

ENHANCING MANUFACTURING-MODERN SERVICES INTEGRATION VIA COMPETITIVE REAL EXCHANGE RATES

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ABSTRACT

This article discusses the role of the Real Exchange Rate (RER) on the integration of manufacturing and modern services sectors theoretically. It explains how deindustrialization has elevated the significance of modern services, which are critical for productivity and innovation. The symbiotic relationship between both sectors is a vital force that induces pro-growth structural economic change. We demonstrate how competitive RER encourages structural adjustments and investments, promoting interaction between the manufacturing and services sectors, particularly in developing economies, thereby enhancing global competitiveness. In a two-cycle process, a competitive RER initially boosts profitability and external competitiveness, leading to increased automation and collaboration with modern services. This interaction catalyzes "amplified dynamic increasing returns to scale," driven by shared innovations. Over time, as sectors reap profits, they deepen their integration, improve products, and broaden market access. Consequently, the RER fosters a symbiotic relationship that is essential for sustainable economic development and competitiveness in international trade.

Keywords: Manufacturing; Services; Real Exchange Rate; Economic Growth; Increasing Returns to Scale.

JEL code: O4; E6; L8.

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1 Introduction

This paper explores the theoretical impact of the real exchange rate (RER) on the symbiotic relationship between manufacturing and modern services, focusing on how this integration can potentially influence economic growth. Structural changes arise from shifts within production systems and labor dynamics across different sectors. These transformations can either promote or hinder growth, primarily determined by productivity changes in sectors reallocating resources. The increasing integration of manufacturing and modern services is identified as a crucial driver of structural economic change that supports sustainable economic growth.

Modern services sector can be defined as a set of dynamic activities based on the generation and dissemination of technical and scientific knowledge, applied transversally in the productive structure through digital means, with the aim of increasing productivity and/or adding value to production. Specifically, we can see its presence in products manufactured with embedded software for everyday use and in production lines, through the integration of mechanical, electronic and digital systems.

This type of service plays an essential role in modern economies because it contributes to adding value and increasing productivity. Its integration with manufacturing can therefore be understood as a new stage in the process of structural change in which the rigidly defined boundaries of agriculture, manufacturing and services are no longer clear. Modern services are pervasive and transversal to the entire productive structure.

Therefore, sustained long-term economic growth depends heavily on a production structure in which manufacturing and modern services are symbiotically integrated. This synergy is believed to enhance dynamic increasing returns to scale, with the advantages from both sectors being maximized through mutual collaboration. The convergence of these sectors spurs cooperative development and reinforces mutual growth.

The paper highlights how a competitive exchange rate may theoretically enhance the efficiency of interactions between manufacturing and services, thereby fostering economic growth. Productive efficiency is conceptualized as the capacity to lower production costs while optimizing the use of available technology through the integration of manufacturing and modern services. Integration, in this sense, is defined as the symbiosis between manufacturing and modern services. Symbiosis refers to the interdependence and integration between manufacturing production and the modern services sector capable of generating

static and dynamic increasing returns to scale to a greater degree and extent than manufacturing or services alone. That is, Extended Increasing Returns to Scale.

This analysis underscores the pivotal role of services in boosting production efficiency and catalyzing economic growth. It suggests that policymakers should integrate insights from the manufacturing-services symbiosis into their strategic frameworks, particularly in managing the RER, to fully exploit the theoretical potential of this relationship.

The paper is organized as follows: Section 2 reviews the literature on the role of deindustrialization and the rise of modern services in economic growth, including the impact of the exchange rate on their symbiotic relationship. Section 3 explores the integration of manufacturing and modern services, providing insights into RER channels. Finally, Section 4 presents the conclusions.

2 Manufacturing and Services Sector in economic growth perspectives

The manufacturing sector plays a crucial role in driving economic growth due to several reasons, such as improvement of productive, higher levels of technological progress and relaxing the balance of payments constraints. Firstly, the sector exhibits a positive impact on the overall output of the economy and demonstrates the ability to generate high productivity gains compared to other sectors, which aligns with Kaldor-Verdoorn's law (Di Meglio & Gallego, 2022). Secondly, the manufacturing sector facilitates the development of activities that involve higher levels of technological progress and value addition. Lastly, as economies progress to more advanced stages, the industrial sector assumes the role of a net exporter of capital goods and/or other products with high income elasticity, relaxing the balance-of-payments constraint.

Furthermore, it enjoys dynamic increasing returns to scale, which distinguishes it from other economic sectors that are characterized by either constant returns to scale (such as traditional services) or decreasing returns (like agricultural activities and mining). As a result, the dynamics of industrial activities drive overall productivity growth in the economy, leading to long-term income growth.

The role of RER on growth has been extensively discussed since the 1960s, with one notable outcome being the Balassa-Samuelson effect (BS). This effect posits that productivity gains positively impact wages and have differential effects on the tradables (manufacturing sector) and nontradables sectors (Balassa, 1964; Samuelson, 1964). In the case of tradable

products, where prices tend to equalize in the international market, a country with higher production levels experiences an appreciation of its currency in terms of Purchasing Power Parity - PPP. Conversely, in the nontradables sector, characterized by lower productivity, prices rise more rapidly than in the tradables sector. These dynamics lead to the expansion of the nontradables sector within the economy.

Some literature raises concerns about the expansion of the services sector and its implications for economic growth. Baumol (1967) developed a theoretical evaluation on services sectors known as the “costs disease”. From the supply side, this approach argues that despite being less productive, services tend to follow wage increases in the manufacturing sector. This leads to rising production costs and changes in relative prices within the economy, potentially limiting the competitiveness of countries whose productive structure shifts towards services.

Conversely, from the demand side, there is a strong connection between the income elasticity of demand for goods and services and the increase in per capita income. As per the assumption of technical progress in the manufacturing sector, income growth drives changes in society's consumption patterns. If societies adopt more sophisticated consumption habits, the services sector becomes increasingly significant in the dynamics of economic growth¹ (Clark, 1967; Fuchs, 1965).

The point to emphasize is that for more than half of the twentieth century, the literature on economic growth has provided evidence that the manufacturing sector has a primacy in output growth. On the other hand, the service sector did not show any characteristics of greater importance for economic growth. It was not until the 1970s that a significant shift occurred with the process of deindustrialization and the emergence of the Information and Communication Technology (ICT) paradigm. This led to a profound change in the way the services sector began to organize its productive activities and position itself within the productivity chains of the economic system.

The emergence of specific segments within the service sector as an independent and productive sector, capable of enhancing productivity and adding value to production, increased its relevance in relation to economic growth. This shift drew the attention of

¹ According to Engel's law (or Bell's law), an increase in real income causes changes in the composition of domestic demand in favor of more sophisticated consumption desires, consequently reallocating economic resources. Since services have a higher income elasticity of demand than manufactured goods, consumption shifts towards them (Clark, 1967; Comin *et al.*, 2021).

researchers and policymakers (Roach 1988; Dunning, 1989). This question is discussed in the next section.

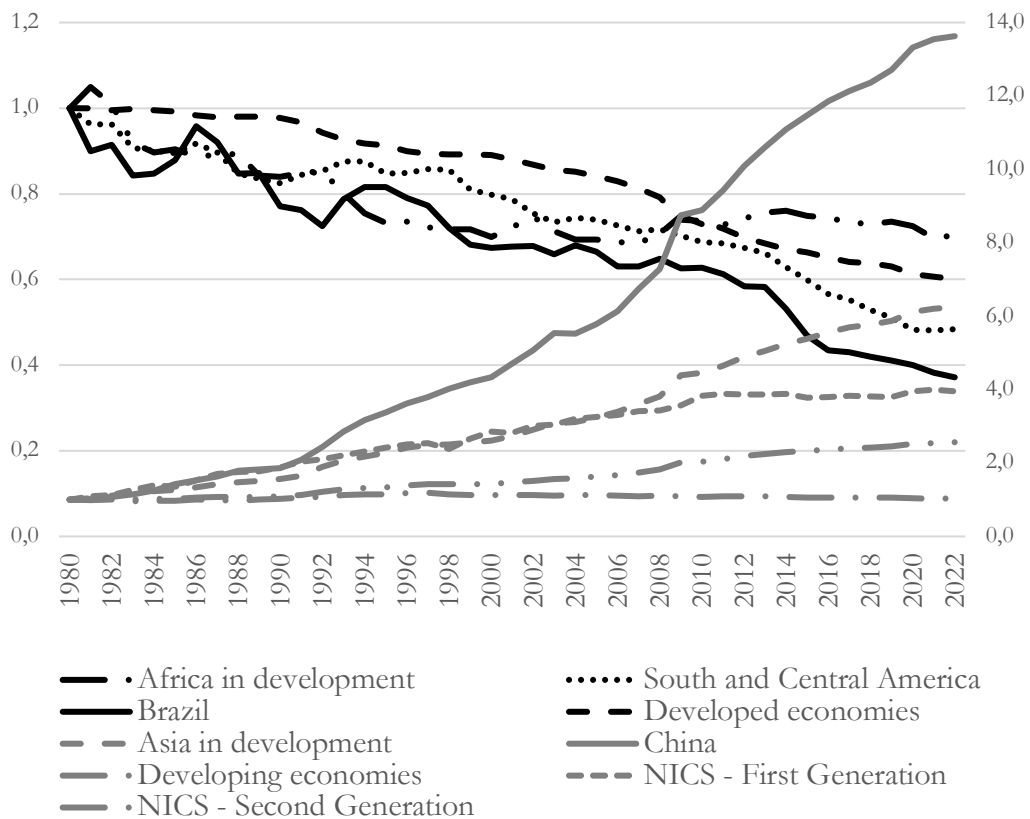
2.1 Deindustrialization and the rise of modern services

Deindustrialization began in the 1970s, marked by a decline in the relative significance of the manufacturing sector in advanced economies and a corresponding increase in the contribution of the services sector to national income. Tregenna (2009) posits that deindustrialization is evidenced by a decrease in industrial employment and value-added in the manufacturing sector relative to total employment and Gross Domestic Product (GDP).

In developed countries, deindustrialization is viewed as a natural outcome of successful economic development, where the manufacturing sector has played a role in improving living standards (Baumol, 1967; Fuchs, 1965; Rowthorn & Ramaswamy, 1997; Tregenna, 2016). However, in developing countries, deindustrialization is considered early or premature as it occurs before reaching a similar per capita income level to that of developed countries. In such cases, the long-term development prospects of these countries tend to be limited (Rowthorn & Wells, 1987; Palma, 2005; Rodrik, 2016). This limitation on economic development arises due to decrease in the capacity to add value to production, a decline in investment rates, a limitation of technical progress, and imbalances in the balance of payments.

Figure 1 shows the trajectory of deindustrialization in the Western world, compared to the behavior of manufacturing in the Eastern world, with a focus on Brazil and China, over the past forty-two years. Developed countries, Africa, and South and Central America show continued losses. In the special case of South and Central America, deindustrialization has been more intense since 2010. Brazil, as the largest economy in South America, stands out in the process of deindustrialization. It is noted that the behavior of the Brazilian manufacturer is completely opposite to the Chinese case. The behavior of these economies illustrates why this phenomenon is relevant to understanding long-term growth.

Figure 1 - International Relative Deindustrialization Index - selected regions, 1980 - 2022



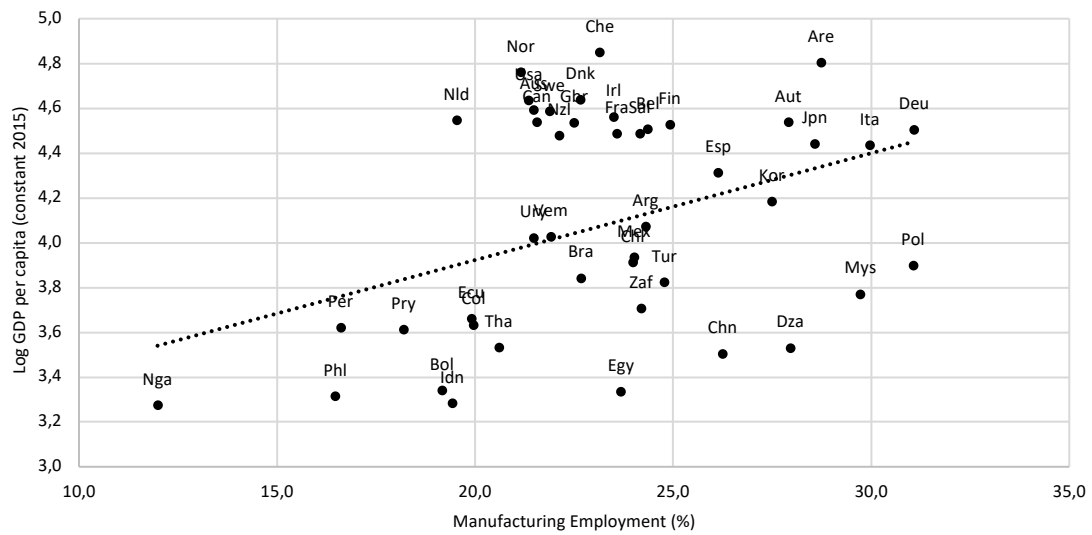
Source: prepared by the authors based on Arend's methodology (2015).

On the other hand, Asian countries have shown the opposite trajectory, with China standing out as the leader of the industrialization phenomenon. The first and second direction Newly Industrialized Countries (NICs) and developing economies follow the same trend, but at a slower pace. In any case, Figure 1 helps to understand the degree and extent of the phenomenon taking place in the world. Asia, on the one hand, stands out as the dynamic center of innovation and a lever for global productivity, especially since the 2000s, while developed economies seek to reconfigure their productive structure in the face of deindustrialization.

Central to the deindustrialization process is that long-term economic growth depends on the productivity of the service sector, especially those subsectors that emerge with new production dynamics (Rowthorn & Ramaswamy, 1999). These subsectors are those that we can call modern services and that play a decisive role in driving economic development.

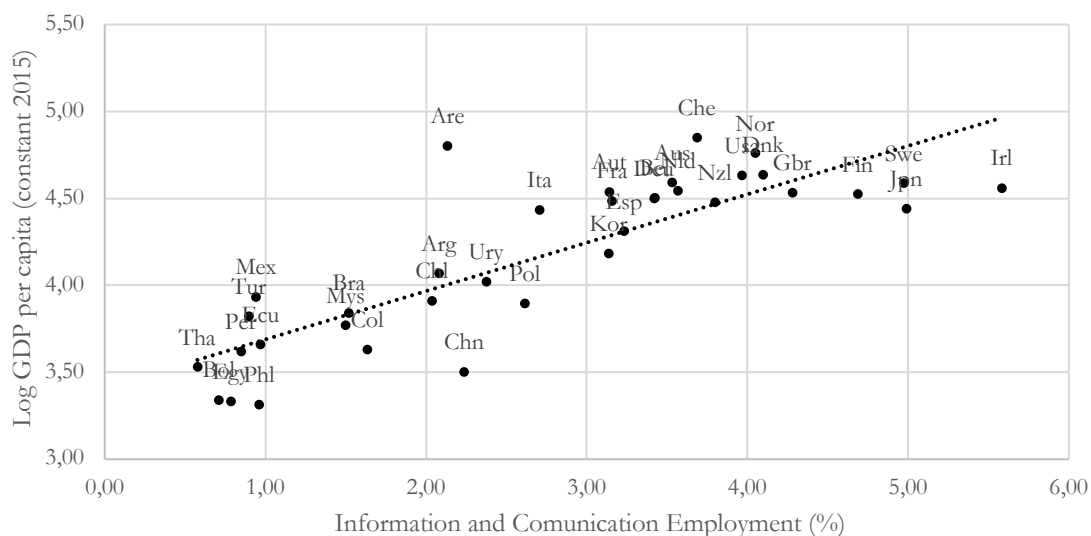
Figures 2 and 3 illustrate some of this literature on the importance of modern services. It shows the relationship between GDP *per capita* and the share of employment in manufacturing and employment in information and communication services. The correlation is positive in both cases. Figure 2 summarizes the historical relationship between the level of economic development and employment in manufacturing, while Figure 3 suggests the recent positive correlation between the level of development and employment in modern service activities.

Figure 02 – Relationship between GDP *per capita* and employment share in the manufacturing sector for selected countries, 1970-2023.



Source: prepared by the authors based on IOLstat.

Figure 03 – Relationship between GDP per capita and employment share in Information and Communication services sector² for selected countries, 2014-2023



Source: prepared by the authors based on IOLstat.

In the literature, it is possible to find terms such as intermediate services, modern services, sophisticated services, productive services, professional or business services, and finally, cost and value-added services (see Appendix – Table 1). The classification depends on the availability and level of data disaggregation, and variations may occur over time due to the evolution of the global economy itself, based on constant technological changes (Kon, 2006).

Thus, modern services sector can be defined as the set of dynamic service activities that are intensive in knowledge, technology, and highly qualified human capital, based on the generation, application, and dissemination of technical and scientific knowledge within the productive structure, which perform strategic functions in economic coordination, the diffusion of innovation, and the enhancement of productivity and value creation, frequently supported by information and communication technologies and other digital means that enable the transversal application of knowledge throughout the economy. The term “modern services” is more appropriate, as it carries with it the idea of technological progress (Mishra *et al.*, 2011). Furthermore, assuming that the current economy is based on the generation, dissemination and application of knowledge intensively, the word “modern” is more

² Communication and information activities are representative of the modern services sector, as it is the most dynamic and largest recipient of investment, and is considered a proxy. "In terms of number of businesses, the information and communication sector has been the most active since 2000" (UNCTAD, 2022, p. 25). For more details, see: UNCTAD, 2022).

appropriate because it expresses the dynamic behavior of this sector (Dominiak, 2018), always expressing the avant-garde.

For the purposes of the concept of modern services adopted in this study, it is important to emphasize that the modern services sector is not homogeneous, despite performing the functions of generating and disseminating technical-scientific knowledge. In these terms, we can divide the modern services sector into two groups that are interconnected.

They are: 1) Modern technological services: These combine highly qualified technical-scientific professionals with highly technological equipment, mainly aiming to add value and lead the technological frontier; 2) Modern professional services: These combine highly skilled technical and organizational professionals with socially widespread technological equipment, mainly aiming to increase efficiency and productivity. The service activities classified into the two proposed groups are presented in Appendix – Table 2.

These qualifications about the modern services sector contribute to a better understanding of what this sector is and how it operates within the productive structure. This is important because there is an emerging literature showing that the modern service sector contributes positively to economic growth.

2.2 Services in economic growth

The first signs of a change in the role of services in growth were observed in the 1980s. Roach (1988) identified that in the United States, the growth rate of capital stock was higher in the services sector compared to the manufacturing sector, particularly in activities related to ICT activities. A similar trend was observed in Europe. Additionally, Ark and McGuckin (2003) support the notion that the productivity improvement in these economies was driven by the dominant employment share in the ICT production sector and the rapid productivity growth of manufacturing industries that extensively utilized ICTs.

The repositioning of services within the productive structure can be attributed to several factors. Firstly, there has been an increase in the share of services in intermediary consumption. Secondly, there has been a trend towards outsourcing certain activities. Thirdly, services have expanded their role by incorporating additional value into physical production through marketing, distribution, maintenance, after-sales, and assistance services. Fourthly, the growth of financial and transportation services has contributed to enhancing

overall economic efficiency. Lastly, the services sector has demonstrated its ability to create new products and expand markets (Dunning, 1989).

The diffusion of information technologies, particularly the use of computing and software in financial and operational management of manufacturing production, has played a crucial role in facilitating the transverse position of services within the productive structure (Bell & Pavitt, 1993). Among the activities within modern services, Knowledge-Intensive Business Services (KIBS) have emerged as noteworthy. The literature on KIBS highlights their contribution to supplying knowledge to the industrial sector and fostering innovation (Hertog, 2000; Miles *et al.*, 2008; Gallego & Maroto, 2015).

Besides, services contribute to productivity and economic growth, since they are also subject to Kaldor's laws (Dasgupta & Singh, 2006; Ariu *et al.*, 2019; Di Meglio *et al.*, 2018; Giovanini & Arend, 2017; Leon-Ledesma & Moro, 2020; Pereira *et al.*, 2024; 2025). Especially in developing countries, ICTs perform a relevant role in raising productivity and ensure a relatively satisfactory position in the global value chain (Dasgupta & Singh, 2006; Di Meglio & Gallego, 2022).

Other researchers have argued that the services' activities add value and contribute to product differentiation by generating innovation and ensuring external competitiveness, so they are important to relieve external pressure (Castellacci, 2008; Cainelli & Mazzanti, 2013; Arbache, 2014).

Regarding symbiosis, it emphasizes the importance of considering the integration between the manufacturing sector and services in order to understand economic development (Engelbrecht, 1992; Park, 1994; Karaomerioglu & Carlsson, 1999; Ascani & Iammarino, 2018; Di Bernardino & Onesti, 2018; Giovanini & Arend, 2019; Giovanini *et al.*, 2020; Pereira *at al.*, 2024).

Thus, the relationship between modern services and the manufacturing sector is bidirectional, and their interaction plays a vital role in maintaining the economy's total employment in conditions of intersectoral transition of employment. This is the basic trait of a positive structural change. In other words, ICTs narrow the intersectoral dynamics present in value chains and contribute to the overall productive efficiency of the economy (Di Bernardino & Onesti, 2018).

Recent studies further support the argument that in advanced economies, the productive structure is characterized by a significant involvement of companies in the

production of integrated goods and services. This trend is observed in many countries worldwide (Barreto *et al.*, 2017; Cadestin & Miroudot, 2020). Consequently, the current production process goes beyond the creation of tangible goods and incorporates a wide range of intangible goods or a combination of both. This poses a challenge in accurately measuring the share of services incorporated in the diverse products available in the market.

The current production process is increasingly characterized by a symbiotic integration between manufacturing and modern services, supported by development strategies and industrial policies that recognize this symbiosis as a crucial factor for growth. Merely producing a manufactured product is no longer sufficient; the product needs to possess differentiating factors that can only be achieved through the incorporation of modern services, such as design, on-board computer systems, mobile applications, artificial intelligence, and software for human-machine interactions. These elements contribute to enhancing the value and competitiveness of the final product in the market.

In summary, the literature on services highlights several factors that underscore the importance of this sector in boosting productivity, fostering innovation, enhancing the quality of production efficiency, and ultimately driving economic growth. The productive dynamic stimulates forms of integration between manufacturing and services (symbiosis) that outperform the traditionally known forms of production.

This scenario imposes challenges for economic policymakers. Understanding how to stimulate the symbiosis between the sectors is relevant for improving economic policies. Particularly in developing countries, services offer new opportunities for job creation, value generation, and structural change. (UNCTAD, 2017). We dedicate special attention to this question of macroeconomic policy in the next section.

2.2 The RER and its role in the symbiosis between the manufacturing sector and modern services

There is extensive empirical literature showing that an undervalued RER has positive effects on growth (Rodrik, 2008; Razmi *et al.*, 2012; Missio *et al.*, 2015; Rapetti, 2016, 2020; Habib *et al.*, 2017; Nassif *et al.*, 2017; Guzman *et al.*, 2018; Gabriel & Missio, 2018; Demir & Razmi, 2021; among others).

According to this literature, the RER can promote economic growth through various channels, including the “foreign savings channel”, the “development channel” or “tradable-

led channel”, and the “capital accumulation channel”, among others (see Blecker, 2021). In the first case, it is argued that RER depreciation can affect aggregate savings by influencing consumption and investment paths through alterations in the functional distribution of income (Lima & Porcile, 2013; Rapetti, 2016). Basically, the RER affects real wages and transfers workers' income to profits. In this way, the self-funding capacity of firms increases, as does the availability of funds that can be changed in the process of expansion and improvement of productive quality (Levy-Yeyati & Sturzenegger, 2009; Dao *et al.*, 2017).

Through the “tradable-led growth channel”, a competitive RER can promote a structural change from towards non-tradable to tradable sectors (Frenkel and Ros, 2006, Rodrik, 2008; Rapetti, 2020; among others). In the same vein, a competitive exchange rate also has a positive impact on investment and capital accumulation by inducing changes in the sectoral composition of GDP and employment. Razmi *et al.* (2012), and Rapetti (2020) argue that real depreciation redirects domestic consumption towards non-tradable goods and frees up a larger share of the tradable sector's production for exports, leading to increased profitability and investment.

Some studies investigate the integration of these different transmission channels. In general, these analyses suggest that a competitive exchange rate induces changes in the productive structure by facilitating the transition of tradable sectors from low to high productivity. The management of the RER favors the manufacturing sector, influencing investment decisions, changing the distribution of intersectoral profits, promoting resource reallocation, and stimulating increasing returns to scale (Vaz & Baer, 2014; Dhasmana, 2015; Hunegnaw, 2017; Dao *et al.*, 2017; Alfaro *et al.*, 2018; Mazorodze & Tewari, 2018; Panda & Nanda, 2019; Gabriel *et al.*, 2020; Iasco-Pereira *et al.*, 2024;). Furthermore, there is a body of research suggesting that the structural change induced by a competitive RER affects the income elasticity of imports and exports, which relaxes the foreign restrictions (Missio & Jayme Jr., 2012; Porcile *et al.*, 2020; Goda *et al.*, 2024).

Recent studies also indicate that RER competitiveness can stimulate the services sector (Baggs *et al.*, 2010; Alimi, 2025; Pereira *et al.*, 2025). Evidence from Canadian firms shows that a competitive RER favors the survival and sales of the services sector, while manufacturing is more sensitive in terms of profitability (Baggs *et al.*, 2010). Alimi (2025) shows that the effects of changes in the RER on sectoral employment shares are neutral in the short term and significant in the long term. According to the author, the effect differs across sectors, and while undervalued currencies boost employment in the agriculture and

services sectors, the same may not be true for manufacturing. Similar results are found for the modern services sector. The undervalued RER is capable of promoting structural changes in modern service activities and is capable of positively affecting employment and value added (Pereira *et al.*, 2025).

In terms of international trade, Pattichis (2012) suggests that the RER has a significant effect on the services trade balance of the United States and the United Kingdom between 1986 and 2009. Similar findings have been observed for developed and developing countries, with the RER's effect being stronger for modern services exports compared to goods exports. Eichengreen and Gupta (2013a) argue that a depreciated exchange rate alters the relative prices of exports and promotes resource allocation in favor of the tradable sector. In the case of modern services, the effect of the RER on resource allocation is faster, as this sector relies less on imported inputs and has lower fixed input costs, leading to a more elastic response in service supply. Additionally, the price elasticity of demand for these exports is higher.

Lastly, Sahoo *et al.* (2019) conducted a study on the impact of RER movements on the total of exports and modern and traditional services in India. The authors argue that a competitive exchange rate policy contributes to sustaining the exports of services in the long term. Mahalik & Pal (2024) conduct the investigation from the point of view of total, traditional and modern service imports to India. The authors show that the devalued real exchange rate reduces service imports differently. Traditional services are more sensitive than modern services to exchange rate depreciation, highlighting the nature of remittances in consumption and production activities.

Despite the existing studies, we have identified some gaps in literature. Firstly, there is limited mention of the symbiosis between the manufacturing sector and services and its impact on economic growth. This intersectoral relationship appears to be crucial in understanding the recent economic growth of certain nations. Second, we noticed an absence of studies investigating the role of macroeconomic policy in promoting interaction between the services sector and manufacturing sector. An important question to consider is whether the RER, which can affect the dynamics of added investment, also influences the rate of investment in the modern services sector. These are relevant and unexplored questions that we aim to discuss in the next section.

3 Integrating Manufacturing and Modern Services: insights into RER channels

The RER plays a crucial role in enhancing the symbiotic integration between the manufacturing sector and modern services, working through two complementary cycles: the short term (Cycle 1) and the long term (Cycle 2). In both cycles, three transmission channels - external competitiveness, profitability, and investment - operate in a complementary manner, alternating in importance over time. In Cycle 1, characterized by companies with limited access to foreign markets, competitive RER boosts external competitiveness and domestic demand, increasing profits and stimulating investment in both manufacturing and modern services. This process fosters productive modernization, laying the groundwork for structural changes and GDP growth. In Cycle 2, with companies accessing foreign markets, the maintenance of investments and competitiveness gains consolidates the development of a new service portfolio. This progress is further enhanced by technical advancements resulting from investments in new technologies and Research and Development (R&D), supporting structural growth and sustainable economic expansion.

More specifically, in the manufacturing sector, during the nascent phase of structural change, the channels of profitability and external competitiveness are particularly sensitive to a competitive RER. This sensitivity arises from the need for the economic structure to recalibrate itself to adapt to shifting market dynamics. The depreciation of the exchange rate enhances external competitiveness by making domestically produced goods more attractive in international markets, thereby increasing export demand. This boost in demand directly influences potential profitability by allowing firms to achieve greater sales volumes at competitive prices, improving margins in the short to medium term.

Besides, for manufacturing sectors reliant on imported inputs, a competitive RER policy puts pressure on costs. As a result, these companies are compelled to invest in productivity improvements and automation of their production lines as a means of cost reduction. In such circumstances, the solution lies in acquiring modern machinery and hiring skilled personnel in modern services to implement and/or enhance industrial automation within their facilities. At same time, industrial sectors that produce goods/inputs competing with similar imports experience an increase in demand and subsequently higher profits. This upturn in demand encourages investments aimed at expanding production capacity.

Over the long term, a sustained competitive RER induces structural change by prompting changes in sectorial production shares. As certain manufacturing industries expand due to favorable export conditions, resources are reallocated, leading to a transformation in the sectorial composition of the economy. This shift not only supports a more export-oriented industrial base but also fosters the development of manufacturing industries with higher value-added production, contributing to economic resilience and sustainable growth. In essence, the competitive RER serves as a catalyst for dynamic adjustments within the manufacturing sector, driving both immediate gains in profitability and enduring structural transformation.

In the case of the modern services sector, it is important to highlight some characteristics of this sector: i) wages are typically higher compared to the traditional services sector; ii) production stages are shorter and developed within relatively compressed timeframes; and iii) investment in physical capital is generally lower than in the manufacturing sector, resulting in lower inflow and outflow costs.

Thus, a competitive RER reallocates relative operating costs in favor of domestic service companies by increasing external competitiveness and encouraging domestic manufacturing to consume service inputs. The signaling of greater profits by service companies operating in the domestic and international market encourages investment in physical capital and the hiring of new professionals. Therefore, the expectation of profit and the conquest of foreign market share, induce the integration between manufacturing and service companies. This occurs to improve productivity via automation and reduce costs to face international competition.

The competitive RER also stimulates investment in the product creation process. From the services sector, the manufacturing sector demands market research, product design, and data analysis, as well as the creation of applications that will be incorporated into the final product. This process, focused on product development and engaging service companies to improve productivity and automation, introduces a new stage known as the amplified dynamic increasing returns to scale. This phenomenon is a productive manifestation of the symbiosis between manufacturing and modern services.

At this stage, the products are ready for sale. The hired services have successfully accomplished their objectives, including market mapping, improved design, enhanced sales strategies, and the development of specific and integrated applications for the product,

facilitating interaction with consumers. The result of the symbiosis is reflected in the increase in GDP.

After that, the industrial facilities are expanded and modernized. The production process is automated, and at each stage, information is generated, processed, and analyzed to identify any failures and monitor production performance over time. As a result, both sectors become more competitive and are well-positioned to enter the international market favorably. This sets the stage for the beginning of a new cycle of productive development.

Cycle 2 begins following the realization of profits and rise of GDP. Companies, now equipped with greater financial resources, embark on a new investment cycle with the objective of conquering a larger share of the international market.

In this new cycle, both sectors benefit from the experience and knowledge gained in the previous one. Incremental advancements and novel formulations are integrated into existing production processes. With the presence of amplified dynamic increasing returns to scale, the interaction process expands the possibilities for developing new products and enhancing existing ones. As a result, the complexity regarding the level of technological embodied in these products increases.

In addition to the new basket of products prepared for sale, the symbiosis between manufacturing sector and modern services has created a range of related products. This means that the main product paves the way for offers of auxiliary products and services that ensure differentiation and value addition. Both sectors progress along the production chain and begin to possess the necessary conditions to compete for new markets in international trade.

In summary, the RER significantly fosters economic dynamism and strengthens ties between the manufacturing sector and services. Across both cycles, dynamic increasing returns to scale operate in their amplified form, driven by research, innovation, and learning that generate positive externalities and technological spillovers, becoming shared assets across sectors. This environment creates a productive symbiosis, where mutual dependencies ease knowledge diffusion and innovation absorption. Such interactions not only boost productivity but also underpin the mechanisms of economic growth in the twenty-first century, creating a virtuous cycle where each sector enhances the other, laying the groundwork for sustainable, long-term growth.

4 Conclusions

From a theoretical perspective, this work places the service sector at the center of the debate on economic growth and its role in underdeveloped economies. In this context, it emphasizes the importance of reviving traditional theories to comprehend the current economic transformations and, when needed, revising the current theoretical framework.

A novel theoretical and interpretative effort is made to indicate that the ongoing structural change is advancing towards new forms of productive organization, which requires scholars to revisit and reconsider current theoretical frameworks. Understanding reality and constructing theory necessarily involves acknowledging that the capitalist mode of production is undergoing reconfiguration.

Furthermore, it highlights the need to analyze economic dynamics beyond traditionally established sectoral determinations, given that the classic division between agriculture, manufacturing, and services limits the understanding of the exchange rate policy's effect on the productive process and, consequently, on economic growth. An integrated sectoral analysis enhances the analytical and explanatory capacity of the effects of economic policy on the level and pace of economic activity growth.

In terms of economic policy formulation, two contributions are pointed out, with implications extending both in the dimension of macroeconomic policy and in terms of productive development policy. Regarding macroeconomic policy, we show exchange rate policy acting in a manner that extend beyond the immediate impact on manufacturing.

A competitive RER contributes to the relative expansion of the service sector, in terms of added value and employment. This helps to understand the determinants of performance differentials between countries, highlighting the role of macroeconomic policy instruments. Apart from factors related to supply, such as education, technology, and institutional patterns, the exchange rate level has a catalytic effect on productive interactions.

Moreover, the RER stimulates the symbiosis between manufacturing and sophisticated services, allowing the establishment of increased dynamic returns to scale. This is an important issue as it indicates a possible path to understand why the sophisticated services sector has been growing in various countries, highlighting the significant performance of Asian nations.

Thus, considering that the productive structure is characterized by an increase in the composition of the service sector in production over the last decade, this study demonstrates that exchange rate policy remains a current and relevant instrument for boosting the economy.

In terms of productive development policy, it is argued that the formulation of development strategies needs to be renewed from the terms conceived in past decades. Hence, both for developed countries and, especially, for developing ones, it is vital to incorporate the modern service sector in the formulation of economic development policies.

Efforts to reduce the gap relative to developed countries, concerning technical progress, demand special attention to the degree of interaction between the service sector and the manufacturing. In other words, the symbiosis between these sectors is key to economic growth, demonstrating that solutions for peripheral countries require a systemic view of the economy. Simple industrialization or reindustrialization is not capable of generating the necessary results for economic development in Latin America.

References

- Alfaro, L., Cuñat, A., Fadinger, H., & Liu, Y. (2018). *The Real Exchange Rate, Innovation and Productivity: Heterogeneity, Asymmetries and Hysteresis* (No. w24633). National Bureau of Economic Research. DOI: 10.3386/w24633.
- Alimi, N. (2025). Real exchange rate changes and employment in emerging economies: Sectorial analysis. *The Japanese Political Economy*, 1-19. DOI: 10.1080/2329194X.2025.2469262
- Arbache, J. (2014) *Serviços e Competitividade Industrial no Brasil*, Confederação Nacional da Indústria, Brasília.
- Arend, M. (2015). A industrialização do Brasil ante a nova divisão internacional do trabalho. In A. Biancarelli, A. Calixtre, & M. Cintra (Orgs.), *Presente e futuro do desenvolvimento brasileiro*. IPEA.
- Ariu, A., Breinlich, H., Corcos, G., & Mion, G. (2019). The interconnections between services and goods trade at the firm-level. *Journal of International Economics*, 116, 173–188. DOI: 10.1016/j.jinteco.2018.10.005
- Ark, B. V., Inklaar, R., & McGuckin, R. H. (2003). *ICT and Productivity in Europe and the United States* (No. 200311). University of Groningen, CCSO Centre for Economic Research. DOI: 10.1093/cesifo/49.3.295
- Ascani, A., & Iammarino, S. (2018). Multinational enterprises, service outsourcing and regional structural change. *Cambridge Journal of Economics*, 42(6), 1585–1611. DOI: 10.1093/cje/bey036

- Baggs, J., Beaulieu, E., & Fung, L. (2010). Are service firms affected by exchange rate movements? *Review of Income and Wealth*, 56, S156–S176. DOI: 10.1111/j.1475-4991.2010.00389.x
- Balassa, B. (1964). The purchasing-power parity doctrine: a reappraisal. *Journal of Political Economy*, 72(6), 584–596. DOI: 10.1086/258965
- Barreto, L., Amaral, A., & Pereira, T. (2017). Manufacturing 4.0 implications in logistics: an overview. *Procedia Manufacturing*, 13, 1245–1252. DOI: 10.1016/j.promfg.2017.09.045
- Baumol, W. J. (1967). Macroeconomics of unbalanced growth: the anatomy of urban crisis. *American Economic Review*, 57(3), 415–426. <http://www.jstor.org/stable/1812111>
- Bell, M., & Pavitt, K. (1993). Accumulating technology captivity in developing countries. *Industrial and Cooperative Change*, 2(2), 35–44. DOI: 10.1093/wber/6.suppl_1.257
- Blecker, R. (2021). New advances and controversies in the framework of balance-of-payments-constrained growth. *Journal of Economic Surveys*, special issue, pp. 1-39. DOI: 10.1111/joes.12463
- Browning, H. L., & Singelmann, J. (1978). The transformation of the US labor force: the interaction of industry and occupation. *Politics & society*, 8(3-4), 481-509. DOI: 10.1177/003232927800800306
- Cadestin, C., & Miroudot, S. (2020). Services exported together with goods. *OECD Trade Policy Papers*, No. 236, OECD Publishing, Paris, DOI: 10.1787/275e520a-en.
- Cainelli, G., & Mazzanti, M. (2013). Environmental innovations in services: Manufacturing services integration and policy transmissions. *Research Policy*, 42(9), 1595–1604. DOI: 10.1016/j.respol.2013.05.010
- Castellacci, F. (2008). Technological paradigms, regimes and trajectories: Manufacturing and service industries in a new taxonomy of sectoral patterns of innovation. *Research Policy*, 37(6–7), 978–994. DOI: 10.1016/j.respol.2008.03.011
- Clark, C. (1967). *The Conditions of Economic Progress*. London: MacMillan.
- Comin, D., Lashkari, D., & Mestieri, M. (2021). Structural change with long-run income and price effects. *Econometrica*, 89(1), 311-374 DOI: 10.3982/ECTA16317
- Dao, M. C., Minoiu, M. C., & Ostry, M. J. D. (2017). *Corporate Investment and the Real Exchange Rate*. International Monetary Fund. DOI: 10.1016/j.jinteco.2021.103437
- Dasgupta, S., & Singh, A. (2006). *Manufacturing, services and premature deindustrialization in developing countries: A Kaldorian analysis* (No. 2006/49). Research Paper, UNU-WIDER, United Nations University (UNU). DOI: 10.1057/9780230801462_23
- Demir, F., and Razmi, A. (2021). The real exchange rate and development theory, evidence, issues and challenges. *Journal of Economic Surveys*, 0, pp. 1-43. DOI: 10.1111/joes.12418
- Dhasmana, A. (2015). Transmission of real exchange rate changes to the manufacturing sector: The role of financial access. *International Economics*, 143, 48–69. DOI: 10.1016/j.inteco.2015.04.006
- Di Bernardino, C., & Onesti, G. (2018). The two-way integration between manufacturing and services. *The Service Industries Journal*, 40(5–6), 337–357. DOI: 10.1080/02642069.2018.1438415

- Di Meglio, G., Gallego, J., Maroto, A., & Savona, M. (2018). Services in developing economies: the deindustrialization debate in perspective. *Development and Change*, 49(6), 1495–1525. DOI:10.1111/dech.12444
- Di Meglio, G., Gallego, J. (2022). Disentangling services in developing regions: A test of Kaldor's first and second laws. *Structural Change and Economic Dynamics*, 60, 221–229. DOI: 10.1016/j.strueco.2021.11.007
- Dominiak, J. (2018). Modern services: terminological considerations and the characteristic features of their role in socio-economic development. DOI: 10.2478/quageo-2018-0020
- Dunning, J. H. (1989). Multinational enterprises and the growth of services: some conceptual and theoretical issues. *The Service Industries Journal*, 9(1), 5–39. DOI: 10.1080/02642068900000002
- Eichengreen, B., & Gupta, P. (2013). *The Real Exchange Rate and Export Growth: Are Services Different?* The World Bank.
- Eichengreen, B., & Gupta, P. (2013a): The two waves of service sector growth. NBER. Working Paper, no. 14968. DOI: 10.1093/oep/gpr059
- Engelbrecht, H. J. (1992). New perspectives on intersectorial relationships between manufacturing and services. *Economics of Planning*, 25(2), 165–178. DOI: 10.1007/BF00373065
- Frenkel, R., and Ros, J. (2006). Unemployment and the real exchange rate in latin america. *World Development*, 34(4), pp. 631-646. DOI: 10.1016/j.worlddev.2005.09.007
- Fuchs, V. R. (1965). The growing importance of the service industries. *The Journal of Business*, 38(4), 344–373. <http://www.jstor.org/stable/2351716>
- Gabriel, L. F., & Missio, F. J. (2018). Real exchange rate and economic complexity in a North-South structuralist BoPG model. *PSL Quarterly Review*, 71(287), 439–465. DOI: 10.13133/2037-3643_71.287_4
- Gabriel, L. F., Ribeiro, L. C. D. S., Jayme Jr, F. G., & Oreiro, J. L. (2020). Manufacturing, economic growth, and real exchange rate: Empirical evidence in panel data and input-output multipliers. *PSL Quarterly Review*, 73(292), 51–75. DOI: doi:10.13133/2037-3643_73.292_3
- Gallego, J., & Maroto, A. (2015). The specialization in knowledge-intensive business services (KIBS) across Europe: Permanent co-localization to debate. *Regional Studies*, 49(4), 644–664. DOI: 10.1080/00343404.2013.799762
- Giovanini, A., & Arend, M. (2017). Contribution of services to economic growth: Kaldor's fifth law. *RAM. Revista de Administração Mackenzie*, 18(4), 190–213. DOI: 10.1590/1678-69712017/administracao.v18n4p190-213
- Giovanini, A., & Arend, M. (2019). Simbiose entre indústria e serviços intermediários: a mudança na dinâmica setorial contemporânea brasileira. *Revista de Economia*, 39(68). DOI: 10.5380/re.v39i68.61145
- Giovanini, A., Pereira, W. M., & Saath, K. C. D. O. (2020). Intermediate services' impact on capital goods production. *Nova Economia*, 30(1), 203–230. DOI: 10.1590/0103-6351/4572
- Goda, T., Torres García, A., & Larrahondo, C. (2024). Real exchange rates and manufacturing exports in emerging economies: the role of sectoral heterogeneity and

- product complexity. *Review of World Economics*, 160(3), 1057-1082. DOI: 10.1007/s10290-023-00523-3
- Guzman, M., Ocampo, J. A., & Stiglitz, J. E. (2018). Real exchange rate policies for economic development. *World Development*, 110, 51–62. DOI: 10.1016/j.worlddev.2018.05.017
- Habib, M. M., Mileva, E., & Stracca, L. (2017). The real exchange rate and economic growth: Revisiting the case using external instruments. *Journal of International Money and Finance*, 73, 386–398. DOI: 10.1016/j.jimonfin.2017.02.014
- Hauknes, J. (1998). *Services in innovation—Innovation in services* (No. 199813). The STEP Group, Studies in technology, innovation and economic policy.
- Hertog, P. D. (2000) Knowledge-intensive business services as co-producers of innovation. *International Journal of Innovation Management*, 4(4), 491–528. DOI: 10.1142/S136391960000024X
- Hunegnaw, F. B. (2017). Real exchange rate and manufacturing export competitiveness in Eastern Africa. *Journal of Economic Integration*, 32 (4): 891–912. DOI: 10.11130/jei.2017.32.
- Iasco-Pereira, H. C., Libânio, G., & Missio, F. (2024). The real exchange rate and industrial investment: new evidence for Brazil. *Cambridge Journal of Economics*, 48(4), 741-766. DOI: 10.1093/cje/beae020
- Karaomerioglu, D. C., & Carlaaon, B. (1999). Manufacturing in decline? A matter of definition. *Economy, Innovation, New Technology*, 8, 175–196. DOI: 10.1080/10438599900000008
- Kon, A. (2006). O comércio internacional da indústria de serviços: os impactos no desenvolvimento de países da América. *Brazilian Journal of Latin American Studies*, 5(9), 09-47. DOI: 10.11606/issn.1676-6288.prolam.2006.81806
- Las Casas, A. L. (1991). *Marketing de serviços*. Editora Atlas.
- Leon-Ledesma, M., & Moro, A. (2020). The rise of services and balanced growth in theory and data. *American Economic Journal: Macroeconomics*, 12(4), 109-46. DOI: 10.1257/mac.20180373
- Levy-Yeyati, E. & Sturzenegger, F. (2009) Fear of appreciation: exchange rate policy as a development strategy. In Hammond, G., Kanbur, R., & Prasad, E. (Eds.), *Monetary Policy Frameworks for Emerging Markets*. Edward Elgar Publishing, pp. 69–94. DOI: 10.4337/9781848449190.00010
- Lima, G. T., & Porcile, G. (2013). Economic growth and income distribution with heterogeneous preferences on the real exchange rate. *Journal of Post Keynesian Economics*, 35(4), 651–674. DOI: 10.2753/PKE0160-3477350407
- Machado, A., Arbache, J., & Moreira, R. (2015). *Classificações das atividades de serviços* (Nota técnica). Economia de Serviços. Available in: <https://economiadeservicos.com/wpcontent/uploads/2015/09/NotaT%C3%A9cnica-Classifica%C3%A7%C3%B5es.pdf>
- Mahalik, M. K., & Pal, S. (2024). Factors Affecting Traditional and Modern Services Imports in an Emerging Economy: The Role of Real Exchange Rate and Remittances Inflows. *The Indian Economic Journal*, 0(0). DOI: 10.1177/00194662241265485

- Marshall, J. N. *Services and Uneven Development*. New York: Oxford University Press, 1988.
- Mazorodze, B. T., & Tewari, D. D. (2018). Real exchange rate undervaluation and sectoral growth in South Africa. *African Journal of Economic and Management Studies*, 4(4), 462–476. DOI: 10.1108/AJEMS-06-2017-0132
- Miles, I. (2008). Patterns of innovation in service industries. *IBM Systems Journal*, 47(1), 115. DOI: 10.1147/sj.471.0115
- Miozzo, M., & Soete, L. (2001). Internationalization of services: a technological perspective. *Technological Forecasting and Social Change*, 67(2-3), 159-185. DOI: 10.1016/S0040-1625(00)00091-3
- Mishra, Saurabh; Lundstrom, Susanna; Anand, Rahul. 2011. Service Export Sophistication and Economic Growth. Policy Research working paper ; no. WPS 5606. © World Bank. <http://hdl.handle.net/10986/3372>
- Missio, F., Jayme Jr., F. G. (2012). Structural heterogeneity and endogeneity of elasticities on the balance of payments constrained growth model. In: Souziakis, E. & Cerqueira, P. (Eds.). *Models of Balance of Payments Constrained Growth* (vol. 1), first ed. London: Palgrave, pp. 239–267. DOI: 10.1057/9781137023957_10
- Missio, F. J., Jayme Jr, F. G., & Conceição, O. A. (2015). O problema das elasticidades nos modelos de crescimento com restrição externa: Contribuições ao debate. *Estudos Econômicos (São Paulo)*, 45(2), 317–346. DOI: 10.1590/0101-4161201545233ffo
- Nassif, A., Feijó, C. A., & Araújo, E. (2017). A structuralist-Keynesian model for determining the optimum real exchange rate for Brazil's economic development process: 1999–2015. *CEPAL Review*. DOI: 10.18356/f7f73b44-en
- Nusbaumer, J. (1984). *Les services: Nouvelle donne de l'économie*. Economica.
- Palma, J. G. (2005). Quatro fontes de desindustrialização e um novo conceito de doença holandesa. In: *Conferência de industrialização, desindustrialização e desenvolvimento*. Centro Cultural da Fiesp.
- Panda, AK & Nanda, S 2019, 'The nexus between exchange rate and long-term investment in Indian manufacturing industry', *Management Research Review*, 42, 174-198. DOI: 10.1108/MRR-01-2018-0024
- Park, S. H. (1994). Intersectoral relationships between manufacturing and services: new evidence from selected Pacific Basin countries. *ASEAN Economic Bulletin*, 10 (3). 245-263. <https://www.jstor.org/stable/25770495>
- Pattichis, C. (2012). Exchange rate effects on trade in services. *Journal of Economic Studies*, 39(6), 697–708. DOI: 10.1108/01443581211274629
- Pereira, W., Missio, F., & Jayme Jr, F. (2024). Structural Change in the 21st Century: The Role of the Modern Services Sector in the Economic Development Strategy. *Review of Political Economy*, 1-25. DOI: 10.1080/09538259.2024.2342431
- Pereira, W. M., Missio, F. J., & Jayme Jr, F. G. (2025). Modern services, real exchange rate and economic growth. *Brazilian Journal of Political Economy*, 45(1), e253562. DOI: 10.1590/0101-31572025-3562
- Porcile, G., Spinola, D., & Yajima, G. (2020). *Patterns of Growth in Structuralist Models: The Role of the Real Exchange Rate and Industrial Policy* (No. 2020-027). United Nations University –

Maastricht Economic and Social Research Institute on Innovation and Technology (MERIT).

- OECD (2000). *The Service Economy*, OECD Publishing, Paris, DOI: 10.1787/9789264182516-en.
- OECD (2005), “Growth in Services - Fostering Employment, Productivity and Innovation”, OECD Digital Economy Papers, No. 94, OECD Publishing, Paris. DOI: 10.1787/232370436752
- Rapetti, M. (2016). The real exchange rate and economic growth: some observations on the possible channels. In: Damill, M., Rapetti, M., & Rozenwurcel, G. (Eds.), *Macroeconomics and Development*. DOI: 10.7312/dami17508-014
- Rapetti M. (2020). The real exchange rate and economic growth: A survey. *Journal of Globalization and Development*, 11(1), 1–054. DOI: 10.1515/jgd-2019-0024
- Razmi, A., Rapetti, M., & Skott, P. (2012). The real exchange rate and economic development. *Structural Change and Economic Dynamics*, 23(2), 151–169. DOI: 10.1016/j.strueco.2012.01.002
- Roach, S. S. (1988). Technology and the services sector: The hidden competitive challenge. *Technological Forecasting and Social Change*, 34(4), 387–403. DOI: 10.1016/0040-1625(88)90006-6
- Rodrik, D. (2008). The real exchange rate and economic growth. *Brookings Papers on Economic Activity*, 2008(2), 365–412. DOI: 10.1353/eca.0.0020.
- Rodrik, D. (2016). Premature deindustrialization. *Journal of Economic Growth*, 21(1), 1–33. DOI: 10.1007/s10887-015-9122-3
- Rodrigues, R. L. (2024) *Ensaio sobre Serviços e Crescimento Econômico*. 2024. 131f. Tese (Doutorado) Curso de Programa de Pós-Graduação em Economia, Universidade Federal de Uberlândia, Uberlândia.
- Rowthorn, R. E., & Wells, J. R. (1987), *De-industrialization and Foreign Trade*. Cambridge: Cambridge University Press.
- Rowthorn, R., & Ramaswamy, R. (1997). *Deindustrialization: Its Causes and Implications* (Vol. 10). Washington, DC: International Monetary Fund.
- Rowthorn, R., & Ramaswamy, R. (1999). Growth, trade, e deindustrialization. *IMF Staff papers*, 46 (1), 18-41. Sahoo, M., Babu, M. S., & Dash, U. (2019). Asymmetric effects of exchange rate movements on traditional and modern services exports: Evidence from a large emerging economy. *The Journal of International Trade & Economic Development*, 28(4), 508–531. DOI: 10.1080/09638199.2018.1561744
- Samuelson, P. A. (1964). Theoretical notes on trade problems. *The Review of Economics and Statistics*, 46 (2): 145–154. DOI: 10.2307/1928178
- Silvestro, R., Fitzgerald, L., & Johnston, R. (1992). Towards a classification of service processes. *International Journal of Service Industry Management*, 3(3), 62–75. DOI: 10.1108/09564239210015175
- Tregenna, F. (2009). Characterising deindustrialisation: An analysis of changes in manufacturing employment and output internationally. *Cambridge Journal of Economics*, 33(3), 433–466. DOI: 10.1093/cje/ben032

- Tregenna, F. (2016). Deindustrialisation and premature deindustrialisation. In Ghosh, J., Kattel, R., Reinert, E., (Eds.), *Elgar handbook of alternative theories of economic development*, Edward Elgar, Cheltenham. DOI: 10.4337/9781782544685.00046
- Unctad. (2017). *The role of the services economy and trade in structural transformation and inclusive development*. Geneva: Trade and Development Board.
- Unctad. (2022). *World Investment Report 2022: International tax reforms and sustainable investment*. United Nations.
- United Nations, Department of Economic and Social Affairs, Statistics Division. (2002). *International standard industrial classification of all economic activities: ISIC Rev. 3.1 (Draft ESA/STAT/SER.M/4/Rev.3.1, updated February 21, 2002)*. United Nations. <https://unstats.un.org/unsd/statcom/doc02/isic.pdf>
- Vaz, P., and Baer, W. (2014). Real exchange rate and manufacturing growth in Latin America. *Latin American Economic Review*, 24(2), pp. 1-17. DOI: 10.1007/s40503-014-0002-6

Appendix

Table 1 - Classification of service activities

Authors	Criteria	Typology
Browning & Singelmann (1978)	Demand Driven	i) Productive services: Banking; Insurance; Real estate; Engineering; Accounting; Miscellaneous business services; Legal services; ii) Distributive services: Transportation; Communication; Wholesale trade; Retail trade; iii) Personal services: Domestic services; Hotels; Restaurants; Repair services; Barber shops; Entertainment; Laundry; Miscellaneous personal services; iv) Social services: Medical and health services; Hospitals; Education; Welfare, religious services; Non-profit organizations; Postal service; Government services; Miscellaneous social services;
Nusbaumer (1984)	Functions performed and position occupied in the production and exchange circuit	i) Primary: Repairs; Construction; ii) Intermediate: Transportation; Insurance; Financial services; Professional services; Data processing; Rental services; Ancillary services; Dispatch services; Real estate; Wholesale and retail trade; Administration; Insurance; Financial services; Databases; iv) Final: Transportation; Insurance; Financial services; Recreational services; Real estate; Wholesale and retail trade; Domestic and personal services; Rental services;
Marshall (1988)	Type of service consumer	i) Information processing services: R&D; marketing; advertising; engineering; financial services; auditing, office services, photography; architectural and design services; computer services; accounting; real estate; ii) Goods-related services: distribution and storage of goods; wholesalers; maintenance and repair of equipment; communications networks and public utilities; maintenance and repair of vehicles, buildings and other infrastructure; iii) Personnel support services: health, cleaning, domestic, security and insurance, accommodation and personal transport;
Las Casas (1991)	Consumer effort to obtain services	i) Services provided directly to the end consumer and are subdivided into: a) convenience services: when the consumer does not wish to waste time looking for a company, such as a shoe store; b) choice services: referring to services with differentiated costs according to the quality and type of services provided, such as banking and insurance services; and; c) specialty services: whose activities are highly technical and specialized, such as medical and legal services; ii) Industrial services provided to industrial, commercial and institutional organizations, subdivided into: a) equipment services: related to the installation, assembly or maintenance of equipment; b) facility services: which facilitate the company's operations, such as financial services; and; c) consulting services: which assist in decision-making, such as consulting, research and education services;

Silvestro et al. (1992)	Customer processing volume	i) professional services: have a relatively low volume of transactions, relatively high contact time, a high degree of personalization and process orientation, consisting of consulting and engineering activities, corporate services, among others; ii) service stores: have average levels of transaction volume, contact time with customers and customization, orientation of their structure towards the front-office or back-office, such as hotels, retail trade, banking and real estate services, and; iii) mass services: high volume of transactions with customers, limited contact time and little personalization, such as the transportation, confectionery and other sectors.
Hauknes (1998)	Required knowledge base	i) Capital-intensive services: These services use manufacturing technologies and capital goods intensively, including services that are intensive in the use of computing and infrastructure, such as financial, transportation and telecommunications services; ii) Services based on the creation and perceptive use of functional and technologically specialized capabilities: consulting, R&D activities, industrial design, engineering consultancy, software and systems development, etc.; iii) Services based on the application of codified professional skills and abilities: There is usually strong regulation of professional organizations, such as medical, legal, accounting services, among others; iv) Services based on tacit skills: These are human-centered services, which may or may not be regulated, such as restaurants, fashion design, hairdressing, cleaning services;
Oecd (2000; 2005)	Standard Industrial Classification (SIC) Rev. 3	i) Professional business services: Post and telecommunications, financial intermediation, commercial real estate activities, machinery and equipment rental, IT and related activities, R&D and other business activities; ii) Traditional services: Supply of electricity, gas and water; Construction; wholesale and retail trade; repair of motor vehicles, motorcycles and personal and household goods; hotels and restaurants; land, water and air transport; Support and auxiliary transport activities; Travel agency activities; Public administration and defence; Compulsory social security; Education; Health and social assistance; Other community, social and personal service activities;
Miozzo & Soete (2001)	Technological capabilities	i) Supplier-dominated: consisting of personal services (such as education, health, entertainment) and public services, which have little or no technological development and low interaction as final service providers; ii) Large-scale physical networks and information networks: formed by transportation and trade services, telecommunications, gas and electricity distribution, among others, which present economies of scale, great division of labor, and low capacity for innovation; iii) Science-based services and specialized suppliers: composed of R&D activities, software, IT development, etc.,

		characterized as intensive in skilled labor, with capacity for developing technological innovations;
Castellacci (2008)	Innovation patterns	i) Knowledge-intensive services: consisting of activities with a high capacity for generating knowledge and innovation, such as R&D, software, engineering projects and consulting; ii) Support infrastructure services: category subdivided into physical and distributive infrastructure services, for example, transportation and wholesale trade, and network infrastructure services, consisting of activities that make intensive use of ICTs developed by other advanced sectors to increase the efficiency of the production process and the quality of their services, such as finance and telecommunications; iii) Personal services dominated by suppliers: have lower technological content and limited capacity to develop new products and processes internally;
Eichengreen e Gupta (2013)	Technological standard	i) Traditional services: retail and wholesale trade; transport, storage and mail; public administration; ii) Hybrid services: Health; Education; hotels and restaurants and personal services; iii) Modern services: financial services; intellectual property services; insurance and pension services; information services; business services, telecommunications;
Arbache (2014)	Functionality	i) Cost services: infrastructure; logistics; transportation; storage; repairs and maintenance; outsourcing services; travel; accommodation; distribution; ii) Value addition: R&D activities; design; engineering projects; specialized technical services; sophisticated IT services; customized software; branding; marketing;
Machado et. al. (2015)	Destination	i) Final consumption: services consumed predominantly by families; ii) Consumption for companies: services used predominantly in the production process;

Source: adapted from Rodrigues (2024)

Table 2 - Proposal for classifying service activities into two groups.

Modern Technological Services — ISIC Rev. 3.1 Analytical Classification		
Code	Activity name	Selection criterion
6420	Telecommunications	Included as a technological infrastructure service. The activity enables the transmission of voice, images, data and other information through cable, broadcast, relay, satellite and internet-related networks, supporting digital connectivity and cross-sectoral diffusion of knowledge.
7210	Hardware consultancy	Included as a direct ICT technological service. The activity applies specialized technical knowledge to advise on hardware type, configuration and system requirements, combining qualified professionals with advanced computing equipment.
7221	Software publishing	Included as a core technological service. The activity produces, supplies and documents ready-made software, including operating systems and application software, generating codified technological outputs with broad productivity and automation effects.
7229	Other software consultancy and supply	Included as a core technological service. The activity covers analysis, design, programming, maintenance and development of customized software and web pages, directly applying technical knowledge to create digital systems and technological solutions.
7230	Data processing	Included as a data-intensive technological service. The activity operates data-processing systems, customer or proprietary programs, computer time-sharing services and web-hosting facilities, supporting digital production and information-based value creation.
7240	Database activities and on-line distribution of electronic content	Included as a knowledge-diffusion and digital-platform service. The activity assembles, stores, organizes and distributes databases and electronic content online, including search portals and database publishing, enabling broad dissemination of codified knowledge.
7310	Research and experimental development on natural sciences and engineering (NSE)	Included as the central frontier-technology service. The activity conducts basic research, applied research and experimental development in natural sciences, engineering and technology to expand the stock of knowledge and devise new applications.
7421	Architectural and engineering activities and related technical consultancy	Included as an applied engineering and technical-scientific service. The activity covers engineering design, industrial plant design, project management, technical consultancy, geophysical and seismic surveying, spatial information and other engineering-based services.
7422	Technical testing and analysis	Included as a technological validation and measurement service. The activity performs technical testing, inspection, reliability assessment, performance testing, failure analysis, environmental measurement and certification, requiring specialized technical expertise and equipment.
Modern Professional Services — ISIC Rev. 3.1 Analytical Classification		
Code	Activity name	Selection criterion
6511	Central banking	Included as a financial-governance and macro-coordination service. It relies on specialized financial, monetary and organizational expertise to supervise banking operations, manage reserves and currency, monitor money supply and coordinate monetary conditions.
6519	Other monetary intermediation	Included as a modern professional financial-intermediation service. Banks, savings banks, discount houses and credit unions mobilize and redistribute funds through qualified financial labour, organizational capabilities and general-purpose information technologies.

6591	Financial leasing	Included as a capital-allocation and financing service. It structures long-term asset financing and risk allocation, enabling firms to access productive capital goods without being primarily a technological-frontier service.
6592	Other credit granting	Included as a professional credit-allocation service. It covers loan-making by non-deposit institutions, including consumer credit, long-term industrial finance and credit for house purchase, relying on financial expertise and information processing.
6599	Other financial intermediation n.e.c.	Included as advanced financial intermediation. It covers securities investment, dealing on own account, property investment for financial intermediaries, swaps, options, hedging arrangements and financial holding companies, all based on specialized financial knowledge and risk-management capabilities.
6601	Life insurance	Included as a risk-management and long-term financial-planning service. It combines actuarial, financial and organizational expertise to design, price and manage life insurance and reinsurance contracts.
6602	Pension funding	Included as a long-term savings and retirement-income service. It requires actuarial, financial and institutional expertise to organize retirement-income provision and support long-horizon capital allocation.
6603	Non-life insurance	Included as a professional risk-management service. It covers accident, fire, health, property, motor, marine, aviation, transport, liability and pecuniary-loss insurance, supporting business continuity and economic risk allocation.
6711	Administration of financial markets	Included as a market-coordination service. It operates and supervises financial markets, such as stock and commodity exchanges, requiring specialized organizational and financial expertise.
6712	Security dealing activities	Included as a financial-market intermediation service. It covers dealing in financial markets on behalf of others, such as stockbroking, using specialized financial knowledge, market information and transaction technologies.
6719	Activities auxiliary to financial intermediation n.e.c.	Included as a financial advisory and brokerage service. It includes financial advisers, mortgage advisers and brokers, and foreign-exchange bureaux, supporting financial decision-making and capital allocation.
6720	Activities auxiliary to insurance and pension funding	Included as an insurance-professional support service. It includes insurance agents, loss adjusters, risk and damage evaluators, insurance investigators, actuaries and salvage administration, applying specialized professional knowledge to risk systems.
7020	Real estate activities on a fee or contract basis	Included because it covers real estate agents and brokers, intermediation in buying, selling and renting of real estate, property management, real estate appraisal and escrow agents. These activities involve professional intermediation, asset valuation, information processing and transaction-cost reduction, contributing to organizational and allocative efficiency.
7320	Research and experimental development on social sciences and humanities (SSH)	Included as a non-technological knowledge-production service. It performs systematic studies and creative work in economics, psychology, sociology, legal sciences, linguistics, arts and related fields to increase knowledge and devise new applications.
7411	Legal activities	Included as a legal-professional service. It provides legal representation, counselling and preparation of legal documents, including company-formation documents, patents and copyrights, supporting institutional coordination and business organization.

7412	Accounting, book-keeping and auditing activities; tax consultancy	Included as an accounting, audit and tax-professional service. It records transactions, prepares and certifies financial accounts, prepares tax returns and represents clients before tax authorities, supporting compliance, accountability and managerial control.
7413	Market research and public opinion polling	Included as a market-information and analytical service. It investigates market potential, product acceptance, consumer buying habits and collective opinions, including statistical analysis, supporting product development and strategic decision-making.
7414	Business and management consultancy activities	Included as a core organizational-productivity service. It provides advice, guidance and operational assistance on planning, organization, efficiency, control, management information, public relations and accounting procedures.
7430	Advertising	Included as a market-communication professional service. It creates and realizes advertising campaigns across newspapers, periodicals, radio, television, the Internet and other media, supporting demand formation, market expansion and value realization.
7491	Labour recruitment and provision of personnel	Included as a human-capital allocation and organizational service, with internal heterogeneity. Its modern professional component is personnel search, job-description formulation, applicant screening and testing, reference investigation and executive search.
7499	Other business activities n.e.c.	Conditionally included as a residual professional-business class. It contains knowledge-intensive activities such as translation and interpretation, credit rating, business and patent brokerage, appraisal, graphic design, exhibition and congress organization, franchising consultancy and operation of enterprises on behalf of others. Because the class is heterogeneous, it should be used cautiously in empirical applications.

Source: Elaborated by the authors. Note: The activities defined as Renting of land transport equipment (code 7111); Renting of water transport equipment (code 7112); Renting of air transport equipment (code 7113); Renting of agricultural machinery and equipment (code 7121); Renting of construction and civil engineering machinery and equipment (code 7122); Renting of office machinery and equipment, including computers (code 7123); Renting of other machinery and equipment n.e.c. (code 7129) may only be included under a broader efficiency criterion.