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PRODUCTIVITY AND FOREIGN DIRECT INVESTMENT IN THE SERVICES SECTOR: AN ECONOMETRIC ANALYSIS

PRODUTIVIDADE E INVESTIMENTO DIRETO ESTRANGEIRO NO SETOR DE SERVIÇOS: UMA ANÁLISE ECONOMÉTRICA

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ABSTRACT

Purpose: Our study seeks to measure the impact of Foreign Direct Investments (FDI) in the services sector on the productivity of municipalities in the state of São Paulo.

Theoretical framework: FDI in the services sector has become increasingly important for emerging economies due to the spillover effects, which can boost regional economic development.

Methodology/Approach: This study uses econometric modeling to measure the impact of services FDI at the municipal level in the state of São Paulo, the most FDI-intensive region in Brazil. To do so, this study employs an unbalanced panel of data that includes all FDI-receiving municipalities in the state between 2010 and 2016.

Findings: Our results point to a positive relationship between FDI in services sectors and municipal productivity.

Research, practical & social implications: This study outcomes offer valuable perspectives for the formulation of public policies aimed at attracting foreign investments. They also have important implications for the service sector and could be a reference for future studies on the subject.

Originality/ Value: This study addresses FDI in emerging countries, an important discussion given the impact of this type of investment on economic development and social indicators. In addition, this paper expands the FDI literature beyond the manufacturing sector.

Keywords: Foreign Direct Investment; Foreign Direct Investment in Services; Spillovers; Productivity.

RESUMO

Objetivo: Nosso estudo busca mensurar o impacto do Investimentos Diretos Estrangeiros (IDE) no setor de serviços sobre a produtividade dos municípios do estado de São Paulo.

Referencial Teórico: O IDE no setor de serviços têm sido cada vez mais importante para países de economias emergentes devido aos efeitos spillover que podem gerar, e que impulsionam o desenvolvimento econômico regional.

Metodologia/Abordagem: Este estudo utiliza modelagem econométrica para medir o impacto do IDE de serviços a nível municipal no estado de São Paulo, a região mais intensiva em IDE no Brasil. Para tal, este estudo emprega um painel desbalanceado de dados que contempla todos os municípios receptores de IDE no estado entre os anos de 2010 a 2016.

Resultados: Nossos resultados apontam para uma relação positiva entre o IDE de serviços e a produtividade municipal.

Contribuições, implicações práticas e sociais: Nossos resultados oferecem valiosas perspectivas para a formulação de políticas públicas destinadas a atrair recursos estrangeiros. Eles também têm implicações importantes para o setor de serviços e podem ser referência para estudos futuros relacionados à temática.

Originalidade/Valor: Este estudo aborda o IDE em países emergentes, uma discussão fundamental dado o impacto deste tipo de investimento no desenvolvimento econômico e indicadores sociais. Além disso, este artigo expande a literatura de IDE além do setor de manufatura.

Palavras-chave: Investimento Direto Estrangeiro; Investimento Direto Estrangeiro de Serviços; Spillovers; Produtividade.

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1. INTRODUCTION

Foreign Direct Investments (FDI) have been one of the primary sources of external financing for emerging economies in recent decades. Attracting foreign capital can bring significant benefits to the local economy, including technology transfer, job creation, and integration into international trade flows, thereby driving the economic development of the host region (Lin, Liu & Zhang, 2009).

Blomström e Kokko (1998) define spillover as the phenomena that occurs when a company gets FDI but is unable to internalize all of the advantages of the investment. In this context, spillovers are the positive externalities that result from the transfer of knowledge and technology from the foreign investor to other enterprises in the local economy. According to the literature, spillovers can be categorized into two types: vertical and horizontal. The former are commercial ties between suppliers, firms, and customers, whereas the latter refers to companies in general in the same industry which may, or may not, be direct competitors.

Although the literature points to the benefits of vertical spillovers, the relationship between horizontal spillovers and the regional economy is controversial and often considered negative (Duong, 2020). This negative relationship may be related to the protection of corporate information (Mariotti, Mutinelli, Nicolini, & Piscitello, 2015), the mobility of skilled labor towards multinational enterprises (MNEs) (Lu, Tao & Zhu, 2017) and increased sectoral competition (Fons-Rosen, Kalemli-Özcan, Sorensen, Villegas-Sanchez & Volosovych, 2017). It is therefore important to understand the effects of horizontal and vertical spillovers on the regional economy and domestic companies.

Crespo and Fontoura (2007) state that absorptive capacity is a determining factor in the occurrence of spillover effects from FDI. Absorptive capacity refers to a company's ability to assimilate and use external knowledge. It is considered a prerequisite for the development of national companies through the exploitation of spillovers (Duong, 2020). Thus, if companies in the host region do not have sufficient absorptive capacity, they will not be able to take advantage of the positive externalities of MNEs. Kim (2015), points out that the increased competition brought by multinationals can harm companies in the host country; however, positive spillovers can mitigate these negative effects. Therefore, without the minimum absorptive capacity to assimilate the transfer of knowledge and technology from FDI, local companies are unable to mitigate the negative results of increased competition.

Furthermore, the literature has highlighted the importance of geographical proximity in determining the absorptive capacity of foreign investment by national companies. Wang e Kafourous (2020) indicate that geographical proximity should also be taken into account when determining absorptive capacity. The authors identified that large physical distances between domestic and foreign companies can represent an obstacle to building vertical links, as well as limiting learning by demonstration and imitation, demonstrating the importance of location for an organization's success. Therefore, analyzing spillover effects in micro-regions is essential to understanding the dynamics between FDI and the regional economy.

It is worth mentioning that part of the FDI oriented towards the manufacturing sector has been redirected towards the services sector (Doytch & Uctum, 2011, 2019). Similar to manufacturing, FDI in services benefits host countries through job creation, technology transfer, capital accumulation and improved services. It should also be noted that increased competition allows for an increase in the availability and quality of services related to production (Golub, 2009). In addition, services offer benefits over manufacturing, such as low levels of capital equipment, high dissemination of information, cooperation in the production and consumption of services over time and space, the importance of human capital and organizational factors in determining the competitiveness of service companies due to the intangible nature of most services (Kam, Associate, He & Park, 2015). Furthermore, input cost factors are likely to have a much smaller impact on FDI in service, since services products are

less marketable than manufactured ones (Riedl, 2010). However, despite growing investment in the sector, the analysis of the relationship between FDI in service and its impact on the regional economy is still little explored in the literature (Jones & Wren, 2016).

Our study seeks to analyze the impact of FDI in services on the productivity of municipalities in the state of São Paulo. To this end, we used a unique database that presents the intensity of FDI at the municipal level between 2010 and 2016 for all municipalities in the state. Our results indicate that FDI intensity has a positive impact on the productivity of the service sector in municipalities. This result is valuable for public policymakers looking to attract FDI, who should know the impacts of this type of investment in the region. The stratification of FDI in the services sector shows the positive impact of a sector that has seen growing investment.

2. LITERATURE REVIEW

The literature review carried out in this study is structured in two parts. In the first, the main concepts are related to spillovers, their definition, the places where they occur, the factors that determine them and the positive and negative impacts that can affect local companies. In the second part, the concept and the impacts of Foreign Direct Investments (FDI) in the services sector will be addressed. The aim of this review is to provide a broader understanding of the effects of spillovers and FDI on economic development, as well as to identify gaps in the existing literature.

2.1 Relationship between Spillovers and FDI

Foreign Direct Investments are seen as an efficient and affordable way of modernizing the host country (Jude, 2016). This is based on the premise that FDI affects not only the productivity of recipient companies, but also that of domestic firms through spillover effects (Kim, 2015). Therefore, the possibility of inexpensive modernization becomes an attraction, especially for developing countries. According to Demena e Van Bergeijk (2017), a reflection of this view is the substantial increase in incentive policies aimed at attracting FDI in recent decades in these countries.

Crespo e Fontoura (2007) point out that there are five main channels where spillovers can occur: demonstration and imitation, labor mobility, competition, forward and backward linkages, and exports. In addition, there are also determining factors for the occurrence of spillovers, including: absorptive capacity, regional effect, characteristics of domestic companies and characteristics of FDI.

Demonstration occurs when an MNE intentionally transfers technology to domestic companies, while imitation occurs unintentionally and consists of copying technology through informal processes. Domestic enterprises choose this channel since it is more cost effective (Chen, Chen & Lin, 2020) and requires less development time when an R&D investment is initiated (He, Kwan & Fan 2019).

Labor mobility is a way of spreading spillovers, given the training needed to work in technologically and/or organizationally superior companies, such as MNEs. However, this channel can generate negative spillovers arising from the "brain drain" of domestic companies towards MNEs, thus generating an additional cost and loss of technical capacity in companies belonging to the host country (Heggedal, Moen & Preugschat, 2017).

Backward and forward linkages are a company's connections with suppliers and customers (Fan, He & Kwan, 2020), where the backward linkage occurs between MNEs and suppliers and the forward linkage between MNEs and customers. Technology transfer effects in this context can also be known as vertical spillovers.

In a balanced competition, the domestic company is able to enjoy the spillovers of foreign competitors (Carnahan, Agarwal & Campbell, 2010), since, in order to maintain its attractiveness in the market, the domestic firm must invest in innovation in order to match the level of competing companies. However, the competition channel is commonly related to negative spillovers, due to domestic companies losing market share to technologically and organizationally superior MNCs (Lu et al., 2017).

The presence of MNEs positively influences the ability of domestic firms to enter the export market (Wu, Hong & Muhammad, 2020). This effect is even more evident in firms belonging to the same sector as the MNE, since they will be able to take advantage of a previously established export process, and thus reduce the costs of entering the export market (Hong & Wu, 2018).

At the firm level, Girma (2005) states that the absorptive capacity of domestic firms is an essential requirement for them to be able to internalize MNE spillovers. However, absorptive capacity is influenced by a company's distance from the technological frontier (Morales & Moreno, 2020). In other words, the technological proximity of the national company to the MNE reduces the use of spillovers, and technological distance can make knowledge transfer unfeasible. In addition, the level of absorptive capacity of firms also depends on the characteristics of the region where it is located (Morales & Moreno, 2020), the culture of the organization (Ali & Park, 2016), social relations in the company (Giannoccaro & Carbone, 2017), among others.

The geographic factor, or regional effect, is a determining factor for taking advantage of spillovers, and the increase in physical distance between MNEs and domestic companies hinders the transfer of technology between them, however this effect is not linear when considering the particularities of different types of industries and regions (Song & Son, 2020). The agglomeration of companies, especially in the same or complementary sectors, increases the capacity for knowledge exchange and enriches labor mobility, demonstration or imitation and backward linkages, as well as reducing transportation costs and fostering competition between firms.

Furthermore, the characteristics of domestic companies, particularly in terms of heterogeneity, is also a determining factor for FDI (Bu & Wagner, 2016). Generally, larger, older and state-owned companies have better access to resources in their home countries than other companies without these characteristics (Li, Zhang & Shi, 2020).

Finally, another determining factor is the FDI origin and institutional background. FDI from one country can have a different impact on domestic companies compared to other nationalities (Javorcik & Spatareanu, 2011; Zhang, Guo & Wang, 2014). This can happen due to transportation costs, distance, languages, cultures and types of negotiations that each country and its respective MNCs provide.

2.2 FDI in service

There is an ongoing debate about the relationship between FDI and increased employment, technology transfer (Jude, 2016) and increased productivity (Mühlen & Escobar, 2020) in domestic companies. In addition, the economic impact of FDI on countries' growth has been the subject of controversy (Alvarado, Iñiguez & Ponce, 2017). However, most of the studies that analyze its effects are oriented towards the manufacturing sector (Zhang, 2016), thus leaving a research gap to be analyzed with regard to the effects of FDI in the service sector. According to Mariotti et al., (2015), in 2011 one third of Foreign Direct Investments were directed to the services sector, and the number of investments in the sector is set to increase further.

The effects of FDI in the services sector differ from the impacts on the manufacturing

sector for several reasons: the services sector is more geared towards the domestic market than exports, there are unproductive costs and inputs due to the poor condition of domestic services, also, because there is liberalization of services that bring benefits to the economy in which they are better evenly distributed among owners and because of barriers to foreign services (Latorre, Yonezawa & Zhou, 2018).

The literature analyzing the service sector currently has two classifications: Low Knowledge-Intensive Services (LKIS) and High Knowledge-Intensive Services (KIS). It is worth noting that KIS companies, also known as Knowledge Intensive Business Services (KIBS), have the main objective of providing knowledge-intensive inputs to other companies (Seclen-Luna & Moya-Fernández, 2020). In other words, when the manufacturing sector demands high-tech intermediate inputs, legal services, consulting support and other business services, KIS are contracted to provide these services (Wyrwich, 2019). These companies are considered catalysts of innovation, as they are able to bridge the gap between the generic knowledge available in the economy and the tacit knowledge located in companies (Savic, Lawton Smith & Bournakis, 2020). As these two types of services exist, FDI can also be analyzed separately.

Ali, Li, Wang, Yue & Chang (2021) found a positive long-term relationship between the FDI of logistics companies and the productivity growth of the country's logistics services sector. In addition, Doytch and Uctum (2019) state that FDI in services tends to benefit the GDP growth of its own sector even if it hinders the growth of manufacturing in the countries analyzed. Thus, the division of empirical studies is the same: while some researchers find evidence that FDI in services is related to positive results, others point to side effects (Doytch & Uctum, 2011). In short, the literature points to a positive relationship between the presence of FDI in certain sectors and the general increase in their productivity, which can be explained by sectoral spillovers.

Based on the aforementioned literature, we have drawn up the following research hypotheses:

H1: The presence of MNEs in the service sector positively affects the productivity of the host region through spillovers effects.

H2: The presence of LKIS MNEs positively affects the productivity of the host region through spillover effects.

H3: The presence of KIS MNEs positively affects the productivity of the host region through spillover effects.

3. METHODOLOGY

The aim of this study is to analyze the impact of FDI in services on the productivity of companies at a regional level. To this end, this study uses the added value per capita of each municipality as the dependent variable, serving as a proxy variable for regional productivity. This variable is calculated according to Equation 1:

$$PROD_{jt} = \frac{AV_{jt}}{POP_{jt}} \quad (1)$$

Where productivity is given by the municipal added value (AV) divided by the population (POP) for each municipality j and year t . This calculation follows the recommendations of the Organization for Economic Cooperation and Development. Therefore, this variable is able to measure the efficiency with which the municipality's population contributes to the economy. The higher the value resulting from the division, the higher the municipality's per capita economic productivity.

The main explanatory variable is FDI. However, there is no publicly available database on FDI in Brazil. In fact, international studies also suffer from the scarcity of data on foreign investment (Morales & Moreno, 2020), which explains the lack of studies of this type in emerging economies. Following recent studies (Morales & Moreno, 2020; Polloni-Silva, Roiz, Mariano, Morales & Rebelatto, 2022), a database was built using data from the Integrated System of Exterior Commerce (Siscomex), covering the period between 2010 and 2016. Each listed company was manually checked to identify its origin (i.e., domestic or foreign). Equation 2 displays how the variable for the 'intensity' of FDI in services in each municipality was estimated:

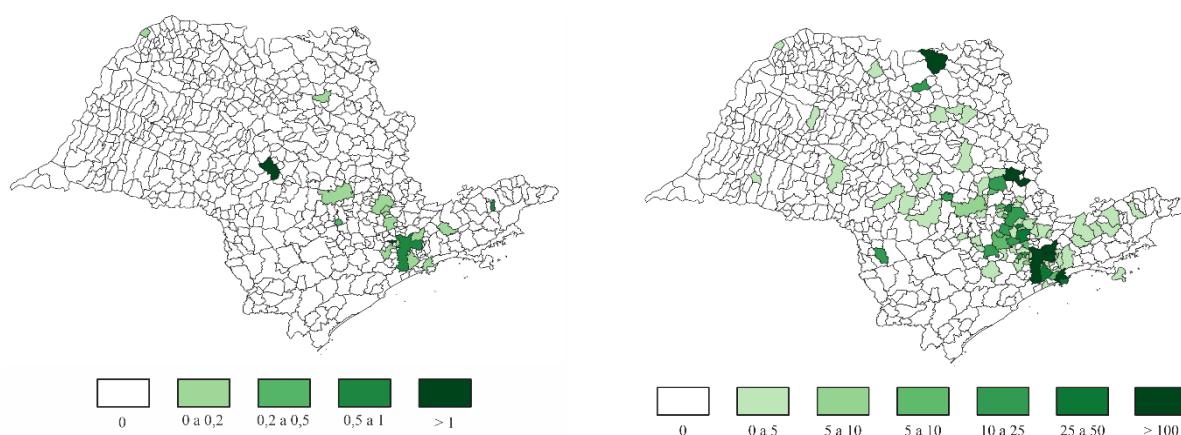
$$FDI_{jt} = \sum_{i=1}^k W_{ijt} \left(\frac{M_{jt}}{N_{jt}} \right) \quad (2)$$

Where M and N are the service companies of foreign and domestic origin, respectively, in each municipality j and year t . In addition, W is the adjustment weight of each company i according to the value of its exports. The higher the value of the variable, the greater the dependence on foreign companies in the services sector for each municipality. The lower the FDI intensity, the lower the relevance of foreign companies in the region.

In addition, FDI in service was divided into FDI of LKIS companies and FDI of KIS companies in order to distinguish the impact of each type of service, following the same procedure as in Equation 2. We used the National Classification of Economic Activities (CNAE) and the Statistical classification of economic activities in the European Community (NACE) to classify the companies. Figure 1 shows the distribution of the two types in 2016. The FDI of LKIS companies is on the right and the FDI of KIS companies on the left.

Figure 1

FDI intensity in São Paulo municipalities.



However, as this study has a base of municipalities with heterogeneous realities, we used control variables to capture the distinct realities of the cities analyzed. Thus, variables such as GDP (Gross Domestic Product) per capita, population density, percentage of the local economy focused on agribusiness, percentage of the local economy focused on industry, economic complexity index and the Firjan fiscal index were inserted as controls in the modeling. Thus, we evaluated the performance of each municipality controlling for the effects of economic growth, technological development, and management, similar to other studies on productivity and regional development (Boix-Domenech & Soler-Marco, 2017; Polloni-Silva,

Morales, Rebelatto & Hartmann, 2021).

Table 1 summarizes the information on the variables used.

Table 1

Variables, descriptions, and sources

Variable name	Description	Source
PROD	Productivity at municipal level.	Calculated from IBGE data
FDI in service	FDI intensity in the services sector	Calculado a partir de dados do Siscomex
LKIS FDI	FDI intensity in services for Low Knowledge-Intensive Services	Calculated from Siscomex data
KIS FDI	FDI intensity in services for High Knowledge-Intensive Services.	Calculated from Siscomex data
GDP per capita	Gross Domestic Product divided by the number of inhabitants	IBGE
DENS	Population density (Population divided by the area of the municipality)	IBGE
AGRI	Percentage of the local economy focused on agribusiness.	IBGE
IND	Percentage of the local economy focused on industry.	IBGE
ECI	Economic complexity index. This variable assesses the diversification and sophistication of the region's exports.	DATAVIVA
FIRJAN	Firjan fiscal index, shows the municipality's ability to allocate resources	Secretaria do Tesouro Nacional

3.1 Econometric model

The following equations were proposed to analyze the impact of FDI in service on regional productivity:

$$PROD_{jt} = \beta_0 + \beta_1 FDI_{jt} + \beta_2 DENS_{jt} + \beta_3 AGRI_{jt} + \beta_4 IND_{jt} + \beta_5 ECI_{jt} + \beta_6 FIRJAN_{jt} + \alpha_{jt} + \varepsilon_{jt} \quad (3)$$

$$PROD_{jt} = \beta_0 + \beta_1 LKISFDI_{jt} + \beta_2 DENS_{jt} + \beta_3 AGRI_{jt} + \beta_4 IND_{jt} + \beta_5 ECI_{jt} + \beta_6 FIRJAN_{jt} + \alpha_{jt} + \varepsilon_{jt} \quad (4)$$

$$PROD_{jt} = \beta_0 + \beta_1 KISFDI_{jt} + \beta_2 DENS_{jt} + \beta_3 AGRI_{jt} + \beta_4 IND_{jt} + \beta_5 ECI_{jt} + \beta_6 FIRJAN_{jt} + \alpha_{jt} + \varepsilon_{jt} \quad (5)$$

Where PROD is the dependent variable for each municipality j in year t . FDI, LKISFDI and KISFDI are the explanatory variables. DENS, AGRI, IND, ECI and FIRJAN are control variables, β_0 is the intercept, β_1 to β_6 are the estimated coefficients, α is the fixed-effect term (for the set of models employing fixed effects - DK) and ε is the residual term. Equations 3, 4 and 5 test hypotheses H1, H2 and H3 respectively.

The data used comprised a panel of 297 municipalities in the state of São Paulo between 2010 and 2016, accounting for seven years of analysis. We employed the Variance Inflation

Factor (VIF) to verify the presence of multicollinearity and validate the model variables. The Hausman test was used to determine which specification best fits the econometric model. We also checked the sample for non-spherical disturbances. Specifically, we used the modified Wald test to test for heteroscedasticity (Greene, 2002) and the Wooldridge test to verify the significance of autocorrelation (Wooldridge, 2010). Considering the significant results of these tests, it was necessary to define an estimator that considers non-spherical disturbances in the analysis. Here, it is important to note that the panel used has a larger number of individuals (i.e., municipalities) than time (N>T). Thus, traditional estimation methods are not suitable.

In addition, the Hausman test indicated that the appropriate specification for our model is fixed effects, however we also included a random effects model in order to assess the consistency of our results with different types of specification. Therefore, two estimation methods were chosen to deal with the disturbances indicated by the tests. Firstly, the Feasible Generalized Least Squares (FGLS) technique (Parks, 1967) was used, since a random effects estimator can be indicated in cases of low variability in the study variables. In relation to fixed effects modeling, the Driscoll-Kraay (DK) estimator was used, since this estimator also corrects for all non-spherical disturbances (Driscoll & Kraay, 1998).

Furthermore, in our dataset contains variables with different scales. Therefore, a normalization process was used on the sample. Thus, in order to transform the units present in the sample into a standardized (or normalized) interval, it is possible to apply the methods proposed by Borkin, Némethová, Michal'čonok e Maiorov (2019) in order to make the possible interpretation of the parameters in the form of elasticity more susceptible. Therefore, data processing consists of rescaling the values in a range of [0:1] under the following equation:

$$x' = \frac{x - \min(x)}{\max(x) - \min(x)} \quad (6)$$

Where x is the primary value and x' corresponds to the normalized value.

To test the robustness of the results, two additional tests were employed. First, we assessed whether endogeneity would be a problem in the model. Thus, endogeneity tests were carried out using the lagged value of FDI (i.e., value in the previous year; t-1) using the values of the C-statistic (Baum, Schaffer, & Stillman, 2003) to test the significance of the result, following the steps presented by similar works (Polloni-Silva et al., 2021). These tests showed that endogeneity is not significant. In addition, a sensitivity analysis was carried out to check whether the presence of outliers interferes with the results. In this way, the 2.5% highest and lowest observations in the sample were removed using the dependent variables as a reference. The results are discussed in the next section.

4. RESULTS AND DISCUSSION

The results of the econometric modeling are shown in Table 2, where models (1) and (2) test hypothesis H1, (3) and (4) hypothesis H2 and (5) and (6) hypothesis H3.

Table 2

Econometric model main results

Variables	(1) FGLS	(2) DK	(3) FGLS	(4) DK	(5) FGLS	(6) DK
FDI in service	0.0272 (0.0207)	0.0409 (0.0613)				
LKIS FDI			0.0447** (0.0223)	0.104** (0.0391)		

KIS FDI					-0.0938 (0.0857)	-0.459 (0.240)
GPD per capita	0.338*** (0.0133)	0.103** (0.0359)	0.338*** (0.0133)	0.103** (0.0365)	0.279*** (0.0153)	0.103** (0.0356)
DENS	-0.0397*** (0.00369)	-0.0437 (0.0489)	-0.0390*** (0.00347)	-0.0433 (0.0484)	-0.0234*** (0.00456)	-0.0427 (0.0485)
ECI	-0.107 (0.0698)	-0.132 (0.134)	-0.117* (0.0689)	-0.128 (0.136)	-0.108 (0.0702)	-0.152 (0.118)
AGRI	-0.0590*** (0.00436)	-0.0252 (0.0254)	-0.0572*** (0.00417)	-0.0252 (0.0255)	-0.0726*** (0.00461)	-0.0265 (0.0262)
IND	0.0212*** (0.00470)	-0.0356 (0.0469)	0.0215*** (0.00472)	-0.0343 (0.0471)	0.0147*** (0.00359)	-0.0279 (0.0440)
FIRJAN	0.00960** (0.00382)	0.00856 (0.00930)	0.0114*** (0.00381)	0.0102 (0.00982)	0.0113*** (0.00346)	0.00894 (0.00941)
Constant	0.235*** (0.0236)	0.314*** (0.0360)	0.237*** (0.0233)	0.309*** (0.0372)	0.247*** (0.0237)	0.321*** (0.0371)
Hausman	32.01***	32.01***	32.40***	32.40***	34.64***	34.64***
Wooldridge	27.883***	27.883***	27.922***	27.922***	26.971	26.971
Mod. Wald.	1.7E+33***	1.7E+33***	7.4e+33***	7.4e+33***	7.3E+33***	7.3E+33***
Endogeneity	0.131	0.131	0.083	0.083	2.299	2.299
Observations	1,405	1,453	1,405	1,453	1,405	1,453
Number of municipalities	249	297	249	297	249	297

Note. Standard deviations in brackets. *** p < 0.01, ** p < 0.05, * p < 0.1

Table 2 results show that FDI in service is unable to explain municipal productivity (models 1 and 2), refuting hypothesis H1. However, when FDI is broken down into LKIS and KIS, i.e. according to the intensity of knowledge employed in the service, we find that LKIS (models 3 and 4) has a positive impact on municipal productivity, confirming hypothesis H2. On the other hand, FDI of KIS companies has no significant impact on productivity (models 5 and 6), refuting hypothesis H3.

In relation to the control variables used in the model, it is clear that GDP per capita has a positive relationship with productivity and is significant in all models. This result is not surprising, given that regions with greater per capita wealth have a more specialized and productive workforce. Density (DENS) appears to have a negative relationship with productivity, an intriguing result. We must remember that our productivity variable takes into account the municipal added value divided by its total population. If density presents a positive relationship with this variable, this may indicate that less dense regions are capable of generating a greater volume of wealth per resident inhabitant.

The industrial sector contributes to added value in the economy by transforming raw materials into higher value products, driving technological innovation, creating jobs, integrating supply chains and fostering infrastructure development. The presence of agribusiness, on the other hand, provides a favorable environment for innovation and the adoption of technology. This, in turn, not only raises the value of agricultural products, but also transforms commodities into higher added-value products, exerting a positive impact and boosting regional productivity. The expectation was that the percentage of the local economy focused on agribusiness (AGRO) would show a positive relationship with municipal productivity, but the results revealed a contradiction in this scenario. On the other hand, the percentage of the local economy focused on industry (IND) did not show this contradiction.

In relation to the Firjan index (FIRJAN), this variable shows a positive and significant relationship in the FGLS models, which shows that the better the local institutional quality, the higher the productivity.

Table 3 shows the results of the sensitivity test, which replicates the estimation methods used in the second table, but in this case, we disregard the 2.5 highest and lowest values of the dependent variable (municipal productivity).

Table 3

Results with sensitized data

Variables	(7) FGLS	(8) DK	(9) FGLS	(10) DK	(11) FGLS	(12) DK
FDI in service	0.0474*** (0.0179)	0.0461 (0.0427)				
LKIS FDI			0.0673*** (0.0194)	0.0881** (0.0271)		
KIS FDI					-0.0757 (0.0824)	-0.301 (0.214)
GPD per capita	0.282*** (0.0161)	0.0989*** (0.0260)	0.280*** (0.0161)	0.0989*** (0.0265)	0.283*** (0.0163)	0.0992*** (0.0259)
DENS	-0.0251*** (0.00540)	-0.00433 (0.0402)	-0.0252*** (0.00531)	-0.00402 (0.0398)	-0.0265*** (0.00543)	-0.00365 (0.0400)
ECI	-0.0421 (0.0609)	-0.161 (0.119)	-0.0488 (0.0593)	-0.160 (0.119)	-0.0509 (0.0634)	-0.178 (0.105)
AGRI	-0.0513*** (0.00576)	-0.0303** (0.00921)	-0.0494*** (0.00573)	-0.0304** (0.00921)	-0.0592*** (0.00566)	-0.0313** (0.00918)
IND	0.00578 (0.0101)	-0.0626 (0.0412)	0.00638 (0.00997)	-0.0618 (0.0411)	0.0134 (0.01000)	-0.0598 (0.0387)
FIRJAN	-0.0200*** (0.00398)	-0.0137** (0.00455)	-0.0189*** (0.00394)	-0.0124** (0.00491)	-0.0216*** (0.00412)	-0.0135** (0.00511)
Constant	0.218*** (0.0209)	0.319*** (0.0301)	0.219*** (0.0203)	0.316*** (0.0302)	0.223*** (0.0218)	0.326*** (0.0283)
Hausman	43.11***	43.11***	42.72***	42.72***	45.21***	45.21***
Wooldridge	14.798***	14.798***	14.907***	14.907***	14.281***	14.281***
Mod. Wald.	8.2E+32***	8.2E+32***	7.2e+31***	7.2e+31***	6.0e+34***	6.0e+34***
Endogeneity	0.147	0.147	0.244	0.244	0.024	0.024
Observations	1,327	1,381	1,327	1,381	1,327	1,381
Number of municipalities	241	295	241	295	241	295

Note. Standard deviations in brackets. *** p < 0.01, ** p < 0.05, * p < 0.1

In Table 3, which disregards the most and least productive regions in the sample, the results indicate that general FDI in service has a positive impact on regional productivity (model 7). FDI disaggregated into LKIS and KIS seems to repeat what was found in Table 1. In other words, FDI of KIS companies still does not explain the productivity of municipalities (models 11 and 12). FDI in service and FDI of LKIS companies again have a positive and significant relationship with municipal productivity (models 9 and 10). Modeling with the sensitized sample seems to have had a positive impact on the coefficients of the dependent variable in the models that showed statistical significance. This means that removing the most and least productive regions provided more robust results, as well as corroborating the previous results in their main findings.

5. CONCLUSION

This study analyzed the impact of foreign direct investment in the services sector on municipal productivity in Brazil's most FDI-intensive state, São Paulo. The results indicate that FDI in the services sector has a positive effect on productivity at the municipal level,

corroborating previous studies that show the importance of the services sector for economic growth (Bounthone & Phouphet, 2023; Zhang, 2023), and even for increasing manufacturing productivity (Ali et al., 2021; Fernandes & Paunov, 2012). However, this result for aggregate FDI is marginal, whereas FDI in low-knowledge services has a positive impact on municipal productivity. Research has shown that LKIS contribute significantly to regional productivity by providing vital support services to businesses and individuals. For example, the retail sector provides goods and services to consumers, creating demand for products and services and contributing to regional economic growth. In addition, the hospitality sector, such as hotels and restaurants, plays a significant role in the tourism industry, which is an important contributor to the economy in many regions. Furthermore, the cleaning sector plays an important role in maintaining a clean and healthy environment, which is essential for the population's well-being and productivity. This result may also be related to the fact that these services are more labor-intensive and can therefore create more jobs and increase income, boosting the regional economy and therefore local productivity.

On the other hand, FDI in knowledge-intensive services (KIS) did not have a significant impact on municipal productivity. Theoretically, this type of service is capable of fostering innovation and in turn boosting productivity in the region in which it is located (Savic et al., 2020). This can be explained by the fact that these services require a high level of specialized skills and knowledge, which may not be available in the local workforce, given the large labor gap that exists in the country, especially in high-tech and knowledge sectors (Ramalho, Luiz de Paula & Oliveira, 2018). In addition, these services may be more concentrated in large urban centers (Cooke & Leydesdorff, 2006), which limits their ability to generate economic benefits in less developed areas. The absence of KIS companies outside of large urban centers, especially multinational companies, can also be seen as a limitation for the development of econometric models at a regional level. This is because the number of regions, in this case municipalities, that have FDI of KIS companies is very low, which limits the econometric approach. In this study, models suitable for small samples were used to overcome this specificity.

This study contributes to understanding the role of FDI in the services sector on regional productivity in Brazil. Our sample was limited to the state of São Paulo, which is the largest recipient of FDI in the country. Although significant, our results fail to portray large regions without this type of investment. However, these characteristics allow for econometric modeling of municipalities with closer cultural characteristics, due to the restriction to just one state. Therefore, we advise caution when extrapolating these results to other regions. The results suggest that policies to encourage investment in low-knowledge services can have a positive impact on local productivity. However, it is necessary to carefully consider the type of services to be encouraged in order to maximize the economic benefits. In addition, policies to improve education and skills training can help increase the absorptive capacity of knowledge-intensive services in less developed regions. We suggest that the research method be replicated in studies that can cover the whole country, taking into account regional particularities and cautiously analyzing the large FDI gap in other macro-regions.

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