

Modern services, real exchange rate and economic growth

Serviços modernos, taxa real de câmbio e crescimento econômico

WALLACE MARCELINO PEREIRA*

FABRICIO J. MISSIO**

FREDERICO GONZAGA JAYME JR.***

RESUMO: O artigo investiga os efeitos de variações do nível da taxa real de câmbio (RER) sobre o setor de serviços modernos. A hipótese é que a manutenção de uma RER competitiva contribui para melhorar o desempenho desse setor na economia. Para tanto, estimamos modelos econométricos com base no Generalised Method of Moments (GMM) para uma amostra de 24 países entre 2000 e 2014. Os resultados sugerem que a RER afeta positivamente o setor de serviços modernos em termos do produto, do emprego e de um índice de mudança estrutural.

PALAVRAS-CHAVE: Crescimento; taxa de câmbio real; mudança estrutural; serviços.

ABSTRACT: This paper explores the effects of changes in the real exchange rate (RER) level on the performance of the modern services sector. The hypothesis is that sustaining a competitive RER contributes to improving the performance of modern services. To do so, we estimated econometric models based on the Generalized Method of Moments (GMM) for a sample of 24 countries between 2000 and 2014. The results suggest that the RER positively affects the modern services sector in terms of output, employment, and a structural change index.

KEYWORDS: Economic growth; real exchange rate; structural change; modern services.

JEL Classification: O1; O2; C23.

* Assistant Professor of the graduate program in Economics at the Federal University of Pará, Belém/PA, Brazil. E-mail: wmpereirabr@ufpa.br. Orcid: <https://orcid.org/0000-0003-1817-3332>.

** Associate Professor of Economics at the Center for Development and Regional Planning, Federal University of Minas Gerais – CEDEPLAR/UFMG, Belo Horizonte/MG, Brazil. E-mail: fjmissio@cedeplar.ufmg.br. Orcid: <https://orcid.org/0000-0003-4561-6039>. The author wishes to acknowledge the financial support from the Brazilian National Research Council (CNPq) and Fapemig (APQ-01964-18).

*** Full Professor of Economics at the Center for Development and Regional Planning, Federal University of Minas Gerais – CEDEPLAR/UFMG, Belo Horizonte/MG, Brazil. E-mail: gonzaga@cedeplar.ufmg.br. Orcid: <https://orcid.org/0000-0002-4617-0107>. This author thanks the financial support from CNPq. Submitted: 12/June/2023; Approved: 23/January/2024.

1. INTRODUCTION

In recent decades, a new productive reshape in economic activities and structure has gained prominence. Within this reconfiguration, the modern services sector has emerged prominently, experiencing a notable increase in its share of aggregate output. Modern services encompass a range of intangible economic activities characterized by high knowledge intensity, innovation, and the utilization of advanced technology. Typically delivered by highly specialized firms, these services include financial services, information technology, telecommunications, consulting services, research and development, and more. These activities rely heavily on the expertise of their workforce to generate and manage knowledge effectively, as well as on their network relationships to drive innovation and economic growth. Furthermore, they can be horizontally integrated into production structures through digital means, thereby enhancing productivity and value addition. Recent studies show the contributions of services to innovation, productivity, and economic growth (Meglio et al., 2018; Ariu et al., 2019; Ledesma and Moro, 2019). In that regard, it can be asserted that the advancement of the modern services sector represents an important opportunity to the economic growth of nations.

The level of development of the productive structure of each nation largely determines the possibilities for expanding the sector itself. While developed countries advanced infrastructure, skilled labor force, and robust technological capabilities, which are conducive to the expansion of the modern services sector, developing economies are often constrained to the production of traditional services (Pereira et al., 2023). There is a significant difference in terms of productivity and the ability to induce economic growth between these two subsectors.

The challenge for developing economies is to create incentives to ease structural change towards sectors with the potential to drive economic growth, such as the industrial sector, ideally characterized by high technological intensity, and the modern services sector. The question that arises is how to achieve this goal. Economic literature suggests that maintaining a stable and competitive real exchange rate (SCRRER) in developing countries is crucial to encouraging the development of industrial sectors (see Bresser-Pereira and Rugitsky, 2020; Pereira and Missio, 2023; among many others). However, there is a scarcity of studies that examine the relationship between the real exchange rate (RER) and the modern services sector.

This paper aims to examine the effects of the real exchange rate (RER) on the performance of the modern services sector. Our hypothesis suggests a positive relationship, supported by identified transmission mechanisms. To this end, we empirically estimate these effects from the perspectives of output, employment, and structural change, the latter measured through a proposed index capturing changes in the productive structure.

Before forwarding this discussion, it is necessary to clarify a certain ambiguity in the literature. On the one hand, we agree with part of the existing literature that argues that services became important because the industry over time has come to

demand complex services. Therefore, the industry continues to be the engine, but now expanding its reach to also impact the services sector¹. In other words, the growth of the latter sector would be associated with the growth of the former one (Zysman et al., 2011). Our previous works have demonstrated a symbiotic relationship between industry and services, wherein the growth of one positively influences the other. This relationship is further reinforced by the maintenance of a competitive RER (Pereira, Missio and Jayme Jr, 2023).

Nevertheless, we implicitly assume that the modern services sector also plays, at least partially, an autonomous role, as long as it adds value to the economy in itself. This is not always clear in the literature. To illustrate our argument, let us take as a starting point the ongoing discussion about the emerging “green transformation”, which emphasizes the transition to environmentally sustainable practices across industries. In our understanding, for this transformation to effectively occur, both a new industry and a new set of modern services must emerge simultaneously, since transformation poses challenges for both sectors. Many of these challenges are correlated, reinforcing the symbiotic relationship between the sectors, while others are not. In other words, for the latter, it is not a derived demand from the industrial sector.

In a world undergoing constant transformation due to the increasing impacts of climate change, economic progress becomes increasingly dependent on advancements in service engineering. This evolution encompasses diverse areas such as logistics, where efficient transportation and supply chain management reduce carbon emissions; insurance, which offers financial protection against climate-related risks; digital transformation, which facilitates data-driven decision-making for sustainability initiatives; and environmental preservation services, which focus on conservation efforts and renewable energy development, among others. In this context, the ability to adapt and innovate in these sectors proves essential for the sustainability and success of global economies.

To fulfill the objective, this work is divided into four sections, in addition to this introduction and the concluding remarks. Section 2 reviews the literature on structural change and the services sector. Section 3 examines studies on the role of the real exchange rate in growth and productive transformation. Sections 4 and 5 address the methodology used for the analysis and the discussion of the results, respectively, providing insights into the empirical approach taken and the implications of the findings.

¹ Authors such as Amsden (2001), for example, argue that poor and developing countries cannot jump directly into medium and high technology services without establishing a relatively diversified and competitive manufacturing sector. As the author documented, there is no historical experience in which a country has achieved high per capita income without industrialization. Therefore, deindustrializing economies will necessarily have to recover their manufacturing industry as an additional condition to advance in more sophisticated manufacturing technologies along with new services.

2. STRUCTURAL CHANGE, ECONOMIC GROWTH, AND THE SERVICES SECTOR

Economic growth can be understood as a process of structural change that stimulates a shift in the sectoral composition of the economy. The prominence of the traditional sector (agriculture and traditional services) transfers to the modern sector (industry). Thus, the acceleration and sustainment of economic growth are strongly correlated with a dynamic and integrated industrial base, both within and across sectors.

Simultaneously, there has been a broad debate about the role of the services sector in economic growth. This issue gained prominence from the mid-1960s to the early 1970s when the share of the services sector in employment and output began to increase expressively.

The central point of the discussion revolves around enquiring whether the rise of the services sector would be able to ensure growth rates consistent with the pace of growth led by the industrial sector (Fisher, 1935, 1939; Clark, 1967). Furthermore, efforts were made to understand the causes of the emerging structural change in developed countries.

In this regard, on the demand side, the relative change between the income elasticity of demand for industrial products and services deserves attention, precisely in resulting in an increase in per capita income. The expansion of services arises from their ability to meet the more sophisticated demands of society, so that, as per capita income increases, there is a greater propensity for consumer habits to shift towards products in this sector. Therefore, as per capita output grows faster in the industry, the expansion of services is determined by the intermediary demand for services (Fuchs, 1965).

On the supply side, the discussion about the role of services in the emerging structural change focused on Baumol's concept of the cost of disease. According to Baumol (1967), the growth of the services sector implies a reduction in the overall productivity of the economy. In other words, with the increase in productivity of the industry, there would be a transfer of labor from the industry to the services sector, resulting in an overall reduction in productivity. Regarding relative prices, although the services sector is less productive, wages in this sector follow industrial sector wages, leading to an increase in production costs. This singularity, known as the cost disease, suggests that the relative increase in the employment share of the services sector compared to total employment could pose challenges for economic performance.

Recent research has challenged conventional perspectives by uncovering new roles for the services sector.

2.1 Modern services and the Real Exchange Rate

Recent studies demonstrate that a set of activities referred to as the modern services sector can stimulate economic growth, particularly when establishing a

symbiotic relationship with the industry (Miles et al., 2008; Hertog, 2000; Muller, 2001; Miozzo and Soete, 2001; Cainelli et al., 2005; Cainelli and Mazzanti and 2013). Thus, countries that undergo deindustrialization while preserving sophisticated manufacturing activities, and simultaneously manage to stimulate the emergence of modern services, minimize the negative effects of deindustrialization on output.

In developed economies, the current productive structure is characterized by a significant number of companies involved in the production of integrated goods and services (Acemoglu et al., 2007; Nordås, 2010; Nordås and Kim, 2013; Cadestin and Miroudot, 2020). This results from the advent of the technical-economic paradigm of the 1970s and 1980s, driven by the development of Information and Communication Technology (ICT) and the creation of new Research and Development (R&D) activities.

Dunning (1989) points out the role of outsourcing on the growth of services; the expansion of the value-added of physical production through the incorporation of marketing, distribution, maintenance, after-sales, and support services; growth in financial services, insurance, and transportation, aiming for greater efficiency in the economy; and, finally, their ability to contribute to product innovation².

Recently, evidence reinforced the thesis of increasing returns and a positive relationship between modern services and industrial and aggregate productivity (Dasgupta and Singh, 2006; Giovanini and Arend, 2017; Di Meglio et al., 2018; Ariu et al., 2019; Ledesma and Moro, 2019).

Simultaneously, a competitive real exchange rate can have an impact on the services sector. Baggs et al. (2010) analyze Canadian firms and show that real depreciations of the dollar increase the probability of firms' survival, sales, and profitability. Furthermore, the authors find evidence that the magnitude of the effects of the exchange rate is different for manufacturing and services firms. The exchange rate has a more significant impact on the profits of manufacturing firms, while the impact on survival is greater among service firms. Finally, the magnitude of the impact on sales is similar in both sectors.

Regarding exports, Visintin et al. (2010) analyzed the trade performance of 15 European countries in eight service sectors from 1992 to 2004. The results showed that the real exchange rate positively affects the trade performance of services and that the impact is closely related to the structural characteristics of each service activity. Pattichis (2012) explored the short- and long-term effects of the real exchange rate on the trade balance of services in the United States and the United Kingdom between 1986 and 2009 (quarterly data). The results show that the real exchange rate has a statistically significant effect on the trade in services. Similarly, Eichengreen and Gupta (2013), in their analysis of developed and emerging countries, conclude that the effect of the real exchange rate is stronger for the exports

² Based on these characteristics, Baumol (1985) re-examined his 1967 theses and argued that there are certain activities within the services sector that present levels of productivity comparable to industrial activities.

of modern services than for goods. This is because modern services sectors use fewer imported inputs and have lower fixed entry costs, making the supply response more elastic. Additionally, the demand for these exports is also more elastic in terms of price.

In addition, Sahoo et al. (2019) analyzed the exports of the services sector in India and concluded that a competitive exchange rate policy, along with appropriate supply-side policies, is essential to sustain the long-term increase in services exports.

On the other hand, Seo et al. (2012) did not find evidence that the real exchange rate affects the services export market for a sample of 17 OECD countries between 2001 and 2007. Nevertheless, they conclude that factors related to research and development (R&D), fixed capital formation, and investment in information technology, among others, positively impact services exports.

3. THE REAL EXCHANGE RATE AND THE SERVICE SECTOR: OPERATING CHANNELS

This section intends to elucidate features of the modern services sector that are closely related to the channels through which the Real Exchange Rate (RER) impacts this sector.

It is important to emphasize that the entry and exit costs of firms in the modern services sector are lower than in manufacturing (see Eichengreen and Gupta, 2013). Also, production chains are shorter compared to manufacturing. This is because the production process in services involves fewer stages and is carried out in relatively smaller physical spaces. Thus, the sector requires a smaller volume of investment in physical capital. Additionally, being a “tradable” sector, it is highly sensitive to international competition.

Hence, it is possible to consider that the RER affects the services sector through at least three channels: external competitiveness; profitability/profit; and investment (Figure 1).

A competitive RER improves the relative position of domestic service companies both in the country and abroad, as it reallocates the relative operating costs in favor of national companies, as highlighted by Baggs et al. (2010). Regarding foreign trade, service prices become relatively cheaper in terms of foreign currency, implying an increase in external competitiveness (step 1).

Under these conditions, engineering, architecture, and specialized consulting services such as ICT, product design, financial services, R&D, and the development of various software and applications gain market share internationally. Regarding the domestic market, the currency devaluation increases competition among service companies.

With more expensive import prices, local companies shift demand to domestic suppliers, thus inducing the substitution of service imports. This shift leads to the

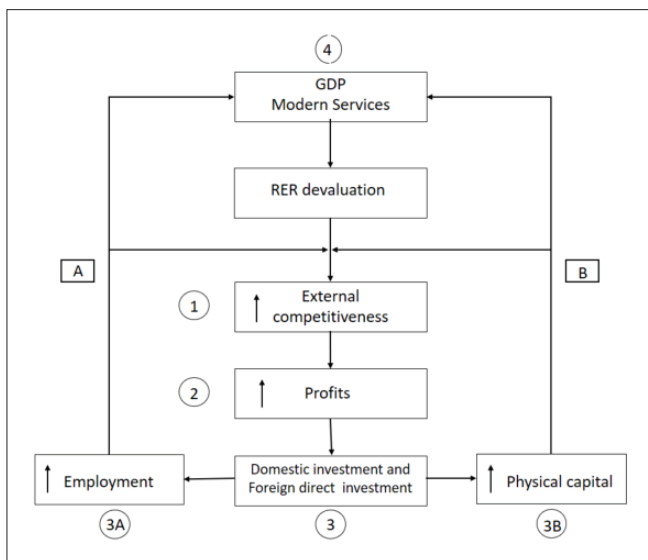
acquisition of new clients and an increase in sales volume, resulting in sectoral profit growth (step 2).

The signal provided by the profits of companies operating in the domestic market, coupled with the devalued RER, creates a favorable environment for both foreign direct investment and domestic investment (3).

In the former case, the currency devaluation makes service assets cheaper, encouraging foreign investors to establish operations or expand businesses in the country.

In the latter case, domestic entrepreneurs update their investment plans to increase investments. The combination of external and domestic investments arises through the expansion of physical capital (3A) and the hiring of new professionals (3B).

Figure 1: Effects of RER on modern services



Source: Prepared by the authors.

Investment in physical capital occurs through the acquisition of modern machinery, expansion of work facilities, and overall infrastructure, including hardware, software, communication systems, network structures, and electronic devices typical of each service activity.

On the other hand, hiring investment focuses on highly qualified and specialized professionals. This strategy requires an evaluation of the existing skill set, with decisions made based on the level and type of demand to acquire new skills or expand those already employed.

This is because techno-scientific knowledge is the distinguishing factor in the sector, and companies have a portfolio of standardized basic products that differentiate as customers customize the product. Furthermore, with the job market in

the service sector thriving, and the expectation of higher wages compared to traditional services, segments of society are motivated to invest in knowledge with the aim of securing employment in the sector.

Therefore, a competitive RER contributes to expanding market size through investment in physical capital and new hires. The result of this cycle is the increased share of modern services in GDP resulting from economic dynamization (step 4). This entire process contributes to enhancing the sector's innovation capacity through "*learning by doing*" and "*learning by using*" in a feedback loop.

The macroeconomic effects are perceived collectively. On the one hand, the exchange rate positively affects the manufacturing sector, and on the other hand, the modern services sector. Assuming there is a symbiosis between both sectors, a favorable exchange rate policy affects the economic system in a complementary and interdependent manner. If manufacturing uses the modern services sector as an input for its production activity, this behavior contributes to improving manufacturing productivity and the economy.

In summary, based on the identified transmission mechanisms, we argue that maintaining a competitive and stable RER can contribute to long-term growth by influencing sectoral composition and integration between the manufacturing sector and sophisticated service sectors. With this understanding, we will now proceed to conduct econometric exercises to investigate the RER's ability to affect the performance of the modern services sector or to generate a pro-economic growth structural change.

The next section performs empirical analysis and seeks to discern the impact of the Real Exchange Rate (RER) on a structural change index to measure changes in the production structure towards the modern services sector. Additionally, it examines the effects on both an International Relative Servitization Index based on employment, and one based on Gross Domestic Product (GDP).

4. MATERIAL AND METHODS

The dataset consists of a sample comprising 24 countries spanning the years 2000 to 2014 (a list of countries can be found in Appendix A). Countries were selected based on specific criteria: Inclusion of European countries with a per capita GDP below the European Union average, while for other countries in the dataset, we chose those with a per capita GDP below that of the United States. The choice of this selection criterion follows the literature which asseverates that the RER plays a significant role as an economic policy tool for countries that are far from the technological frontier. It serves as a mechanism to expedite economic growth and ease *catching up* (Rodrik, 2008; Razmi, Rapetti and Skott, 2012; Missio, Jayme Jr., Brito, and Oreiro, 2015; Gabriel, Jayme Jr., and Oreiro, 2017).

Data come from the WIOD Socio-Economic Accounts, which encompasses 56 sectors. We chose this dataset because it enables a more accurate categorization of activities into traditional and modern services (a list of modern services activities

is provided in Appendix B). However, there is a limitation concerning the availability of disaggregated data for a wide-ranging sample of countries.

The variables of interest include: 1) Structural Change Index (SCI), capturing the intensity of changes in activities within a particular sector; 2) International Relative Servitization Index (IRSI) on the employment side; and 3) International Relative Servitization Index (IRSI) on the Value-Added side.

The SCI ranges from zero to one, where zero represents the absence of structural change and one stands for complete structural change. The closer the index approaches unity, the higher the intensity of productive transformation. The SCI follows:

$$SCI = \frac{1}{2} \sum |x_{i,t} - x_{i,t-1}| \quad (1)$$

where $x_{i,t}$ and $x_{i,t-1}$ are the share of each sector in the total number of people employed in different periods. The values are taken as absolute values to prevent the cancellation of positive and negative values when sectors are aggregated. The sum is divided by two to avoid double counting.

The International Relative Servitization Index (IRSI) is a version of the International Relative Deindustrialization Index (IRDI) proposed by Arend (2015). Its goal is to emphasize the relative performance of sectoral products across various countries and regions over time. In this study, the adaptation of the indicator aims to incorporate the dimensions of both employment and value added.

The index is constructed in two stages. Firstly, a services employment index (EI) is built, expressing the relative change over time between two numerical magnitudes. This index serves as an alternative way to make international performance comparisons of services. The base year is 2000. The equation is expressed as follows:

$$EI_{t,t+n} = \left(\frac{EI_{t+n}}{EI_t} \right) * 100 \quad (2)$$

The second stage is the construction of the IRSI. It is built from EI and can be expressed as follows:

$$IRSI_{t, país} = \frac{EI_{t, país}}{EI_{t, país/região de referência}} \quad (3)$$

Therefore, if $IRSI > 1$ ($IRSI < 1$), the modern services sector is growing (contracting) compared to the reference country. For our study, the reference economy is the United States. The procedure for the value added of the services sector is identical.

An important challenge is defining and estimating the RER. To ensure robust results, we opted for the use of different measures. Data for this variable were obtained from the Bruegel dataset and the Research and Expertise on the World Economy – CEPII (Table 1). Bruegel's exchange rates are constructed from a basket of trading partners. For example, in the case of 66 partners, we have the variable *rer66*, and for 171 partners, the corresponding variable is *rer171*.

Regarding CEPII, we have included the real exchange rate weighted by 30

fixed trading partners (rer30), by 186 fixed trading partners (rer186), as well as the real exchange rates weighted by 30 and 186 alternating fixed trading partners in the non-overlapping five-year average (rer30a) and (rer186a), respectively.

The model includes a set of control variables based on the literature on structural change and deindustrialization. These variables encompass manufacturing productivity, wage share in income, degree of economic openness, and population (used as a proxy for market size), as presented in Table 1.

Table 1: Indicators and variables used

Description of indicators	Variables	Source
Index of Structural Change in Services	sci_{ms}	WIOD
International Relative Servitization Index (Employment)	$irsi_e$	WIOD
International Relative Servitization Index (Gross Domestic Product)	$irsi_{gdp}$	WIOD
Real exchange rate weighted by 171 trading partners	rer (171)	Bruegel datasets
Real exchange rate weighted by 66 trading partners	rer (66)	Bruegel datasets
Real exchange rate weighted by 30 trading partners	rer (30)	CEPII
Real exchange rate weighted by 186 trading partners	rer (186)	CEPII
Real exchange rate weighted by 30 alternating trading partners	rer (30a)	CEPII
Real exchange rate weighted by 186 alternating trading partners	rer (186a)	CEPII
Manufacturing productivity (Value Added ratio per employed person – VA/PO)	manup	WIOD
Labour Share	lsh	WIOD
Degree of openness of the economy	open	World Bank data
Population	pop	World Bank data

Source: Prepared by the authors.

4.1 Empirical assessment

The empirical analysis seeks to analyze the impact of the Real Exchange Rate (RER) on a structural change index, which measures changes in the production structure towards the modern services sector. Additionally, it examines the effects on both an International Relative Servitization Index based on employment and one based on Gross Domestic Product (GDP). Therefore, the following empirical models will be considered:

$$SCI_{ms,i,t} = \alpha_i + \lambda_1 SCI_{ser,i,t-1} + \beta_1 rer_{i,t} + \beta_3 X_{i,t} + \varepsilon_{i,t} \quad (4)$$

$$IRSI_{e,i,t} = \alpha_i + \lambda_1 IRSI_{e,i,t-1} + \beta_1 rer_{i,t} + \beta_3 X_{i,t} + \varepsilon_{i,t} \quad (5)$$

$$IRSI_{gdp,i,t} = \alpha_i + \lambda_1 IRSI_{gdp,i,t-1} + \beta_1 rer_{i,t} + \beta_3 X_{i,t} + \varepsilon_{i,t} \quad (6)$$

Where the subscribed t represents the present time; $SCI_{ms,i,t}$ ($SCI_{ms,i,t-1}$) correspond to the Structural Change Index in the modern services sector, constructed from employment data by economic activity; $IRSI_{e,i,t}$ ($IRSI_{e,i,t-1}$) corresponds to the International Relative Servitization Index of employment in the services sector; $IRSI_{gdp,i,t}$ ($IRSI_{gdp,i,t-1}$) corresponds to the International Relative Servitization Index from the perspective of GDP; $rer_{i,t}$ is the real exchange rate; $X_{i,t}$ corresponds to the group of control variables and; lastly, $\varepsilon_{i,t}$ are the error terms of the respective equations.

It is worth emphasizing that the index in equation (3), being more sensitive to changes over time, identifies only the presence or absence of changes in the productive structure without specifying whether the change is positive or negative. It captures the relationship between the level of the real exchange rate and the employment structure in the service sector. That is, to what extent does the level of the real exchange rate stimulate the intensity of the change in the economic structure captured through employment?

In contrast, equations (5) and (6) capture the relative growth or decline of the modern service sector from the perspectives of both employment and GDP in the sector. This serves to complement the analysis. These equations aim to measure the extent to which competitive exchange rates contribute to reducing the relative distance of the service sector in the analyzed countries compared to the U.S. economy.

Methodologically, according to estimations by Bruegel and CEPIL, “a real (nominal) appreciation of the national currency is recorded as an increase in the real (nominal) effective exchange rate index” (Couharde et al., 2018, p. 9). Therefore, regarding the real exchange rate, the results are expected to reveal an inverse relationship. That is, a devalued exchange rate positively impacts the dependent variables.

Control variables are expressed in growth rates and lagged by one period to mitigate simultaneity and reverse potential causality bias. Additionally, we conducted the Harris-Tzavalis unit root test to ensure stationarity. Thus, it is expected that manufacturing productivity contributes positively to the structural change in the service sector, both from the employment and GDP perspectives. Existing literature suggests that an influential factor contributing to the performance of the service sector is manufacturing productivity. As productivity in the manufacturing industry improves, portions of its workforce are typically reallocated to either traditional or modern service sectors.

Furthermore, studies suggest that a productive industry tends to demand more modern services. Therefore, this variable captures the role of manufacturing technological advancement in the performance of service activities.

Regarding the share of wages in income (*lshg*), the anticipated effect is ambiguous. On the one hand, we understand that variable captures how sensitive modern services are to capital accumulation. In other words, if profits are compressed, the tendency is to reduce hiring and increase investment in labor-saving technolo-

gy. Therefore, a negative effect on job performance is expected ($irsi_e$) and, consequently, in the structural change of services ($scims$).

On the other hand, it should be noted that as the share of wages in income increases, the productive capacity utilization also rises. This not only directly stimulates the modern services sector through higher demand but also indirectly, as this sector plays an essential role in the industrial system. Therefore, it is expected that the sector's GDP ($irsi_{gdp}$) respond positively to an increase in $lshg$.

The degree of openness captures the effect of countries' exposure to the international market. A high degree of openness poses challenges to the sector in terms of importing machinery, software, and workforce. Imports can negatively impact the sector by supplying the local market with external services, but they can also have a positive effect when firms import machinery and hire more qualified professionals. In this case, the overall effect is indeterminate.

Finally, the population variable aims to assess whether the size of the consumer market impacts the performance of the modern service sector. An undefined outcome is expected for two reasons. First, the sector is strongly linked to both domestic and international industrial demand. Second, the sector's performance is contingent upon several factors, including income levels, preferences, and consumption propensities within the local consumer market. Thus, these factors present specific considerations for each country in the sample.

4.2 Methodology

To deal with the endogeneity of the variables, we adopt the GMM System methodology proposed by Arellano and Bover (1995) and Blundell and Bond (1998). This method involves constructing a system of stacked regressions in both differenced and level formats. The instruments for regressions in the first difference remain the same as in GMM difference, although in level, the endogenous variables are lagged differences. Thus, while the level regressors may still be correlated with country-specific effects, the lagged difference of these variables used as instruments is more likely to be uncorrelated with country-specific effects.

The validity of GMM estimators heavily depends on the exogeneity of instruments used in the models, which can be tested by the J-statistic of the Hansen test and the Arellano-Bond test for AR (2) in the first difference.

Regarding instruments, it is likely that many of them exceed endogenous variables. The literature is not very specific in determining the maximum number of instruments to be used. Roodman (2009) suggests, as a practical rule, that instruments should not exceed the number of individual units in the panel. For this study, the maximum number of instruments was set at two by collapsing.

The subsets of regressors we employ contain variables that could be seen as exogenous (e.g., population growth and manufacturing productivity growth) or predetermined/partially endogenous (e.g., labor share in income, degree of economic openness, and the index of structural change in the manufacturing sector). In these cases, we acknowledge the possibility of reverse causality.

The RER is assumed to be endogenous, considering the ability of the exchange rate to shape productive structures and the type of productive structure affecting the exchange rate trajectory. Following Roodman (2009), the treatment for variables did not exceed two lags. Finally, for better consistency, the equations were estimated in two steps with correction for heteroscedasticity and autocorrelation.

It is important to note that constructing averages over time windows is common. This is a standard procedure in panel data analysis, as it reduces undesired effects caused by the likely presence of unit roots and adjusts the panel structure to satisfy the consistency properties of GMM estimators. However, as the panel is short ($N > T$), both with and without time averages, there would be no potential unit root problem. Nevertheless, we conducted the Harris-Tzavalis test to detect the presence or absence of a unit root and proceeded with appropriate corrections.

5. RESULTS

5.1 Analysis of the relationship between exchange rate and Structural Change Index in modern services

The estimates for model (1) reveal a significant and inverse relationship between the RER and the occupational structure of activities within the modern services sector, as demonstrated by all six estimated equations with a confidence level of 5%. This finding supports the hypothesis that a devalued exchange rate intensifies changes in the occupational structure of activities within this sector. Hence, it can be argued that competitive exchange rates influence investment allocation among service activities, thereby promoting the reorganization of the labor market within these sectors (Table 2).

Table 2: Structural Change Index in services and adjusted real exchange rate – GMM System (twostep robust)

	(rer171)	(rer66)	(rer30)	(rer30a)	(rer186)	(rer186a)
lncscms [t-1]	0.2311** (0.100)	0.2256** (0.100)	0.3003** (0.132)	0.3005** (0.132)	0.2953** (0.134)	0.3021** (0.138)
rer	-0.0463** (0.020)	-0.0380** (0.015)	-0.0774** (0.036)	-0.0776** (0.036)	-0.0812** (0.039)	-0.0738** (0.037)
manupg [t-1]	1.3401*** (0.484)	1.1899*** (0.398)	1.4298*** (0.507)	1.4298*** (0.507)	1.4879*** (0.548)	1.3984*** (0.529)
lshg [t-1]	-0.5627 (0.988)	-0.7944 (0.924)	-1.1948 (1.071)	-1.1972 (1.071)	-1.2959 (1.067)	-1.3412 (1.069)
openg [t-1]	-1.5365*** (0.563)	-1.4633*** (0.541)	-1.4018* (0.801)	-1.4044* (0.801)	-1.3992* (0.802)	-1.3348* (0.779)

popg [t-1]	0.7182*	0.6884**	0.3752*	0.3744*	0.3982*	0.4002*
	(0.378)	(0.330)	(0.225)	(0.225)	(0.226)	(0.224)
Const.	3.0987*	2.2970*	6.3609*	6.3713*	6.7543*	5.9953*
	(1.764)	(1.310)	(3.339)	(3.344)	(3.720)	(3.465)
Observations	312	312	312	312	312	312
Instruments	10	10	10	10	10	10
Arellano-Bond test for AR (2) in first difference (p-value)	0.3312	0.4172	0.3823	0.3774	0.3602	0.4520
Hansen test of joint validity of instruments (p-value) ansep	0.8603	0.8821	0.6399	0.6409	0.6505	0.5862

Source: Own elaboration. Note: *p<0.10 ** p<0.05; ***p<0.01.

Based on the results, it is possible to argue that the structural change in modern services fundamentally stems from the structural transformation of the industry, with the exchange rate being significant at 5%. There exists a close relationship between both sectors, to the extent that the literature warns of a symbiotic relationship between them (Miles et al., 2008; Hertog, 2000; Muller, 2001; Miozzo and Soete, 2001; Cainelli et al., 2005; Cainelli; Mazzanti; 2013).

To analyze this issue, we included the structural change index for manufacturing (*scimanu*) in the equation to investigate whether the role of the real exchange rate remains significant, which confirms this hypothesis (Table 3).

Table 3: Structural Change Index in services and adjusted real exchange rate – GMM System (twostep robust)

	(rer171)	(rer66)	(rer30)	(rer30a)	(rer186)	(rer186a)
Inscims [t-1]	0.2668***	0.2616***	0.2102*	0.2100*	0.2022*	0.2089*
	(0.091)	(0.090)	(0.121)	(0.121)	(0.112)	(0.112)
rer	-0.0422***	-0.0371***	-0.0697**	-0.0699**	-0.0726**	-0.0651**
	(0.016)	(0.013)	(0.030)	(0.030)	(0.035)	(0.032)
Inscimanu [t-1]	0.0985**	0.0891*	0.1332***	0.1336***	0.1372***	0.1356***
	(0.048)	(0.049)	(0.046)	(0.046)	(0.036)	(0.036)
manupg [t-1]	1.1179***	1.0101***	1.6820**	1.6841**	2.1177**	1.9973**
	(0.384)	(0.377)	(0.747)	(0.748)	(0.991)	(0.973)
lshg [t-1]	-2.1032***	-2.1054***	-1.4157	-1.4137	-1.4432	-1.4787
	(0.741)	(0.749)	(0.951)	(0.951)	(0.976)	(0.941)
openg [t-1]	-0.9610	-1.0001	-2.1107	-2.1144	-2.3441	-1.9790
	(0.677)	(0.671)	(1.476)	(1.477)	(1.849)	(1.746)

popg [t-1]	0.4375** (0.215)	0.4070** (0.205)	0.3842* (0.198)	0.3839* (0.198)	0.4149** (0.183)	0.4036** (0.187)
Const.	2.8789* (1.578)	2.3612* (1.249)	5.5680* (2.858)	5.5849* (2.869)	5.8598* (3.291)	5.0850* (3.026)
Observations	312	312	312	312	312	312
Instruments	14	14	12	12	12	12
Arellano-Bond test for AR(2) in first difference (p-value)	0.7914	0.8012	0.7543	0.7490	0.6648	0.8245
Hansen test of joint validity of instruments (p-value) hansenp	0.8100	0.8388	0.6900	0.6927	0.6805	0.6522

Source: Own elaboration. Note: *p<0.10 ** p<0.05 ***p<0.01.

The structural change index (scimanu) is positive and significant, indicating that the combination of RER and structural change within the industrial sector notably impacts the degree of structural transformation in the services sector. This finding underscores the shared characteristics between the services and industrial sectors. Consequently, the influence of exchange rate dynamics extends beyond re-allocating resources within manufacturing to invigorating the services sector as well. In an environment where both sectors exhibit symbiotic relationships, the exchange rate can have a dual effect, fostering investment across a diverse spectrum of economic activities.

Assuming that the RER influences both manufacturing and modern services, one could argue that well-coordinated strategies for productive stimulus and appropriate macroeconomic policies can contribute to sustained sectoral growth rates and positive structural change. Maintaining competitive exchange rates has the potential to promote improvements in the sectoral composition of employment and GDP within the modern services sector. These issues are further explored below.

5.2 The relationship between real exchange rate and relative servitization index (employment)

Table 4 illustrates a notable and statistically significant inverse correlation, at the 5% level, between the real exchange rate and the relative servitization index from an employment standpoint. This finding implies that competitive exchange rates enable the expansion of modern service activities, thereby generating heightened demand for labor. Additionally, it plays a role in narrowing the employment gap within the domestic labor market when compared to the labor market of the leading economy (USA).

In other words, the exchange rate enhances the absorption of workers and indicates to the labor market the necessity for developing a skilled workforce

equipped with innate abilities tailored to the modern services sector. The control variables produced the anticipated outcomes.

Table 4: Relative Servitization Index (employment)
and adjusted real exchange rate – GMM System

	(rer171)	(rer66)	(rer30)	(rer30a)	(rer186)	(rer186a)
<i>lnirsi_e</i> [t – 1]	1.1868*** (0.047)	1.2399*** (0.105)	1.2052*** (0.067)	1.2053*** (0.067)	1.1921*** (0.065)	1.1992*** (0.061)
<i>rer</i>	-0.0026** (0.001)	-0.0031** (0.001)	-0.0022** (0.001)	-0.0022** (0.001)	-0.0024** (0.001)	-0.0022** (0.001)
<i>manupg</i> [t-1]	0.3434*** (0.096)	0.7272*** (0.186)	0.3376** (0.160)	0.3378** (0.160)	0.3478** (0.163)	0.3606** (0.150)
<i>lshg</i> [t-1]	-0.0388 (0.310)	-0.6566 (1.535)	-0.3488 (0.360)	-0.3490 (0.360)	-0.0829 (0.918)	-0.3645 (0.387)
<i>openg</i> [t-1]	-0.3423** (0.144)	-0.5225** (0.220)	-0.2580* (0.143)	-0.2578* (0.144)	-0.2482* (0.145)	-0.2702** (0.123)
<i>popg</i> [t-1]	-0.0004 (0.001)	1.3675 (3.708)	1.5495 (2.450)	1.5585 (2.459)	2.4430 (2.716)	1.7593 (2.232)
Const.	0.2798*** (0.100)	0.2948** (0.129)	0.2302*** (0.087)	0.2302*** (0.087)	0.2546** (0.112)	0.2346** (0.095)
Observations	312	312	312	312	312	312
Instruments	10	10	10	10	10	10
Arellano-Bond test for AR(2) in first difference (p-value)	0.0905	0.6517	0.1028	0.1031	0.1429	0.1035
Hansen test of joint validity of instruments (p-value) hansenp	0.2788	0.8919	0.8049	0.8043	0.7575	0.8256

Source: Own elaboration. Note: *p<0.10 ** p<0.05; ***p<0.01.

5.3 Analysis of the relationship between exchange rate and relative servitization index (gross domestic product)

Equation (3) assesses the relationship between RER and relative servitization from the GDP perspective. The results are reported in Table 5. The real exchange rate (*rer*) exhibited the expected sign and is statistically significant. These findings provide empirical evidence supporting the idea that a competitive exchange rate can exert a significant influence on sectoral growth.

Considering the channels outlined, a depreciated RER initiates a series of actions aimed at enhancing the performance of service firms. Increased investments in phys-

ical capital and the hiring of additional workers result in higher sectoral output, making the sector more vibrant and attractive for new entrepreneurial ventures.

Table 5: Relative Servitization Index (Gross Domestic Product)
and Adjusted Real Exchange Rate - GMM System

	(rer171)	(rer66)	(rer30)	(rer30a)	(rer186)	(rer186a)
<i>lnirsi_{gdp}</i> [t-1]	1.0262*** (0.023)	1.0273*** (0.022)	1.0177*** (0.034)	1.0177*** (0.034)	1.0193*** (0.034)	1.0258*** (0.028)
rer	-0.0021*** (0.001)	-0.0018*** (0.001)	-0.0034** (0.002)	-0.0034** (0.002)	-0.0037** (0.002)	-0.0032** (0.001)
manupg [t-1]	0.1338** (0.054)	0.1571*** (0.059)	0.1236* (0.074)	0.1238* (0.074)	0.1261* (0.073)	0.1250* (0.072)
lshg [t-1]	0.1498 (0.101)	0.1452 (0.102)	0.1711 (0.105)	0.1714 (0.105)	0.1731 (0.106)	0.1767 (0.111)
openg [t-1]	-0.1338*** (0.034)	-0.1487*** (0.038)	-0.1287*** (0.043)	-0.1289*** (0.043)	-0.1284*** (0.042)	-0.1276*** (0.043)
popg [t-1]	0.3491 (0.373)	0.4513 (0.345)	0.2579 (0.515)	0.2580 (0.515)	0.3458 (0.550)	0.3517 (0.521)
Const.	0.2032** (0.079)	0.1734** (0.068)	0.3313** (0.157)	0.3324** (0.158)	0.3564** (0.178)	0.3091** (0.137)
Observations	312	312	312	312	312	312
Instruments	10	10	10	10	10	10
Arellano-Bond test for AR(2) in first difference (p-value)	0.1799	0.1812	0.2723	0.2717	0.2976	0.2551
Hansen test of joint validity of instruments (p-value) hansenp	0.6361	0.6430	0.6969	0.6947	0.6795	0.5375

Source: Own elaboration. Note: *p<0.10 ** p<0.05 ***p<0.01.

6. CONCLUSIONS

The findings of this study suggest that the RER exerts an impact on the modern service sector, a conclusion also supported by Baggs et al. (2010). Given the characteristics of this sector, competitive exchange rates have the potential to positively influence entrepreneurs' profit expectations, thereby incentivizing investment in hiring and expanding productive capacities.

As a policy recommendation, it is important to emphasize two issues. First, the need to consider the modern service sector within the framework of economic growth strategy. Meglio et al. (2018), Ariu et al. (2019), and Ledesma and Moro

(2019) illustrate that the service sector fosters innovation and productivity, establishing a symbiotic and increasingly crucial relationship with manufacturing.

Second, the macroeconomic effects of a competitive real exchange rate suggest extensive and complementary outcomes among production chains, a notion supported by Visintin et al. (2010) and Eichengreen and Gupta (2013). The real exchange rate positively affects both the manufacturing and modern service sectors. By stimulating the modern service sector, the industry gains access to a sector capable of offering services that ensure international competitiveness. In an environment where both sectors interact in the production process, long-term growth requires coordinated macroeconomic and productive policies.

Finally, it is noteworthy that this study contributes to the literature by highlighting the need for further research exploring the relationship between RER and modern services. While the findings are not definitive, they warrant attention in catalyzing discussions on the imperative of examining the scope and magnitude of exchange rate policy impacts. Despite challenges associated with data availability that may hinder comprehensive exploration of the topic, there is an ongoing need to analyze temporal and regional subsets with larger samples, representing an open challenge for future research endeavors.

REFERENCES

- Acemoglu, D., Aghion, P., Lelarge, C., Van Reenen, J., & Zilibotti, F. (2007). Technology, Information, and the Decentralization of the Firm. *The Quarterly Journal of Economics*, (22)4, 1759-1799.
- Amsden, A. H. (2001). The Rise of “the Rest”: Challenges to the West from late-industrializing economies. Oxford: Oxford University Press.
- Arend, M. (2015). A industrialização do Brasil ante a nova divisão internacional do trabalho [Texto para discussão, nº 2105]. Rio de Janeiro, RJ: IPEA, 1-62.
- 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.
- Arellano, M., & Bond, S. (1991). Some tests of specification for panel data: Monte Carlo evidence and an application to employment equations. *The review of economic studies*, (58)2, 277-297.
- Arellano, M., & Bover, O. (1995). Another look at the instrumental variable estimation of error-components models. *Journal of econometrics*, (68)1, 29-51.
- Baggs, J., Beaulieu, E., & Fung, L. (2010). Are Service Firms Affected by Exchange Rate Movements? *Review of Income and Wealth*, (56) 156-176.
- Baumol, W.J. (1967). Macroeconomics of unbalanced growth: the anatomy of urban crisis. *American Economic Review*. (57)3, 415-426.
- Baumol, W. J. (1985). Productivity policy and the service sector. *Managing the Service Economy: Prospects and Problems*, 301-317.
- Bresser-Pereira, L. C.; Rugitsky, F. Industrial policy and exchange rate skepticism. *Cambridge Journal of Economics*, v. 42, p. 617-632, 2018.
- Brito, S., Magud, M. N. E., & Sosa, M. S. (2018). *Real exchange rates, economic complexity, and investment*. International Monetary Fund.
- Brown, P., Lauder, H., & Ashton, D. (2010). *The global auction: The broken promises of education, jobs, and incomes*. Oxford University Press.
- Blundell, R., & Bond, S. (1998). Initial conditions and moment restrictions in dynamic panel data models. *Journal of econometrics*, (87)1, 115-143.

- Cadestin, C. & S. Miroudot (2020), "Services exported together with goods", *OECD Trade Policy Papers*, n°. 236, OECD Publishing, Paris, <https://doi.org/10.1787/275e520a-en>.
- Cainelli, G., Evangelista, R., & Savona, M. (2005). Innovation and economic performance in services: a firm-level analysis. *Cambridge Journal of Economics*, (30)3, 435-458.
- Cainelli, G., & Mazzanti, M. (2013). Environmental innovations in services: Manufacturing services integration and policy transmissions. *Research Policy*, (42)9, 1595-1604.
- Clark, C. (1967). The conditions of economic progress. *The conditions of economic progress*. MacMillan, London.
- Couharde, C., Delatte, A. L., Grekou, C., Mignon, V., & Morvillier, F. (2018). Exchange: A world database on actual and equilibrium effective exchange rates. *International economics*, (156), 206-230.
- Dao, M. C., Minoiu, M. C., & Ostry, M. J. D. (2017). *Corporate Investment and the Real Exchange Rate*. International Monetary Fund.
- Dasgupta, S., & Singh, A. (2006). *Manufacturing, services and premature deindustrialization in developing countries: A Kaldorian analysis* (n°. 2006/49). Research Paper, UNU-WIDER, United Nations University (UNU).
- Dhasmana, A. (2015). Transmission of real exchange rate changes to the manufacturing sector: The role of financial access. *International Economics*, (143), 48-69.
- 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.
- Dunning, J. H. (1989). Multinational enterprises and the growth of services: some conceptual and theoretical issues. *The Service Industries Journal*, (9)1, 5-39.
- Eichengreen, B., & Gupta, P. (2013). *The real exchange rate and export growth: are services different?* The World Bank.
- Fisher, A. G. (1935). *Clash of progress and security*. Macmillan and Co. Limited, London.
- Fisher, A. G. (1939). Production, primary, secondary and tertiary. *Economic Record*, 15(1), 24-38.
- Fuchs, V. R. (1965). The growing importance of the service industries. *The Journal of Business*, 38(4), 344-373.
- Gabriel, L. F., & Missio, F. J. (2018). Real exchange rate e economic complexity in a North-South structuralist BoPG model. *PSL Quarterly Review*, 71(287), 439-465.
- Gabriel, L. F.; Jayme Jr., F. G.; Oreiro, J. L. A North-South Model of Economic Growth, Technological Gap, Structural Change and Real Exchange Rate. *Structural Change and Economic Dynamics*, v. 38, p. 83-94, 2016
- Giovanini, A., & Arend, M. (2017). Contribution of services to economic growth: Kaldor's fifth law? *RAM. Revista de Administração Mackenzie*, 18(4), 190-213.
- Guzman, M., Ocampo, J. A., & Stiglitz, J. E. (2018). Real exchange rate policies for economic development. *World Development*, (110), 51-62.
- 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.
- Hertog, P. D. (2000) Knowledge-intensive business services as co-producers of innovation. *International Journal of Innovation Management*, 4(4), 491-528.
- Lewis, W. A. (1954). *Economic development with unlimited supplies of labor*. The Manchester School of Economic and Social Studies, 22(2), 139-191.
- Machado, A., Arbache, J., & Moreira, R. Classificação das atividades de serviços. [sl]: Economia de Serviços, 2015. (Nota Técnica). Disponível em: < <https://bit.ly/2QjmVKT>.>
- McMillan, M. S., & Rodrik, D. (2011). *Globalization, structural change and productivity growth* (No. w17143). National Bureau of Economic Research.
- Miles, I. (2008). Patterns of innovation in service industries. *IBM Systems Journal*, 47(1), 115-128.
- Miozzo, M., & Soete, L. (2001). Internationalization of services: a technological perspective. *Technological Forecasting and Social Change*, 67(2-3), 159-185.
- Missio, F. J.; Jayme JR., F. G.; Britto, G.; Oreiro, J. L. (2015). Real Exchange Rate and Economic Growth: New Empirical Evidence. *Metroeconomica*, v. 66, p. 686-714, 2015.
- Muller, E., & Zenker, A. (2001). Business services as actors of knowledge transformation: the role of KIBS in regional e national innovation systems. *Research Policy*, 30(9), 1501-1516.

- Nordås, H. K. (2010). Trade in goods and services: Two sides of the same coin? *Economic Modelling*, 27(2), 496-506.
- Nordås, H. K., & Kim, Y. (2013). Interaction between Goods and Services Trade: Case Studies. *OCDE, Working Paper*.
- Oreiro, L. J., Missio, F., & Jayme Jr, F. G. (2015). Capital accumulation, structural change and real exchange rate in a Keynesian-structuralist growth model. *Panoeconomicus*, 62(2), 237-256.
- Pattichis, C. (2012). Exchange rate effects on trade in services. *Journal of Economic Studies*, 39(6), 697-708.
- Pereira, H. C. I.; Missio, F. J. Would a competitive real exchange rate be a driver of economic prosperity? *PSL Quarterly Review*, v. 75, p. 355-355, 2023.
- Pereira, W. M.; Missio, F. J.; Jayme Jr, F. G. The role of services in economic development and the core-periphery relationship. *CEPAL Review* v. 139, p. 29-60, 2023.
- Pesaran, M.H. 2015. *Time series and panel data econometrics*. Oxford: Oxford University Press.
- Razmi, A., Rapetti, M., & Skott, P. (2012). The real exchange rate and economic development. *Structural Change and Economic Dynamics*, 23(2), 151-169.
- Rodrik, D. (2008). The real exchange rate and economic growth. *Brookings papers on economic activity*, (2), 365-412.
- Roodman, D. (2009). A note on the theme of too many instruments. *Oxford Bulletin of Economics and Statistics*, 71(1), 135-158.
- 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.
- Seo, H. J., Lee, Y. S., & Kim, H. (2012). The determinants of export market performance in Organisation for Economic Co-operation and Development service industries. *The Service Industries Journal*, 32(8), 1343-1354.
- Unctad (2017). The role of the services economy and trade in structural transformation and inclusive development. *Trade and Development Board*. Geneva.
- Zysman, J. et al. Services with Everything: The ICT-Enabled Digital Transformation of Services. BRIE Working Paper, n. 187a, 2011.

APPENDIX A: SAMPLE COUNTRIES

Brazil	Italy
Bulgaria	Latvia
Cyprus	Lithuania
South Korea	Mexico
Croatia	Poland
Slovakia	Portugal
Slovenia	Czech Republic
Spain	Romania
Estonia	Russia
Greece	Taiwan
Hungary	Türkiye
India	
Indonesia	

Source: Prepared by the authors from WIOD.

APPENDIX B: MODERN SERVICE ACTIVITIES

Publishing activities;	Activities auxiliary to financial services and insurance activities;
Production of films, video and television programs, sound recording and music editing, programming and broadcasting;	Real estate activities;
Telecommunications;	Architecture and engineering activities (testing, technical analysis);
Computer programming consultancy and related activities; information service activities;	Scientific research and development;
Financial services activities, except insurance and pension funds;	Advertising and market research;
Insurance, reinsurance and pension funds, except mandatory social security.	Other professional, scientific and technical activities; veterinary activities.

Source: WIOD SocioEconomic Accounts.

