent worldwide trends in the decline of the relative share of the manufacturing industry, both in terms of value added and industrial employment, and discusses possible explanatory elements. Section 4 investigates empirically the determinants of the share of value added of the manufacturing sector in total value added in several developed and developing countries, extending the basic model to analyze the effects of trade liberalization in different contexts. Section 5 summarizes the main results that, in general, are aligned with the theoretical and empirical literature on the subject and corroborate the hypothesis that certain variables are dependent on the level of economic development. In fact, in the least developed countries, the exchange rate (depreciation) has a positive relationship with the value added of the manufacturing sector, while trade openness has a negative one. In advanced countries, the relocation of physical production and the degree of financialization are notable factors that negatively affect manufacturing value added, whereas trade openness has a positive influence. Given these results, a more in-depth analysis of the causes and costs of deindustrialization is of fundamental importance, especially in developing countries.

2. Manufacturing at the core of economic growth and development and the phenomenon of deindustrialization

2.1. The centrality of manufacturing industry in economic growth strategies

Recently, there has been renewed interest in the role of the manufacturing sector in the promotion of economic growth and development. Some factors observed in the world economy have contributed to this.

First, many developing economies have failed in their attempt to deepen and diversify their industrial capacity, and more than that, many of them have seen the share of the manufacturing sector in GDP shrink prematurely. Second, there is the perception that the export-led growth strategies of developing countries face more constraints now than in the

past, particularly because of the slow pace of growth in global demand. Third, many developing countries remain highly vulnerable to external shocks, both commercially and financially. Fourth, the extraordinary export revenues of primary products, brought about by the commodity price boom in the 2000s, have come to an end. Finally, the deindustrialization of advanced economies, due to their stagnation in the post-2007 global crisis, has been a growing concern (UNCTAD, 2016).

In the literature, there are strong theoretical and empirical arguments that support industrialization as the main engine of economic growth and development. Szirmai (2012)¹ offers a synthesis of the main arguments:

- i There is an empirical correlation between the degree of industrialization and the per capita income in developing countries.
- ii Productivity in the manufacturing sector is greater than in the agricultural sector, such that the transfer of resources from the second to the first provides a structural change bonus. This means the manufacturing sector presents higher rates of productivity growth than other sectors.
- iii The transfer of resources from the manufacturing sector to the services sector provides a structural change burden, under the terms described by Baumol's Law.² As the relative share of services rises, per capita GDP growth tends to slow.
- iv Compared to agriculture, the manufacturing sector offers special opportunities for capital accumulation. This can be easily realized in the more spatially concentrated environment of the processing industry than in the more spatially dispersed agricultural sector, since the former is more capital intensive than the latter, especially in developing countries. Thus, an increase in the relative share of the manufacturing sector contributes to aggregate growth.
- v The manufacturing sector offers special opportunities for economies of scale, which are less available in agriculture or services.
- vi The manufacturing sector offers special opportunities for technological progress, since technological advances originating in the industry are diffused to other sectors of the economy.
- vii Linkage and spillover effects are stronger in the manufacturing sector than in the agricultural or extractive industries.
- viii As per capita income grows, the share of spending on agriculture decreases relative to the total, and the relative share of spending on manufactured goods increases (Engel's Law). Thus, countries that specialize in the production of primary goods do not benefit from the expansion of global markets for manufactured goods.

Within this line of reasoning, the dynamics of economic growth driven by industrialization can be understood as a process of "cumulative causation" (Myrdal, 1957; Kaldor, 1957), in which demand and supply factors interact. With the expansion of the manufacturing sector, there is an increasing absorption of goods (e.g., food, raw materials and extractive industry materials) and services (e.g., banking and financial services, insurance, trade, etc.) produced outside the industrial sector, generating jobs, income, and demand. The manufacturing sector also accelerates productivity increases, boosting income and demand growth. Due to linkage and spillover effects, the continuous upgrading of productive capacity tends to favor (i) productivity gains in other sectors, (ii) the adoption of more advanced technologies, (iii) the production of more sophisticated products, and (iv) integration in global value chains at increasing levels of complexity (Cantore et al., 2014; UNCTAD, 2016).

For those reasons, an increasing number of authors have emphasized the importance of industrialization as a key element for a strategy of economic growth (Palma, 2010; Rodrik, 2008; Timmer et al., 2015). This follows the structuralist and post-Keynesian traditions, which since the mid-twentieth century have emphasized the centrality of the manufacturing industry. Especially for developing countries, implementing macroeconomic policies for this purpose is an essential condition for embarking on a sustainable path of catching up, whereby both the levels of income per capita and quality of life are relatively close to that of the developed countries.

The centrality of the manufacturing industry in economic growth raises the debate on deindustrialization, both of its causes and consequences. Thus, the following section presents a brief conceptualization of this topic and discusses its sources in accordance with the literature.

2.2. The phenomenon of deindustrialization: important concepts and fundamental causes

Starting with the conceptualization of the topic, Rowthorn and Ramaswamy (1999) and Rowthorn and Coutts (2013) define deindustrialization as a relative decline in industrial employment, the causes of which may be linked to internal and external factors. Internally, it can be caused by higher than average labor productivity growth rates in the manufacturing sector when compared to other sectors of the economy, as well as changes in domestic spending patterns, which mean greater demand for services to the detriment of the manufacturing sector. Externally, the factors are linked to the international division of labor, according to which a country specialized in the export of manufactured goods will normally have a larger production sector than a country specialized in the export of services.

¹ The literature reviewed is extensive, ranging from the founding works of Lewis (1954); Hirschman (1958); Kaldor (1966); Cornwall (1977), and others, to the more recent works of Fagerberg and Verspagen (2002); Rodrik and Subramanian (2009), among others.

² Baumol's Law derives from the observation that in the various branches of the services sector the possibilities for productivity growth are limited due to the labor-intensive nature of the sector. Especially for developing countries that have not yet reached high levels of productivity, an increase in the relative share of services in the economy would mean a slowdown in productivity growth and, thus, in GDP growth per capita (Szirmai, 2012).

Palma (2005) notes that one of the most striking post-war stylized facts was the rapid decline in industrial employment in most industrialized countries and in many developing ones. Although in the long run the employment structure has changed substantially, the relative changes in employment, in the scale and speed that occurred during this period, are an unprecedented phenomenon. This most recent phase of changes consists of declining employment in manufacturing, in relative and absolute terms, and of the service sector becoming the main source of labor absorption. This phase, explains Palma (2005), is commonly known as deindustrialization.

In the already industrialized countries, it is worth noting that there is a post-industrialization process underway, in which a reduction in employment in manufacturing is directed to other activities, mainly to the service sector. This result is considered normal given their stage of economic development. In this regard, it is important to clarify that the course of the economic development process would “naturally” lead all economies to deindustrialize after a certain level of per capita income. The reason for this is that the income elasticity of demand for services tends to grow with development, surpassing the income elasticity of demand for manufactured goods. Thus, the continuity of economic development will lead to an increase in the share of services in GDP and, after a certain level of per capita income, a drop in the share of industry in GDP. It is, therefore, a natural phenomenon that differs from the deindustrialization that affects developing countries, which have not yet reached a sufficiently high level of income to justify deindustrialization, being considered in this case as a premature phenomenon with consequences for their development process.

Supported by theoretical and empirical foundations, Tregenna (2009) presents a critique of the concept of deindustrialization as being understood only as a decline in manufacturing employment in total employment. According to the author, the theoretical limitation of this concept is based on the fact that the Kaldorian channels, through which manufacturing stimulates growth, occur via production, not employment. Kaldor argued that since labor productivity was higher in manufacturing than in the rest of the economy, it is normal for growth in industry to be associated with a drop in the relative share of manufacturing employment in total employment.

Furthermore, understanding deindustrialization as a decline in manufacturing employment in total employment also neglects trends in the share of manufacturing production in total production. Such an understanding can lead to misinterpretations, as, for example, in the event of a fall in the share of manufacturing employment in parallel with an increase in manufacturing production and the respective increase in the share of manufacturing in GDP. The said fall in employment would not necessarily impair the manufacturing industry's ability to drive the economy's long-term growth.

In Tregenna's (2009) analysis, the factor that leads most studies on deindustrialization to consider employment, instead of production, is the fact that manufacturing employment in developed economies fell sharply in the 1980s, compared to manufacturing production. Therefore, instead of defining deindustrialization in terms of a single dimension, the author proposes that it be conceptualized as the situation in which there is a sustained decline, both in the share of manufacturing in total employment and in the production of manufacturing in the total production of the economy.

This is because manufacturing growth in terms of real value added, linked to productivity growth in the manufacturing industry, is highly unusual, since in most economies the reduction of the share of manufacturing in total employment occurs at the same time as a reduction in the share of manufacturing in the total production of the economy. According to the author, this finding emphasizes the importance of labor productivity growth in manufacturing, in order to resume growth in the sector.

Regarding the explanatory factors of the process, the conventional interpretation for deindustrialization states that this is a natural outcome of the development process, due to the combination of changes in the composition of demand and the greater productivity gains in the manufacturing sector compared to the others. Assuming that income elasticity of demand for manufactures is greater than unity in the early stages of development, and in the more advanced stages, it becomes less than unity, then in the course of the development process this change in the composition of demand would favor the services sector to the detriment of the manufacturing. In isolation, this factor would be insufficient to explain deindustrialization as it disregards the influences of productivity and the changes in relative prices in the structure of demand, and thus in industrial output and employment. Assuming the same conditions for income elasticity of demand, given that labor productivity grows more rapidly in the manufacturing sector, then in the course of economic development there would be a reduction in the relative prices of manufactured goods, stimulating demand for them in the early stages, while in the more advanced stages there would be a substitution effect towards other items, such as services (Rowthorn and Ramaswamy, 1999).

Therefore, the net effect on industrial output and employment depends crucially on the behavior of demand in response to changes in relative prices. Depending on the response of demand to the falling prices of manufactures, the change in production and employment may be positive or negative. In the advanced economies, there is strong evidence that the fall in relative prices for manufactures due to productivity gains is not sufficiently compensated by an increase in demand for these goods ($\sigma < 1$), so that the relative quantities of the sector (value added and employment) begin to decline, with the decline in employment relatively faster (Rowthorn and Ramaswamy, 1999; Lawrence and Edwards, 2013; Rodrik, 2016).

In addition to the conventional interpretation, other frequently analyzed aspects refer to the phenomenon of globalization, particularly in regards to the effect of international trade or a new international division of labor, where depending on the established pattern of trade there could be a specialization in production between manufactured goods and other goods and services, or even a specialization within the manufacturing sector between the production of skilled and unskilled labor-intensive goods. For developed countries, although this is not the main means affecting deindustrialization, evidence suggests a negative impact on demand for labor, particularly less skilled or less specialized labor (Wood, 1995; Rowthorn and Ramaswamy, 1999).

In developing countries that are deindustrializing, however, it is unlikely that the classic argument of the combination of changes in the composition of demand and labor productivity will apply, since, given the elasticity of demand at this stage of economic development, the difference in productivity in the manufacturing sector would further stimulate demand for industrial goods, feeding the sector's growth. An alternative explanation lies precisely in international trade.

According to [Rodrik \(2016\)](#), a plausible interpretation is that when they opened up to international trade, developing countries were hit by a double blow. First, those without solid comparative advantage in the manufacturing sector became net importers of these goods, reversing the long process of import substitution. Second, by being exposed to the relative price trends in advanced economies, developing countries would have "imported" the deindustrialization of those countries. This is because the fall in relative prices of manufactures in advanced economies squeezed the price globally, even in those countries that had not yet experienced high technological progress. In fact, considering the regional groups, the author finds evidence that the regions with strong comparative advantage in manufactures managed to avoid the decline in the relative share of output and employment, and even when this occurred, it was less severe. Consequently, the main beneficiaries of globalization would have been the Asian countries, while the adverse effects would have mainly been felt in Latin America, particularly in terms of employment.

The recent process of relocation of industrial plants around the globe is also receiving attention as a factor that induces deindustrialization, especially in developed economies. According to [Palley \(2015\)](#), a critical change brought about by globalization is the high international mobility of the factors of production (capital and technology), resulting from improvements in the transport sector, communications, and in the ability to manage globally diversified production networks. This has created a new global production model configured around the principle of global cost arbitrage, in search of, for example, favorable exchange rates, lower taxes, subsidies, less regulation, and abundant and cheap labor.

[Palma \(2005, 2008\)](#), [Palley \(2015\)](#) and [UNCTAD \(2016\)](#), also note that since the 1980s deindustrialization in developed economies – particularly in some European ones – has not been very harmonious or spontaneous, since it has been following the path of political, financial and institutional transformations that have generated macroeconomic instability and a regressive distribution of income. This could contribute to the slowdown in aggregate demand and limit the capacity of the services sector to productively absorb the labor freed from the industrial sector, which in turn leads to high and persistent levels of unemployment and underemployment, to underconsumption and to low levels of productive investment in these economies. These elements could also apply to developing economies experiencing premature deindustrialization.

In other words, the intensification of deindustrialization could be the result of inadequate policies and a negative structural change (financialization). Austere macroeconomic policies, particularly high interest rates and overvalued exchange rates, would have more pronounced negative effects on industry and the "real economy" than on the financial sector, contributing to the financialization and, concomitantly, to deindustrialization. Moreover, liberalization itself and increasing deregulation help to reduce autonomy in domestic economic policy, whereby key prices, such as interest rates and exchange rates, and national policy objectives (e.g., industrial policy) are often destabilized and hampered by the interests of foreign organizations and by dominant players in the financial market, both locally and internationally.

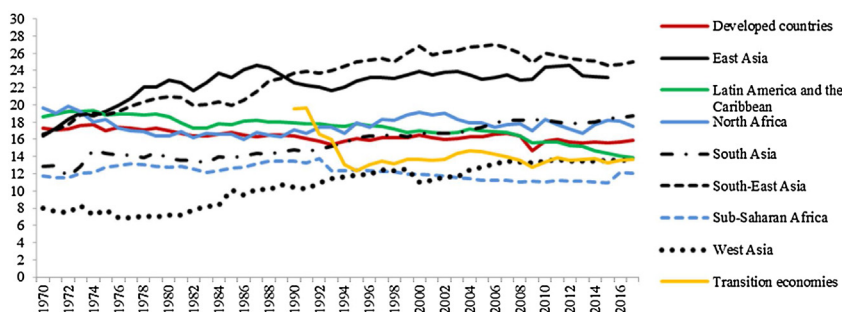
In view of this, the recent industrializing success of Asian economies is attributed in large part to the fact that their governments have subordinated the financial sector to the needs of industrial development through strong regulation and the mobilization of financial sector resources. In contrast to this is Latin America, where since the 1980s the lack of consensus or strategy for industrial development after the exhaustion of the import substitution process and the shift toward a liberalizing agenda and market friendly reforms could help to explain the stagnation of productivity in these economies.³

Finally, an additional source of deindustrialization defined by [Palma \(2005, 2008\)](#) is the Dutch disease. This phenomenon is associated with a change in the "natural" trajectory of industrialization or with an excessive degree of deindustrialization relative to what would be expected given the level of per capita income, the productivity of the manufacturing sector, and the elasticities of demand, etc. This "extra" degree of deindustrialization could result from three different situations: (i) the discovery of abundant natural resources (e.g., the Netherlands), (ii) a significant increase in the export of services, particularly in finance and tourism (e.g., Hong Kong and Greece, respectively), and (iii) changes in economic policy, especially financial and trade liberalization in middle-income countries (e.g., Brazil and South Africa).

There are, therefore, several sources of deindustrialization, and there are probably different combinations of these sources that explain this process in each country in a given period of time better than any of them considered in isolation. In this paper, the intended contribution to the literature is to offer a more detailed analysis on the aspects associated with globalization, such as trade openness and greater financial integration. In light of this, it is understood that the prioritization of financial accumulation to the detriment of productive investments could have contributed to the establishment of high global macroeconomic instability and stagnation of aggregate demand, in which the worldwide trend of deindustrialization emerges as a reflex.

With this brief discussion over on the importance of the manufacturing industry and on deindustrialization and its likely sources, the following section provides an overview of the evolution of industry in the world economy in recent decades.

³ For a detailed discussion of these arguments, see, for example, [Palma \(2010\)](#) and [Lechevalier, Debanes and Shin \(2016\)](#).



Graph 1. Share of the manufacturing sector in total regional value added, 1970–2017. (% in constant 2005 US\$).

Note: Regional values correspond to unweighted averages. The manufacturing sector corresponds to sector D of ISIC Rev. 3. The samples of country groups are as follows: Developed countries: Denmark, France, Germany, Italy, Japan, the Netherlands, Spain, Sweden, the United Kingdom and the United States of America. North Africa: Egypt and Morocco. Sub-Saharan Africa: Botswana, Ethiopia, Ghana, Kenya, Malawi, Mauritius, Nigeria, Senegal, South Africa, the United Republic of Tanzania and Zambia. Latin America and the Caribbean: Argentina, the Bolivarian Republic of Venezuela, Brazil, Chile, Colombia, Costa Rica, Mexico, Peru and the Plurinational State of Bolivia. East Asia: China, Hong Kong, the Republic of Korea and Taiwan Province of China. South-East Asia: Indonesia, Malaysia, the Philippines, Singapore and Thailand. South Asia: Bangladesh, India, Pakistan and Sri Lanka. West Asia: Bahrain, Jordan, Saudi Arabia, the Syrian Arab Republic and Turkey. Transition economies: Albania, Armenia, Azerbaijan, Belarus, Georgia, Kazakhstan, Kyrgyzstan, the former Yugoslav Republic of Macedonia, Republic of Moldova, the Russian Federation and Ukraine.

Source: Author's own elaboration, based on UNSD, *National Accounts Main Aggregates database*, and Groningen Growth and Development Center, *GGDC-10 Sector Database*.

3. Recent trends of industry in the global economy

Over the past four and a half decades, significant changes have occurred in the sectors of economic activity around the world. According to the regional groupings, developing and transition economies⁴ expanded their share of global output between 1970 and 2017, through growth in both industrial value added⁵ and services, from 7.5% to 13.1% and from 7.9% to 18.7%, respectively, while the share of the primary sector remained virtually constant, at around 2.5%. Furthermore, in relation to global value added, the share of industry of developed countries declined from 27.9% to 15% between 1970 and 2017, with services falling marginally from 54.6% to 47.6%.

The manufacturing sector of developed economies, in particular, experienced a fall from 14.5% to 9.7% in the same period. The share of the industrial sector in the group's value added also declined, falling from 33.1% to 23.6%, and although services increased their share from 64.7% to 75.1%, globally they have reduced slightly. In developing and transition economies, the average share of the services sector in the group's aggregate value added also increased, from 44.2% to 54.5%. On the other hand, the average share of the industrial sector dropped slightly from 42.1% to 38.1%, which – in view of the increasing share of the sector in terms of global value added – implies quite distinct performances regionally or even individually.

Taken as a group, the manufacturing share in developing and transition economies total value added reduced slightly from 14.9% to 12.1% in the period 1970–2017, while in developed economies the sector's share fell from 17.2% to 15.4%. **Graph 1** shows the different trajectories of the regional groups. From 1970 to 2017, with the exception of the Asian regions, there was a general reduction in the share of the manufacturing sector in total value added. A reduction in the “industrial gap” of other developing and transition economies vis-à-vis advanced economies is also observed.

Fig. 1 illustrates the gradual loss of representativeness in the total value added of the manufacturing sector since the 1980s in some of Europe's developed economies and in practically the whole of Latin America, while the economies of East and Southeast Asia significantly increased their relative shares – principally China and South Korea, but also Thailand, Malaysia and Indonesia.

Regarding employment in the manufacturing sector, the picture is slightly different. In the group of developed countries, the other face of deindustrialization is much more pronounced. According to **Table 1**, between 1970 and 2017 the average share of employment in manufacturing activities relative to total employment fell from 28.5% to 12.9%. In Latin America, employment in the manufacturing sector also declined from the 1980s, when it accounted for 15.4% of the total, reaching 11.9% in 2017.

The decline in industrial employment was also significant since the 1980s in East Asia, the transition economies and South Africa, while in some other countries in Africa and Asia, like India and West Asia, there was relative stability or a slight increase, in general.

In contrast, there was strong growth in employment in manufacturing in several Asian countries, notably China, Indonesia, Thailand, Pakistan, Sri Lanka and Turkey, although currently more mature economies such as Hong Kong, South Korea and Singapore have negatively affected the behavior of some of these regional averages, especially since the 1990s.

⁴ For manufacturing value added, specifically, country grouping in UNCTADstat does not include China.

⁵ This includes both processing and extractive industries.

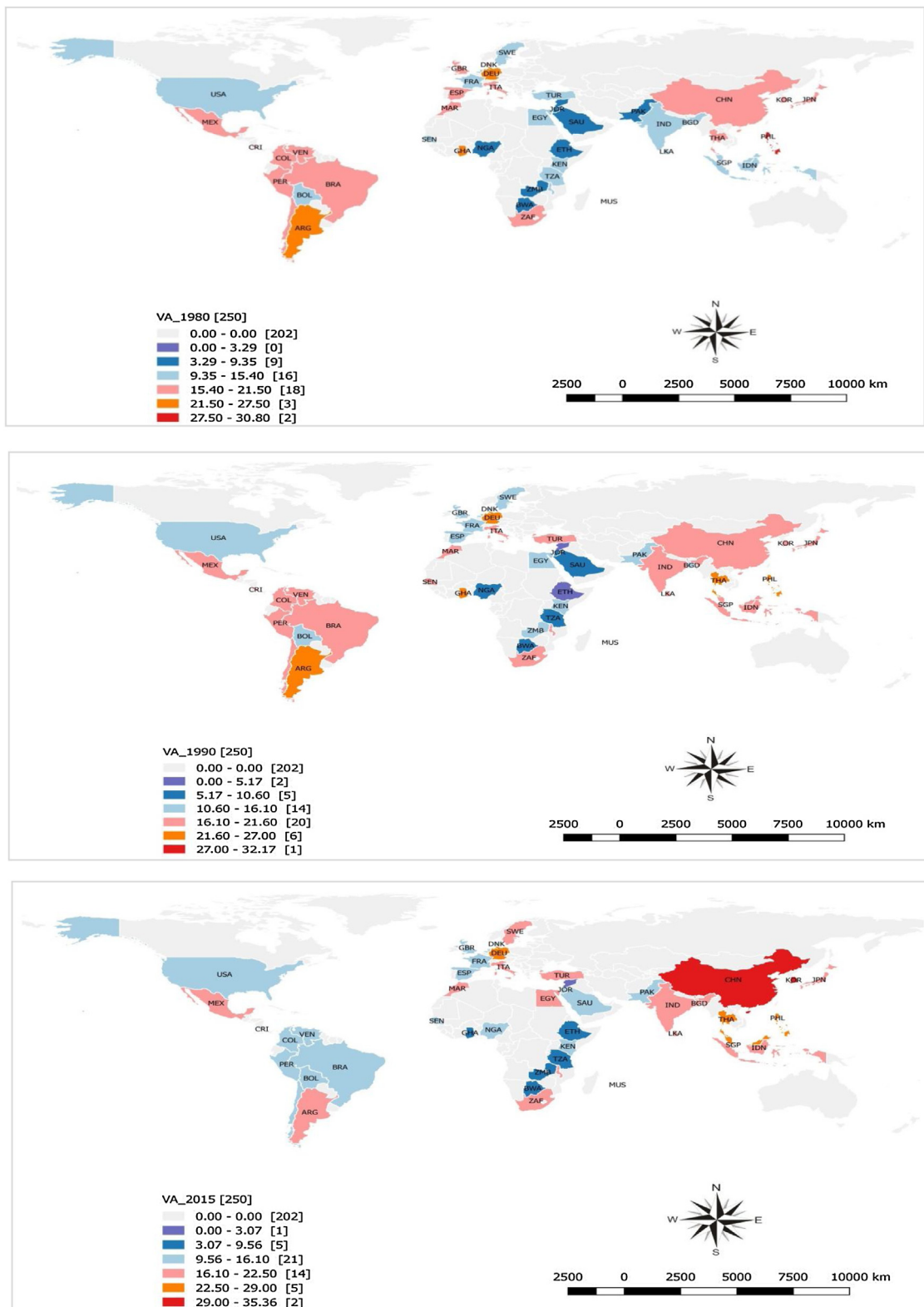


Fig. 1. Spatial distribution of the manufacturing sector in total value added, 1980, 1990 and 2015.

Source: Author's own elaboration, based on UNSD, *National Accounts Main Aggregates database*.

Table 1

Share of the manufacturing sector in total employment, 1970–2017 (in %).

| | 1970 | 1975 | 1980 | 1985 | 1990 | 1995 | 2000 | 2005 | 2010 | 2015 | 2017 |
|--|------|------|------|------|------|------|------|------|------|------|------|
| Developed countries | 28.5 | 27.0 | 25.3 | 23.2 | 22.7 | 20.0 | 18.7 | 16.4 | 13.6 | 13.1 | 12.9 |
| Germany | 39.5 | 35.7 | 34.0 | 32.3 | 31.6 | 25.0 | 23.8 | 22.1 | 20.0 | 19.3 | 19.0 |
| Japan | 27.0 | 25.8 | 24.7 | 25.0 | 24.1 | 22.6 | 20.5 | 18.0 | 16.8 | 16.2 | 16.1 |
| United Kingdom | 34.7 | 30.6 | 27.7 | 22.6 | 28.7 | 18.9 | 16.9 | 13.2 | 9.8 | 9.6 | 9.1 |
| United States | 22.2 | 19.8 | 19.2 | 18.1 | 16.8 | 15.5 | 15.2 | 12.4 | 11.0 | 11.0 | 10.7 |
| Latin America and the Caribbean | 15.5 | 15.5 | 15.7 | 14.9 | 15.8 | 14.9 | 13.6 | 13.1 | 12.6 | 12.2 | 11.9 |
| Argentina | 23.5 | 21.6 | 21.4 | 24.7 | 24.3 | 20.0 | 14.0 | 14.3 | 13.6 | 13.1 | 12.3 |
| Brazil | 13.3 | 13.3 | 15.0 | 14.7 | 15.2 | 14.9 | 13.9 | 14.2 | 12.7 | 11.8 | 11.5 |
| Chile | 20.1 | 20.7 | 17.3 | 13.8 | 16.1 | 16.3 | 14.0 | 13.1 | 11.3 | 11.1 | 10.8 |
| Mexico | 18.0 | 18.8 | 19.9 | 19.2 | 19.2 | 15.6 | 19.6 | 16.8 | 15.4 | 16.0 | 16.6 |
| East Asia | 13.7 | 25.0 | 27.3 | 26.6 | 25.1 | 20.9 | 18.2 | 17.3 | 16.8 | 15.8 | – |
| China | 7.8 | 10.3 | 13.8 | 14.8 | 14.9 | 15.4 | 14.5 | 16.4 | 19.2 | – | – |
| Hong Kong | – | 44.8 | 42.1 | 36.1 | 27.7 | 18.4 | 10.4 | 6.7 | 3.8 | 3.0 | – |
| Republic of Korea | 13.2 | 18.6 | 21.6 | 23.4 | 27.2 | 23.6 | 20.3 | 18.5 | 17.0 | 17.4 | 16.9 |
| Southeast Asia | 11.7 | 12.8 | 14.1 | 13.2 | 15.2 | 16.7 | 16.5 | 14.8 | 14.0 | 13.3 | 14.1 |
| Indonesia | 7.9 | 6.7 | 9.0 | 9.3 | 10.1 | 12.6 | 13.0 | 12.7 | 12.5 | 13.7 | 14.1 |
| Malaysia | – | 9.9 | 13.7 | 13.4 | 17.7 | 23.3 | 24.4 | 20.8 | 17.7 | 16.5 | 16.9 |
| Thailand | 5.4 | 10.3 | 7.9 | 8.5 | 10.2 | 13.4 | 14.5 | 14.8 | 14.1 | 17.0 | 16.7 |
| South Asia | 9.4 | 11.3 | 11.8 | 11.3 | 12.6 | 12.5 | 10.1 | 13.7 | 13.6 | 16.8 | 16.6 |
| India | 9.4 | 9.0 | 9.1 | 9.6 | 10.5 | 10.7 | 11.4 | 11.6 | 11.6 | – | – |
| Pakistan | – | 13.6 | 14.5 | 13.7 | 12.7 | 10.4 | 11.5 | 13.7 | 13.5 | 15.5 | 16.2 |
| Sri Lanka | – | – | 12.0 | 12.6 | 14.6 | 16.3 | – | 18.4 | 17.1 | 18.0 | 19.3 |
| West Asia | 12.6 | 11.8 | 12.2 | 14.8 | 14.5 | 15.5 | 13.5 | 11.2 | 13.4 | 12.9 | 12.7 |
| Turkey | – | – | – | 14.6 | 14.8 | 14.9 | 15.8 | – | 18.7 | 18.7 | 17.6 |
| North Africa | 13.0 | 13.6 | 14.6 | 14.4 | 14.2 | 14.5 | 13.1 | 12.6 | 12.7 | 11.1 | 12.0 |
| Egypt | 15.1 | 14.4 | 14.7 | 13.3 | 13.0 | 14.2 | 11.9 | 11.5 | 12.1 | 11.2 | 12.0 |
| Sub-Saharan Africa | 6.4 | 7.9 | 8.4 | 8.5 | 9.6 | 11.0 | 11.2 | 9.2 | 9.3 | 13.3 | 12.8 |
| South Africa | 13.3 | 14.2 | 16.5 | 16.1 | 14.7 | 13.2 | 14.9 | 15.6 | 13.3 | 11.2 | 11.0 |
| Transition economies | – | – | 19.8 | 18.0 | 19.4 | 13.0 | 8.9 | 11.3 | 9.3 | 11.2 | 11.4 |
| Russian Federation | – | – | – | – | 26.5 | 21.9 | 19.5 | 18.2 | 15.2 | 14.3 | 14.2 |

Source: Author's own elaboration, based on International Labour Organization, *ILOSTAT* and Groningen Growth and Development Centre, *GGDC-10 Sector Database*.

Note: Regional values correspond to unweighted averages. The manufacturing sector corresponds to sector D of ISIC Rev.3 or C in Rev.4. The samples of country groups are as follows: Developed countries: Denmark, France, Germany, Italy, Japan, the Netherlands, Spain, Sweden, the United Kingdom and the United States of America. North Africa: Egypt and Morocco. Sub-Saharan Africa: Botswana, Ethiopia, Ghana, Kenya, Malawi, Mauritius, Nigeria, Senegal, South Africa, the United Republic of Tanzania and Zambia. Latin America and the Caribbean: Argentina, the Bolivarian Republic of Venezuela, Brazil, Chile, Colombia, Costa Rica, Mexico, Peru and the Plurinational State of Bolivia. East Asia: China, Hong Kong, the Republic of Korea and Taiwan Province of China. South-East Asia: Indonesia, Malaysia, the Philippines, Singapore and Thailand. Transition economies: Albania, Armenia, Azerbaijan, Belarus, Georgia, Kazakhstan, Kyrgyzstan, the former Yugoslav Republic of Macedonia, Republic of Moldova, the Russian Federation and Ukraine.

The trends expressed in Fig. 1 and Table 1 can be better understood when we analyze the behavior of labor productivity over the period. Considering labor productivity as the ratio of total output to the number of persons engaged multiplied by the average annual hours worked by persons engaged, data from PWT 9.1 shows that between 1970 and 2017 the average labor productivity in developed economies grew about 1.6 times more than in Latin America and, in 2017, it was five times higher in relative terms. On the other hand, labor productivity in the Asian region grew the most, around 1.7 times more than in developed economies and 2.7 times more in relation to Latin America. However, when we exclude the Asian miracles — Hong Kong, Singapore, Taiwan and South Korea —, which managed to multiply their productivity levels by an average factor of approximately fifty between 1970 and 2017, the differences in productivity growth become somewhat less remarkable: 1.3 times greater in relation to advanced economies and two times greater in relation to Latin American countries.⁶

In terms of level, the labor productivity of developed economies in 2017 was 4.2 times higher than the Asian average and 9.7 times higher than the average without Hong Kong, Singapore, Taiwan and South Korea. As for Latin America, labor productivity in the same year was two times higher than the Asian average without the miracle cases, but when these are considered, the average productivity in Asia is 1.2 times higher than that of Latin America. As an illustration of these miracles, it is interesting to note that in 1970, even when considering the four success cases, the average labor productivity in Latin America was 2.7 times higher than in Asia, and in developed countries it was more than eight times higher. Finally, the countries representing other regions for which information was available, and only from the mid-1990s on, it is worth mentioning that the growth in labor productivity in South Africa and Russia was significantly lower than that observed on

⁶ The countries in our sample for which it was possible to obtain information on both the output, the number of persons engaged and the average annual hours worked by persons engaged were Denmark, France, Italy, Japan, Netherlands, Spain, Sweden, United Kingdom, United States of America; Argentina, Brazil, Chile, Colombia, Costa Rica, Mexico, Peru, Venezuela; Bangladesh, China, Hong Kong, India, Indonesia, Malaysia, Pakistan, Philippines, Singapore, South Korea, Sri Lanka, Taiwan, Thailand, Turkey, South Africa; Russia.

average in the other regions, although in 2017 the productivity level of these economies was above that of some economies in the developing regions, especially when compared to Asia.

Based on the theoretical discussion presented above, the section below tries to empirically capture the determinants of the share of value added of the manufacturing sector, in both developed and developing countries.

4. An empirical investigation into the causes of deindustrialization in developed and developing economies

It was pointed out that a reduction in the share of manufacturing in GDP can be a natural consequence of the process of economic growth. Moreover, other variables linked to macroeconomic policies, such as interest rates and exchange rates, may contribute to the performance of the industrial sector, especially in developing countries, whose effects are exacerbated by the degree of trade openness. Another factor previously mentioned is the Dutch disease, which could be related, for example, to an increase in the export of primary products. Also in need of mentioning again in the case of developed economies is the production relocation phenomenon, in which many large companies move their plants to developing economies with lower production costs. Finally, deindustrialization could result from inadequate policies and a negative structural change expressed in the increase in financialization to the detriment of the real sector.

Bearing that in mind, the choice of the right-hand side variables in the basic model is based on both the argument developed throughout this paper and the theoretical and empirical literature on the topic. Likewise, the basic empirical growth model combines a set of variables identified in the literature as robust determinants of economic growth, based on the neoclassical approach, including human capital, capital stock and a variable of technological progress (the number of patents in our case), and other determinants aligned with our arguments, such as primary exports concentration (proxy for the Dutch disease), the outflows of foreign direct investment (proxy for production relocation), and a proxy for the financialization process.

With that decided, a dynamic panel data model was considered using the generalized method of moments (GMM) proposed by [Arellano and Bond \(1991\)](#), which is appropriate in cases involving (i) a linear functional relationship; (ii) a lagged dependent variable, which means a dependent variable influenced by prior values; (iii) potentially endogenous explanatory variables; (iv) individual fixed effects; (v) heteroscedasticity and autocorrelation within groups of individuals; and (vi) the possibility of “internal” instruments based on their own lagged variables.

That said, the determinants of the share of value added of the manufacturing are analyzed using the basic regression model:

$$vaman_{i,t} = vaman_{i,t-1} + gdppc_{i,t} + \alpha gdppc_{i,t}^2 + hc_{i,t} + open_{i,t} + ck_{i,t} + pt_{i,t} + z_{i,t} + \mu_{i,t} \quad (1)$$

where $vaman$ is the value added of the manufacturing sector in proportion to total value added, $gdppc$ is GDP per capita, $gdppc^2$ is GDP per capita squared, hc is an index of human capital, $open$ is the degree of trade openness, measured as the sum of exports and imports in proportion to GDP, ck is the capital stock and pt is the number of patent grants issued by the U.S. Patent and Trademark Office (USPTO), expressed in per million inhabitants. The variable z represents a set of indicators to assess the variables that we list as possible explanations for the determinants of deindustrialization, such as the real exchange rate, rer ; the real interest rate, rir ; $xprim$ primary exports as a percentage of total exports, $xprim$, as a proxy for the Dutch disease; foreign direct investment abroad by the residents, $fdia$, as a proxy for production relocation; and the aggregate financial flows as a percentage of trade flows, $ifinfcc$, to capture the degree of financialization.⁷ The term μ incorporates the specific fixed effects not observed for each country and an error term.

All variables are in logarithm so that the coefficients can be interpreted as elasticities. These variables, their sources and the list of developed and developing countries are described in detail in [Tables A1 and A2](#) in the table to this paper. There are data for 60 countries between 1980 and 2017, but given the lack of some observations, this is an unbalanced panel of data. [Table 2](#) summarizes the determinants of the share of value added of the manufacturing sector in our complete sample, then [Tables 3 and 4](#) show the results for developing and developed countries.

Considering that the estimates depend on the validity of the instruments used to identify the endogenous variables, Sargan’s test was performed to check the validity of the instruments used in each model. Failure to reject the null hypothesis indicates that the instruments used are robust. Therefore, the tests of the models indicated that the restrictions used are valid. The serial autocorrelation test examined the hypothesis that the error term is not serially correlated. More specifically, it was tested whether the differentiated error term is serially correlated in second order (by construction, the differential error term is probably serially correlated in first order, even if the original error term is not). The tests indicated that the null hypothesis of non-existence of second order serial correlation in the differentiated error term for all the models estimated cannot be rejected.

⁷ Regarding the $ifinfcc$ variable, it should be noted that this indicator generally expresses the degree of financial integration or de facto financial liberalization of an economy and is given by the aggregation of financial inflows and outflows registered by the balance of payments of each country, in proportion to the trade flows. Considering that the phenomenon of financialization can be envisaged in general terms as a gain in importance of the financial sector relative to the real sector, it is understood here that this integration variable can also capture movements in this direction, when considering in external terms whether the country’s integration is predominantly via the financial or the productive sector. For a discussion on this and other measures of financial integration, see [Lane and Milesi-Ferreti \(2007\)](#) and [Kose et al. \(2009\)](#).

Table 2
Determinants of manufacturing value added in the complete sample, dependent variable d.Invaman.

| | 1 | 2 | 3 | 4 | 5 | 6 |
|------------------|-------------|-------------|-------------|------------|-------------|-------------|
| L.Invaman | 0.83463*** | 0.84298*** | 0.81725*** | 0.84456*** | 0.86391*** | 0.80086*** |
| | −0.0111 | −0.01452 | −0.01146 | −0.0137 | −0.01156 | −0.01323 |
| lngdppc | 0.39244*** | 0.24547*** | 0.51280*** | 0.02218 | 0.17276** | 0.27345*** |
| | −0.07953 | −0.08194 | −0.08188 | −0.08199 | −0.08602 | −0.07957 |
| lngdppc2 | −0.02444*** | −0.01793*** | −0.02978*** | −0.00432 | −0.01249*** | −0.01787*** |
| | −0.00443 | −0.00469 | −0.00449 | −0.00453 | −0.0047 | −0.00442 |
| L.lnhc | 0.10767*** | 0.11864*** | 0.12948*** | 0.11295*** | 0.09184*** | 0.11685*** |
| | −0.03335 | −0.04068 | −0.03323 | −0.03605 | −0.03534 | −0.03347 |
| lnck | −0.01902 | 0.04107 | 0.01838 | 0.00831 | 0.01863 | −0.0568 |
| | −0.05022 | −0.05181 | −0.05014 | −0.04861 | −0.05051 | −0.05068 |
| L.lnpt | 0.01811*** | 0.01843*** | 0.01920*** | 0.01964*** | 0.01133** | 0.02935*** |
| | −0.00481 | −0.00612 | −0.00476 | −0.005 | −0.00473 | −0.00508 |
| L.lnopen | −0.02221*** | −0.00024 | −0.02804*** | −0.01874** | −0.01462* | −0.03074*** |
| | −0.00768 | −0.00815 | −0.00767 | −0.00755 | −0.00768 | −0.00762 |
| D.lnrir | | −0.00138* | | | | |
| | | −0.00071 | | | | |
| L.lnrer | | | 0.05306*** | | | |
| | | | −0.0101 | | | |
| L.lnfdia | | | | 0.00006 | | |
| | | | | −0.00045 | | |
| L.lnxprim | | | | | −0.00971* | |
| | | | | | −0.0059 | |
| lnfinfcc | | | | | | −0.00212 |
| | | | | | | −0.0024 |
| Constant | −1.11550*** | −0.45225 | −1.78917*** | 0.51816 | −0.16834 | −0.47073 |
| | −0.35375 | −0.35829 | −0.37243 | −0.37254 | −0.38858 | −0.3584 |
| Observations | 1586 | 1072 | 1586 | 1505 | 1553 | 1550 |
| Number of groups | 47 | 39 | 47 | 47 | 47 | 47 |
| Ar (2) Test | z = 0.23 | z = 0.83 | z = 0.48 | z = 0.82 | z = 0.80 | z = 0.84 |
| Prob > chi2 = | 0.818 | 0.407 | 0.633 | 0.391 | 0.350 | 0.430 |
| Sargan Test | 411.133 | 421.442 | 432.114 | 407.440 | 451.363 | 450.881 |
| Prob > chi2 = | 0.215 | 0.200 | 0.191 | 0.219 | 0.164 | 0.170 |

Standard errors in parentheses.

*** p < 0.01.

** p < 0.05.

* p < 0.1.

Initially, for the complete sample, the data corroborate the stylized fact of the empirical literature about the existence of an inverted U curve between the value added of manufacturing and GDP per capita,⁸ suggesting a positive relationship between the level of income per capita and the relative value added of industry. But after a certain level of income, this becomes negative, setting up a process of deindustrialization as nations become increasingly developed and the elasticities of demand change.

Regarding the other variables, we can highlight the positive and significant coefficient of human capital, the number of patents and the exchange rate. The variables for degree of trade openness, interest rate and Dutch disease were negative and significant to explain the manufacturing value added. The capital stock and the proxies for production relocation and for financialization were not significant for the complete sample.

In view of these results, an interesting question to be explored is whether the determinants of deindustrialization vary between developed and developing economies. Table 3 shows the results for the sample of developed countries.

In the case of developed economies, it should be noted that, unlike the results for the complete sample, the degree of openness now positively affects the manufacturing sector value added, while the proxy variable for production relocation was negative and significant to explain the share of industry in GDP, suggesting that this is indeed an important factor in explaining deindustrialization in this group of countries. Naturally, not all direct investment is allocated to the industrial sector. Yet, the significance and the effect of this variable suggest that, at least for developed countries, an important volume of these investment flows is associated with this sector. In addition, some variables such as the interest rate and the exchange rate are no longer relevant to explain deindustrialization in developed countries, which can be explained by the fact that these variables tend to be more stable in developed economies.

Concerning the financialization or financial integration variable, the results show a significant and negative effect for developed countries. In view of this, it is important to highlight that, contrary to the theoretical formulations in favor of openness and financial integration, several empirical studies have shown that there is no strong evidence of a positive rela-

⁸ Kuznets (1966) initially hypothesized an inverted U relationship between the measure of inequality in income distribution and the level of income per capita.

Table 3
Determinants of manufacturing value added in developed economies, dependent variable d.Invaman.

| | 1 | 2 | 3 | 4 | 5 | 6 |
|------------------|-------------------------|---------------------------|-------------------------|-------------------------|--------------------------|-------------------------|
| L.Invaman | 0.84796*** (0.02244) | 0.72706*** (0.03993) | 0.84815*** (0.02245) | 0.85841*** (0.02261) | 0.86036*** (0.02222) | 0.85376*** (0.02240) |
| lngdppc | 1.70879** (0.75306) | 6.62369*** (1.61819) | 1.70863** (0.75347) | 1.44735* (0.76459) | 0.37296 (0.79192) | 1.35004* (0.77730) |
| lngdppc2 | -0.08193** (0.03612) | -0.31684*** (0.07853) | -0.08179** (0.03614) | -0.06938* (0.03663) | -0.02016 (0.03782) | -0.06574* (0.03717) |
| lnhc | 0.57738*** (0.14677) | 1.04779*** (0.23022) | 0.55722*** (0.15233) | 0.59119*** (0.15515) | 0.34349** (0.15249) | 0.49777*** (0.15133) |
| lnck | -0.04347 (0.08572) | -0.03823 (0.09323) | -0.03226 (0.08868) | -0.06380 (0.11335) | 0.04080 (0.08617) | -0.04795 (0.10900) |
| lnpt | 0.00767 (0.00649) | -0.00543 (0.01143) | 0.00860 (0.00675) | 0.00620 (0.00680) | 0.00032 (0.00655) | 0.00264 (0.00679) |
| lnopen | 0.09908*** (0.01549) | 0.15128*** (0.02625) | 0.09646*** (0.01637) | 0.10563*** (0.01655) | 0.12190*** (0.01594) | 0.10133*** (0.01612) |
| D.lnrir | | 0.00330 (0.00341) | | | | |
| L.lnrir | | | 0.00940 (0.01884) | | | |
| L2.lnfia | | | | -0.00086* (0.00047) | | |
| L.lnxprim | | | | | -0.04708*** (0.00979) | |
| L.lninfcc | | | | | | -0.00692** (0.00364) |
| Constant | -8.07387** (3.83445) | -32.88761*** (8.19743) | -8.11872** (3.83762) | -6.73699* (3.89710) | -1.17802 (4.03923) | -6.24154 (3.96415) |
| Observations | 350 | 119 | 350 | 324 | 350 | 334 |
| Number of groups | 10 | 5 | 10 | 10 | 10 | 10 |
| Ar (2) Test | z = -1.38 | z = -1.29 | z = -1.23 | z = -1.43 | z = -1.27 | z = -1.53 |
| Prob > chi2 = | 0.167 | 0.188 | 0.198 | 0.124 | 0.171 | 0.112 |
| Sargan Test | 362.155 | 311.012 | 362.14 | 327.420 | 351.363 | 350.431 |
| Prob > chi2 = | 0.165 | 0.280 | 0.161 | 0.219 | 0.193 | 0.221 |

Standard errors in parentheses.

*** p < 0.01.

** p < 0.05.

* p < 0.1.

tionship between greater liberalization/financial integration and economic growth.⁹ From this extensive literature, though, it is worth mentioning Prasad et al. (2007) and Eichengreen et al. (2009), who found a positive relationship between financial openness and growth in the industrial sector. However, this effect is limited to high-income countries with developed financial systems and sound institutions. And in the case of Eichengreen et al. (2009), these positive effects are canceled out in crises. For these reasons, the results found here contribute to reinforcing the skepticism regarding the net benefits of financial integration.

Table 4 shows the results for the sample of emerging and developing economies.

In the case of developing economies, the negative coefficient of the degree of openness stands out, showing that, unlike the case for developed countries, this is an important variable to explain the performance of the manufacturing sector in the period, or better, to explain the deindustrialization process in most developing economies. This result is in line with the argument that, in a scenario of greater openness and international competition, the reduced degree of industrial competitiveness of developing economies in relation to more developed and industrialized nations contributed to the deindustrialization of the former. The representative variables of economic policy, real interest and exchange rates, were also significant: The increase in interest rates is related to the reduction of the manufacturing sector's share of GDP, while the depreciation or devaluation of exchange rates positively affected the manufacturing sector.

It should be noted that the result of the real exchange rate reinforces the arguments that consider it an instrument capable of inducing a successful process of industrialization, especially for developing countries. As examples, Rodrik (2008) and Rapetti et al. (2012) show the important role of exchange rate policy or the exchange rate as an instrument to induce structural change toward more technologically sophisticated productive sectors, and consequently, toward a diversification and greater dynamism of exports. In particular, Rodrik (2008) finds two empirical regularities. First, a devaluation of the exchange rate has a direct positive effect on the relative size of the tradable goods sector, especially those related to industrial activities. Second, the effects of the real exchange rate on growth operate, at least in part, through changes associated with

⁹ See, among others, Kose et al. (2009); Prasad et al. (2007); Rodrik and Subramanian (2009) and Jeanne et al. (2012).

Table 4
Determinants of manufacturing value added in developing economies, dependent variable d.Invaman.

| | 1 | 2 | 3 | 4 | 5 | 6 |
|------------------|-------------------------|-------------------------|-------------------------|------------------------|------------------------|-------------------------|
| L.Invaman | 0.85162*** −0.01128 | 0.84999*** −0.01477 | 0.83802*** −0.01165 | 0.86167*** −0.01444 | 0.88124*** −0.01183 | 0.80936*** −0.01402 |
| Ingdppc | 0.33726*** −0.08244 | 0.18558** −0.08136 | 0.44523*** −0.08577 | 0.01953 −0.0828 | 0.14791 −0.09123 | 0.28549*** −0.08149 |
| Ingdppc2 | −0.02169*** −0.00461 | −0.01451*** −0.00466 | −0.02646*** −0.00471 | −0.00421 −0.00459 | −0.01096** −0.005 | −0.01910*** −0.00456 |
| L.lnhc | 0.05536* −0.0336 | 0.09367** −0.03957 | 0.06671** −0.03345 | 0.07730** −0.03613 | 0.04001 −0.03636 | 0.09426*** −0.03374 |
| lnck | −0.04687 −0.05088 | 0.02181 −0.05179 | −0.02975 −0.05065 | 0.00713 −0.04842 | −0.01193 −0.05093 | −0.07891 −0.05013 |
| L.lnpt | 0.02607*** −0.00565 | 0.02042*** −0.00642 | 0.02638*** −0.0056 | 0.02380*** −0.00574 | 0.01743*** −0.00551 | 0.03677*** −0.0059 |
| L.lnopen | −0.01434* −0.00836 | 0.00265 −0.00827 | −0.01956** −0.00839 | −0.00745 −0.00816 | −0.00656 −0.00843 | −0.01829** −0.00819 |
| D.lnrir | | −0.00157** −0.00074 | | | | |
| L.lnrer | | | 0.04650*** −0.01118 | | | |
| L.lnfdia | | | | −0.00036 −0.00057 | | |
| L.lnxprim | | | | | −0.0074** −0.00308 | |
| lninfincc | | | | | | −0.0019 −0.00276 |
| Constant | −0.86626** −0.35814 | −0.198 −0.35312 | −1.46187*** −0.38289 | 0.48552 −0.36628 | −0.11769 −0.40913 | −0.52129 −0.35658 |
| Observations | 1249 | 974 | 1249 | 1183 | 1193 | 1228 |
| Number of groups | 38 | 35 | 38 | 38 | 37 | 38 |
| Ar (2) Test | z = 0.823 | z = 0.83 | z = 0.98 | z = 0.92 | z = 0.90 | z = 0.84 |
| Prob > chi2 = | 0.408 | 0.417 | 0.319 | 0.322 | 0.350 | 0.401 |
| Sargan Test | 162.855 | 111.069 | 162.14 | 127.880 | 151.9663 | 150.341 |
| Prob > chi2 = | 0.115 | 0.280 | 0.122 | 0.191 | 0.132 | 0.181 |

Standard errors in parentheses.

*** p < 0.01.

** p < 0.05.

* p < 0.1.

the relative size of the tradable goods sector. In other words, countries in which devaluation induces a resource allocation to the tradable goods sector – especially to industrial activities – grow faster.

Regarding the Dutch disease proxy, it proved to be important to explain deindustrialization in both developed and developing economies, whereas the proxies for financialization and production relocation were not significant to explain deindustrialization in developing countries, only in developed countries. For the production relocation variable, the result is not surprising, since the relocation process is not a significant feature of developing economies in general, nor do these economies present significant volumes of direct investment abroad relative to advanced economies.

5. Final considerations

This paper theoretically and empirically analyzed the deindustrialization process, investigating its main determinants in both developed and developing economies between 1980 and 2017. Our aim, which also provided the main contribution of this paper, was to empirically investigate the determinants of deindustrialization while taking into consideration the degree of each country's development. We took the perspective that the causes of this process, as supported in the literature, can be quite varied.

In line with the theoretical framework to analyze this topic, we discussed the centrality of the manufacturing sector for economic growth while evidencing, at the same time, the occurrence of deindustrialization in the last decades, as represented by the fall in the share of value added of the manufacturing sector in total value added and the share of employment in the manufacturing sector in relation to total employment in the economy.

The deindustrialization characteristic of most economies in the last decades, according to the reviewed literature, has varied and complex causes, attributed to several factors. These may be a natural consequence of the development process, but principally are originating from other more concerning sources, namely: (i) the behavior of variables linked to stability/macroeconomic policy, such as interest rates and exchange rates, and to trade and financial openness/integration; (ii) the occurrence of the so-called Dutch disease arising, for example, from increased exports of primary products; (iii) the phenomenon of industrial relocation, in which firms migrate from advanced economies to developing countries; and (iv) the increase in the financialization of the economy to the detriment of the real sector.

In order to test these arguments and verify their applicability to developed and developing economies, the empirical part of the research estimated a panel data model in order to capture the determinants of the share of the value added of the manufacturing sector in total value added in 60 countries between 1980 and 2017. The explanatory variables sought to reflect the main sources of deindustrialization discussed in the literature, in addition to the variables traditionally considered in regressions involving economic growth.

Our main results suggested that there exist certain common causes that contribute to explaining the progress of deindustrialization processes, among them, the increase in per capita income, a fact already consecrated in the literature. To explain the manufacturing value added for the set of developing and developed countries, we can also highlight the positive and significant coefficients of human capital, the number of patents and the exchange rate (depreciation), as well as the negative and significant variables representing the interest rate and the Dutch disease.

The importance of other variables, however, is shown to be dependent on the level of economic development: in the least developed countries, variables such as the exchange rate (depreciation) positively affected the value added of the manufacturing industry, while trade openness did so in a negative way. In developed countries, on the other hand, a positive relationship was suggested between manufacturing value added and trade openness and a negative one with respect to relocation and financialization. Such results point to an asymmetrical impact of productive globalization on the world economy. They also suggest the importance of industrial policy, especially for the least developed countries.

It must be mentioned, however, that this analysis has limitations given the complexity involved in the different and multiple causes that may affect the process of deindustrialization and the different institutional environments in which they occur. Our analysis is meant only to shed some light on these differences, believing that a case-by-case investigation may be more effective in defining the particularities of each country and the policies that could be important in each context.

Above all, and in view of such results, we agree it is key to pay a closer look at the causes and costs of deindustrialization, especially in developing countries.

Data availability

The authors are unable or have chosen not to specify which data has been used.

Declaration of Competing Interest

The authors report no declarations of interest.

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Appendix A.

Table A1

Variable list, methodology and construction.

| Name code | Remark | Source |
|----------------|--|--|
| <i>vaman</i> | Value added of the manufacturing sector in relation to total value added. Refers to the code D of ISIC Rev. 3. Values in US\$ of 2005. | UNSD and GGDC 10-Sector Database . |
| <i>xprim</i> | Exports of primary goods, as % of total exports. | WTO. |
| <i>gdppc</i> | Gross Domestic Product per capita (PPP, 2005 international US\$). | WDI. |
| <i>rer</i> | Real exchange rate, adjusted by purchasing power parity. | PWT 9.1 and IFS-WEO-IMF. |
| <i>rir</i> | Short-term real interest rate, represented by the deposit rate (%). | IFS-IMF. |
| <i>fdia</i> | Direct investment, net acquisitions abroad. | IFS-IMF. |
| <i>ifinfcc</i> | Proxy for de facto financial integration (and financialization). Module sum of inflows and outflows of capital, in % of the trade flows. | IFS-IMF. |
| <i>open</i> | Proxy for trade opening. Sum of the value of exports and imports as % of GDP. | WDI. |
| <i>pt</i> | Patent grants at the USPTO, by Inventor(s)'s country(ies) of residence, and per million inhabitants. | OECDstat and WDI. |
| <i>ck</i> | Capital stock. Capital services levels at current PPPs (USA = 1). | PWT 9.1. |
| <i>hc</i> | Human capital index, based on years of schooling and returns to education. | PWT 9.1. |

Table A2
Country list of the survey.

| Developed economies | Emerging and developing economies | | |
|------------------------------|-----------------------------------|-------------------------|------------------------------------|
| Denmark | Albania ^a | Ghana | Republic of Korea |
| France | Argentina | Hong Kong ^b | Republic of Macedonia ^a |
| Germany | Armenia ^a | India | Republic of Moldova ^a |
| Italy | Azerbaijan ^a | Indonesia | Russian Federation ^a |
| Japan | Bahrein | Jordan | Saudi Arabia |
| Spain | Bangladesh | Kazakhstan ^a | Senegal |
| Sweden | Belarus ^a | Kenya | Singapore |
| The Netherlands | Bolivia | Kyrgyzstan ^a | South Africa |
| The United Kingdom | Botswana | Malawi | Sri Lanka |
| | Brazil | Malaysia | Syrian Arab Republic |
| | Chile | Mauritius | Taiwan |
| | China | Mexico | Tanzania |
| | Colombia | Morocco | Thailand |
| | Costa Rica | Nigeria | Turkey |
| | Egypt | Pakistan | Ukraine ^a |
| | Ethiopia | Peru | Venezuela |
| | Georgia ^a | Philippines | Zambia |
| | | | |
| The United States of America | | | |

Note: The classification of countries follows the United Nations Department of Economic and Social Affairs (UN/DESA), but includes transitions economies in the group of developing countries.

^a Transition economies.

^b Special administrative region of China.

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