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## Higher education and economic development: an analysis of the direct economic impact of two federal universities in Minas Gerais, Brazil

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### ABSTRACT

The contribution of universities to the promotion of local and regional economic development is a relevant topic in contexts such as Brazil, where government policies for this purpose are recurrent. The present investigation aims to analyze the short-term economic impact, resulting from the implementation of the campuses of the federal universities of Juiz de Fora (UFJF) and Jequitinhonha and Mucuri Valley (UFVJM) in the Minas Gerais municipalities of Governador Valadares and Janaúba. Of a quali-quantitative nature, applied purpose, exploratory level and deductive method, the study is outlined as a bibliographical research, documental research and multicase study supported by a statistical method. A Linear Regression model with Dichotomous Variable was used to identify how the installation of a university campus influenced the behavior of the economic variables Tax Added Value (TAV) defense, education and public health and social security and, consequently, the TAV Services, for the selected municipalities. It was found that in the municipality of Janaúba the short-term direct impact was more significant than in the municipality of Governador Valadares. Therefore, the cases analyzed corroborate the trend pointed out by Vinhais (2013) and Rolim (2018) that smaller universities located in small towns have a greater direct economic impact in the short term.

### KEYWORDS

University education. Impact of Federal universities. Local and Regional development.

## Ensino superior e desenvolvimento econômico: uma análise do impacto econômico direto de duas universidades federais em Minas Gerais, Brasil

### RESUMO

A contribuição das universidades para a promoção do desenvolvimento econômico local e regional constitui um tema relevante em contextos como o brasileiro, em que políticas governamentais com tal finalidade são recorrentes. A presente investigação tem por objetivo analisar o impacto econômico de curto prazo, decorrente da implantação dos campi das universidades federais de Juiz de Fora (UFJF) e dos Vales do Jequitinhonha e Mucuri (UFVJM) nos municípios mineiros de Governador Valadares e Janaúba. De natureza quali-quantitativa, finalidade aplicada, nível exploratório e método dedutivo, o estudo se delinea como pesquisa bibliográfica, pesquisa documental e estudo multicase subsidiado por método estatístico. Empregou-se um modelo de Regressão Linear com Variável Dicotômica, para identificar como a instalação de um campus universitário influenciou o comportamento das variáveis econômicas Valor Adicionado Fiscal (VAF) defesa, educação e saúde públicas e seguridade social e, consequentemente, o VAF Serviços, para os municípios selecionados. Constatou-se que no município de Janaúba o impacto direto de curto prazo foi mais significativo que no município de Governador Valadares. Portanto, os casos analisados corroboram a tendência apontada por Vinhais (2013) e Rolim (2018) de que as universidades menores localizadas em cidades pequenas apresentam maior impacto econômico direto no curto prazo.

### PALAVRAS-CHAVE

Ensino superior. Impacto das universidades federais. Desenvolvimento local e regional.

## Educación superior y desarrollo económico: un análisis del impacto económico directo de dos universidades federales en Minas Gerais, Brasil

### RESUMEN

La contribución de las universidades a la promoción del desarrollo económico local y regional es un tema relevante en contextos como el brasileño, donde las políticas gubernamentales con este propósito son recurrentes. La presente investigación tiene como objetivo analizar el impacto económico de corto plazo resultante de la implementación de los campus de las universidades federales de Juiz de Fora (UFJF) y Vales do Jequitinhonha y Mucuri (UFVJM) en los municipios mineros de Governador Valadares y Janaúba. De carácter cuali-cuantitativo, finalidad aplicada, nivel exploratorio y método deductivo, el estudio se perfila como investigación bibliográfica, investigación documental y estudio de casos múltiples sustentados en un método estadístico. Se utilizó un modelo de Regresión Lineal con Variable Dicotómica para identificar cómo la instalación de un campus universitario influyó en el comportamiento de las variables económicas Valor Agregado Fiscal (VAF), defensa, educación pública y salud y seguridad social y, en consecuencia, los Servicios del VAF, para los municipios seleccionados. Se encontró que en el municipio de Janaúba el impacto directo de corto plazo fue más significativo que en el municipio de Governador Valadares. Por tanto, los casos analizados corroboran la tendencia señalada por Vinhais (2013) y Rolim (2018) de que las universidades más pequeñas ubicadas en ciudades pequeñas tienen un mayor impacto económico directo en el corto plazo.

### PALABRAS CLAVE

Educación universitaria. Impacto de las universidades federales. Desarrollo local y regional.

### CRedit

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## 1 Introduction

The relationship between the presence and performance of university institutions with the promotion of local and regional economic development constitutes an object of extreme academic relevance (Serra; Rolim; Bastos, 2018), mainly in contexts – such as Brazil – in which the issue of regional development has become a protagonist, culminating in the proliferation of government policies aimed at promoting development at local and regional scales (Bellingieri, 2017).

In the Brazilian scenario, considering the strategic role of higher education as an element capable of producing structural changes in society and the economy, from the 2000s onwards the Federal Government began a series of investments in the federal higher education network. Particularly between 2003 and 2014, new federal universities and new campuses of existing universities were created, aiming to reduce the scenario of historical concentration of these institutions in state capitals and socially and economically favored regions (Brasil, 2012; Subrinho, 2013).

This expansion policy was based on criteria such as the region's vocation, public policies in development, local productive arrangements, promotion of development with reduction of regional asymmetries, geographic location, population of the micro and mesoregions served, Human development Index (HDI), Basic Education Development Index (BEDI), as well as priority training areas in light of local/regional demands (Brasil, 2012; Subrinho, 2013).

Universities contribute to promoting local and regional economic development in three main ways: through the formation of human capital, through activities linked to research and innovation and, from a short-term perspective, through boosting the economy related to expenses for the implementation and operation of these institutions (Caldarelli; Camara; Perdigão, 2015; Casaril, 2019).

As problematized by Caldarelli; Camara; Perdigão (2015), in Brazil, academic production on the contribution of universities to promoting economic development is centered on the university-company relationship and the role of those institutions in innovation processes. At the same time, the relationship between universities and economic development is less frequent in academic production, mainly encompassing local/regional scales.

In view of this, the present investigation aims to analyze to what extent the implementation of a university had a direct short-term economic impact on the “Tax Value Added for Services” (TVA Services), in the Minas Gerais municipalities of Governador Valadares and Janaúba, which hosted campuses of the federal universities of Juiz de Fora (UFJF) and Jequitinhonha and Mucuri Valley (UFVJM), respectively.

The choice of such municipalities is justified because they constitute locations of

different sizes and mesoregions, which received federal university campuses in the same period and context, within the scope of policies to expand the federal higher education network undertaken since 2000. Furthermore, the availability of economic data for both municipalities in the period before and after the implementation of the respective campuses stands out.

It should be noted, in advance, that the impact of a university on a given region can materialize in different ways, involving multiple dimensions (social, cultural, educational, etc.). However, the analysis of economic aspects constitutes one of the most objective and direct ways of estimating the practical consequences associated with the implementation of an institution of this nature (Hoff; Pereira; De Paula, 2017).

The work is organized into five sections in addition to this introduction: in **Local and regional economic development**, a brief conceptual discussion on development and economic growth is presented, in addition to characterizing the process of incorporating local and regional issues into development theories. The **Universities and local/regional development** section addresses, from a theoretical point of view, the contribution of such institutions to promoting economic development.

Next, in **Methodology**, the methodological classification of the investigation is presented, a brief characterization of the spatial sections selected for analysis, as well as the procedures used. Of an analytical nature, the section **The direct economic impact of selected Minas Gerais universities** presents and analyzes the data collected for both municipalities. Finally, the **Conclusion** consist of the concatenation of the research findings, as well as the indication of possible future complementary works.

## 2 Local and regional economic development

In conceptual terms, “economic development” should not be considered “ready” and “finished”, although Corrêa *et. al.* (2019) highlight that despite different interpretations arising from different theoretical alignments, some points are consensus, such as, for example, the notion of dynamizing the economy.

Not infrequently, “economic development” and “economic growth” are assumed by different fields of knowledge to be synonymous. However, it is essential to understand that while economic growth is related to a quantitative perspective, economic development consists of a more complex process that brings together, for example, structural transformations in terms of practical application of technical-scientific knowledge, as well as advances regarding coordination between different actors and social segments (Vieira; Santos, 2012; Vila, 2018).

“Economic development involves a change in the distribution of political power;

consequently, it associates the production of resources with their distribution depending on the political strength of social actors” (Vieira; Santos, 2012, p. 343).

As proposed Bresser-Pereira (2008, p.1) economic development can be defined as “the accumulation of capital and incorporation of technical progress that translate into increased productivity and income, culminating in an improvement in the population’s quality of life”.

From the same perspective, Silva; Lima (2014, p. 135) highlight that:

Even though economic growth is necessary, it is not sufficient to generate development. It is not enough to grow economically, increasing the Gross Domestic Product (GDP) and the population's per capita income, but creating better socioeconomic conditions for the population as a whole.

Bellingieri (2017) problematizes that the concept of economic development with an ideological bias emerged in the middle of the 20th century, being determined by industrialization, synonymous with economic growth and measured by economic activities. However, in the 1960s, development studies began to incorporate social indicators, in an approach that also considered the well-being of the population.

In the years that followed, new contributions conceptually shaped the term “economic development”. In the 1970s, concern with environmental sustainability emerged, arising from concerns about the survival of the planet. In the 1990s, the United Nations Development Program (UNDP) proposes the Human Development Tax (HDT), admitting that the population's income, access to health and education would be sufficient to measure the level of economic development of a given location (Bellingieri, 2017).

However, Vieira; Santos (2012) argues that in the current context of globalization, where economic relations are increasingly intense and complex, measuring development becomes a difficult task, given the involvement of non-economic variables such as culture, achievements, among others.

In parallel, Veenhoven (2000) argues that objective quantitative indicators are not sufficient to measure the population's quality of life and, therefore, are inefficient in measuring economic development, from a perspective that goes beyond the economic aspect. Converging on the same idea, Silva; Lima (2015, p.136) problematize that “economic growth often increases the number of rich and poor, maintaining and even widening inequalities, not producing human and social development”.

In summary, Vieira; Santos (2012, p. 348) consider that the meaning of economic development tends to vary according to the historical context of each society/location, although “it retains at its core the achievement of higher standards of living accessible to the majority of the population”.

## 2.1 The local/regional issue of economic development

The emergence of the term regional development is associated with the incorporation of regional issues into the concept of economic development, amid efforts to explain the territorial concentration of markets, production and financial resources. According to Thisse (2011), regional disparities were the subject of economists for a long time, although their analyzes constituted a mere extension of national-level methods.

According to Bellingieri (2017), in the middle of the 20th century, specific concerns with regional problems emerged, which culminated in two main theoretical axes: Classical Location Theories and Regional Development Theories.

**Classical Location Theories** focus on locational decisions from the perspective of companies, considering transport costs as a determining factor in establishing the optimal location of enterprises. In this approach, externalities associated with the agglomeration of activities in a given region are, as a rule, not considered (Monasterio; Cavalcante, 2011).

**Regional Development Theories**, in turn, are permeated by the idea of the existence of an activity or factor that radiates dynamism over other economic sectors, generating growth. It is, therefore, a perspective associated with some type of dynamic self-reinforcing mechanism, resulting from externalities associated with some industry or enterprise (Monasterio; Cavalcante, 2011; Bellingieri, 2017).

For Amaral Filho (2001), within the scope of Regional Development Theories, three propositions gained prominence from the 1960s onwards: the Growth Pole Theory (Perroux, 1955); Circular Cumulative Causation (Myrdal, 1957) and the Forward and Backward Chaining (Hirschman, 1958). Such theories are briefly presented in table 1.

**Table 1.** Synthesis of the three main Regional Development Theories

Theory	Main features
Growth Pole Theory (Perroux, 1955)	The “motor companies”, due to their complexity, generate demand for services from other companies, the “moved” ones (which have their sales increased). It admits that economic growth manifests itself in “points” of the territory. Motor companies polarize the region in four ways: technique (chaining effects generated by the motor company); economic (generation of employment and income associated with the motor company); psychological (investments resulting from the climate of optimism); geographic (impacts on urban systems and development of the city where the motor company is located). The motor company induces growth based on relationships established with the surroundings.
Circular Cumulative Causation (Myrdal, 1957)	Considers that regional development can be enhanced through mechanisms that, once initiated, are mutually reinforced. A growth spurt in a dynamic region would “awaken” its productive resources, and would begin to attract resources from other poor regions. Businesses in the dynamic region would expand the market for new investments, generating more profits and savings, attracting more trained professionals from other locations. Less dynamic regions, in addition to retaining less qualified professionals, would tend to overcharge production in order to compensate for losses, becoming even less competitive. <b>Feedback effects</b> are the negative consequences of the process, while <b>diffusion effects</b> are the positive consequences. Only public sector action aimed at reducing inequalities between regions would be able to reverse the trend of divergence.

<p>Forward and Backward Chaining (Hirschman, 1958)</p>	<p>Considers inequality a requirement of the development process, which would be achieved through a sequence of imbalances, which would be the way for peripheral regional economies to leverage their scarce resources. The <b>backward linkages</b> would result from the upstream effect of increased demand for inputs (generating imbalance). The <b>forward linkages</b> would consist of the supply of inputs, which would make the positioning of downstream sectors viable. It admits that economic development can be transmitted from one region to another, through planning that seeks complementarity between areas.</p>
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Source: The Authors (2023), based on Perroux (1955); Myrdal (1957); Hirschman (1958)

In view of the Keynesian influence, the theories summarized in table 1 admit state intervention as an important element for economic development. In this regard, Silva; Lima (2015, p. 136) highlight that:

State actions influence transformations in economic structures. Your action is essential to influence business decisions. The State has an important role in economic development, as it is capable of intervening with public policies capable of stimulating economic development, through improving infrastructure, promoting productive activities and social investments.

However, Amaral Filho (2001) warns that in contemporary times there is an urgent need for a new perspective on State action, which merges both neoliberal ideals and principles and those linked to state centrality:

As for the first [neoliberalism], this does not accept the blind belief that the market and prices are the only mechanisms for coordinating the actions of agents. As for the second [state centrality], this does not accept the generalist dirigisme that leads to heavy bureaucracy, rigid hierarchy and financial waste (Amaral Filho, 2001, p. 270).

In other words, the State's actions in favor of local/regional development must be guided by a more pragmatic perspective, with this entity moving between absolute neoliberalism and state centrality.

### 3 Universities and local/regional development

There is consensus in academic literature regarding the effective contribution of universities to the development of the nations in which such institutions are located. However, this contribution is not so evident when the local/regional scale constitutes the focus of analysis (Serra; Rolim; Bastos, 2018), considering that local and regional economies are not necessarily reductions of the national scale (Hirschman, 1961).

In any case, there is a recurrent implementation of universities under the justification of inducing regional development, in light of the precepts of the main Theories summarized in the previous section. In the Brazilian scenario, the 1960s constituted a period of significant expansion of federal universities, with such institutions being understood as “motors” for the development of the country, which was then in a frank process of urbanization and industrialization (Vinhais, 2013; Pereira, 2017).

After this period, only in the 2000s would there be a new impulse in the implementation of new campuses and new federal universities. In that context, the Ministry of Education argued that:

There is recognition that the phenomenon of internalization [of federal universities] brings, in addition to the possibility of access, significant contributions to the development of the regions where these academic units are located, since, together with teaching, research and extension are developed. In this way, Reuni<sup>1</sup> constituted a program that enables the Federal Higher Education Institutions to fulfill its role in supporting the development of states, regions and the country (Brasil, 2012, p.27).

In the wake of the forward and backward chaining theory proposed by Hirschman (1958), Vinhais (2013) problematizes that in the case of a university's local/regional impact, the “backward linkages” are related to the institution's short-term impact, involving the university's direct expenses and investments (implementation and maintenance of campuses, payments of salaries, student expenses, among others). “Forward linkages” are associated with long-term impacts, materialized in the expansion of human capital, growth in research and innovation, attraction of qualified labor, among others.

In line, for Casqueiro; Irffi; Silva (2020) the local/regional impact of universities is not limited to the static economic effect. A dynamic effect is also evident, resulting from the actions of these institutions in the formation of human capital, transfer of technology, provision of assistance services (legal and health, for example), triggering a process of job generation resulting from the boosting of the sectors of services and commerce.

Encouraging education, especially higher education, leads to accelerated growth in the place of implementation. This rapid process occurs due to the need for the environment to adapt to the new local reality, resulting in development due to the increased demand for teachers, technicians and students at the location. At the same time, high school graduates without higher education options in their region tend to migrate, often permanently, to places where the offer is wider and more diverse (Casqueiro; Irffi; Silva, 2020, p. 160).

Although the contribution of universities to local/regional development occurs in different ways<sup>2</sup>, it is a fact that such institutions constitute an active factor for regional development from an economic perspective (Caldarelli; Camara; Perdigão, 2015), as they represent a means of inserting State resources into the municipalities and regions in which they are located (Casaril, 2019; Curi Filho; Wood Júnior, 2021).

<sup>1</sup> The Support Program for Restructuring and Expansion Plans of Federal Universities (REUNI, its acronym in Portuguese) was established by Federal Decree n° 6.096/2007, with the objective of expanding access and retention in higher education. The program made it possible to allocate huge resources to Brazilian federal universities, resulting in the creation of new campuses, new universities, in addition to significant investments in existing university structures. Expected to be valid until 2012, in practice the last investments associated with the program were materialized in 2014 (Brasil, 2012).

<sup>2</sup> Universities can contribute to local/regional development through the formation of human capital, the generation of scientific knowledge, the provision of services to the population, boosting local/regional innovation, increasing local/regional income, creating local competitive advantages, among other aspects (Caldarelli; Camara; Perdigão, 2015; Serra; Rolim; Bastos, 2018).



In the perspective, for Kureski; Rolim (2009), among the short-term impacts of universities on a given region, those that occur on local income flows stand out, materializing in:

Impacts on families (increases in income as a result of various payments and resulting multiplier effects); impact on local governments (increase in revenue, but also greater demand for public infrastructure goods); impact on local companies (increase in demand, but also in competition in the market for purchasing production factors) (Kureski; Rolim, 2009, p. 33).

For Niquito; Ribeiro; Portugal (2018), the impact of universities on a given location tends to be enhanced by the consolidation of partnerships between these institutions and the private sector. However, for these authors, even in the absence of greater involvement of the university institution with the respective community, its economic impacts are representative of the generation of jobs, investments in infrastructure, as well as the increase in demand for goods and services.

A similar finding is presented by Curi Filho; Wood Júnior (2021), according to which, when establishing themselves in a given location, universities promote development through the generation of direct and indirect jobs, as well as through the provision of services and cultural activities that end up promoting the image of the region.

In summary, the brief theoretical discussion undertaken here supports that universities significantly impact the regions/locations in which they are located, in the short and long term. Short-term impacts – related to local income flows – are relatively simpler to estimate, although Curi Filho; Wood Júnior (2021) draw attention to the need for data before and after the implementation of the university.

The next section presents the methodological characterization of the study, the procedures adopted, as well as the municipalities and respective campuses selected for analysis.

## 4 Methodology

From a methodological point of view, the present investigation is characterized by its **qualitative-quantitative nature**, as it employs a combination of both approaches, namely, analysis based on contextualized relationships and the use of numerical data and statistical techniques to understand a phenomenon (Gerhardt; Silveira 2009; Creswell, 2010).

It is also research with an **applied purpose**, given the interest in the practical consequences of knowledge and in local issues and problems (Gil, 2008; Gerhardt; Silveira 2009); **exploratory level**, as it seeks to contribute to a general view of the researched phenomenon, aiming to make it more explicit (Gerhardt; Silveira 2009); and, **deductive method**, for using general laws to understand a particular phenomenon (Gil, 2008).

As for the design, based on Gil (2008); Marconi; Lakatos (2003), It is reasonable to admit that research consists of:

- **Bibliographical research**, carried out based on previous academic material, such as theses, scientific articles and books, aiming to identify production related to the phenomenon researched;
- **Documentary research**, as it involves the manipulation of data that can be reworked according to the objectives of the investigation (in this case, economic data on the municipalities considered for study);
- **Multi-case study**, as it involves an empirical study on a phenomenon in its real context, considering two distinct realities, supported by the **Statistical Method**, due to the use of a Linear Regression model with Dichotomous Variable to manipulate variables in order to identify relationships between phenomena.

#### 4.1 Locus of investigation

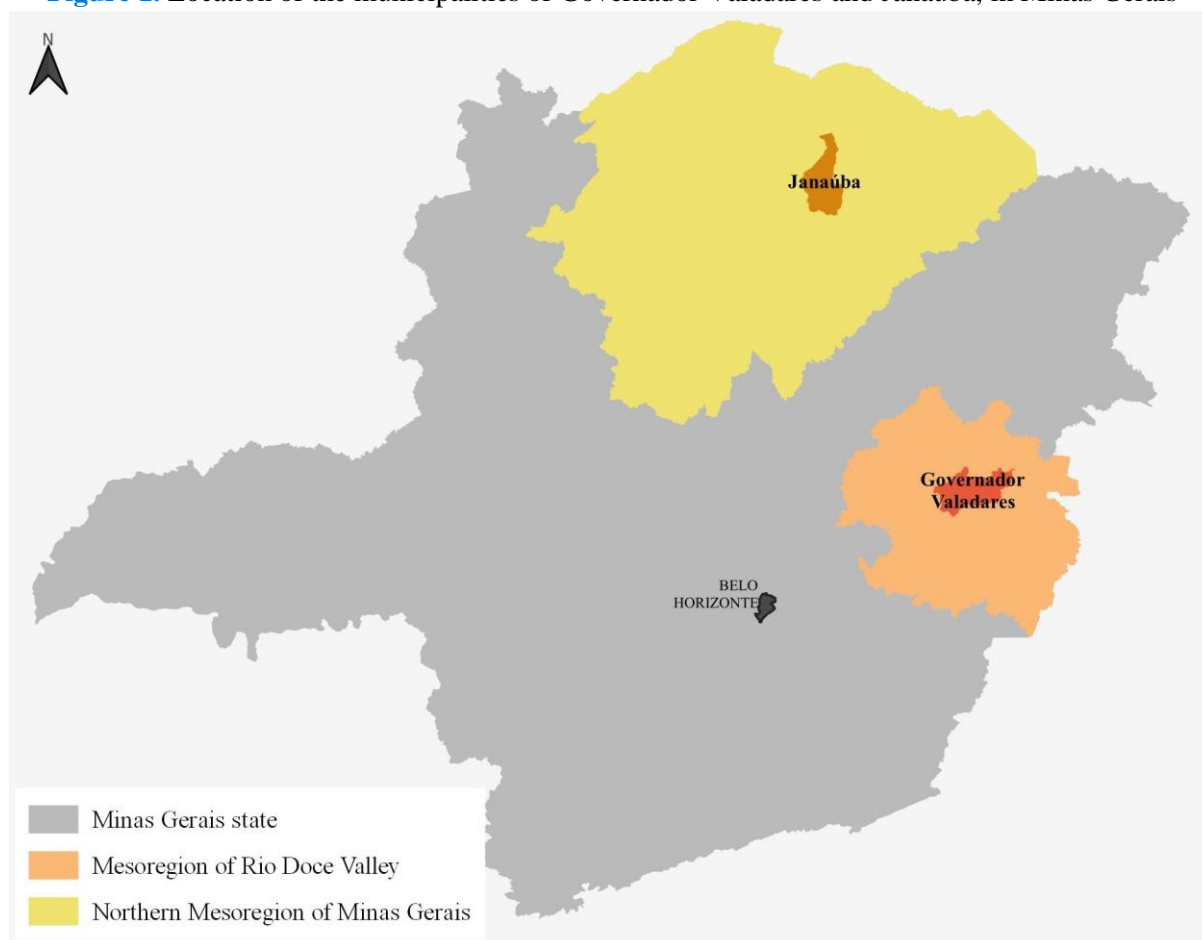
As already mentioned, this investigation aims to evaluate the short-term economic impacts resulting from the implementation of the campuses of the federal universities of Juiz de Fora and Jequitinhonha and Mucuri Valley, on the Minas Gerais municipalities of Governador Valadares and Janaúba, respectively.

The municipality of Governador Valadares is located in the Mesoregion of Rio Doce Valley in Minas Gerais, being crossed by this river. Most populous municipality in the eastern region of Minas Gerais with 257,172 residents according to the 2022 Census (IBGE, 2023c), it is considered medium-sized – in terms of population – being classified as Regional Capital C (IBGE, 2018), polarizing much of the eastern portion of the state.

In turn, the municipality of Janaúba is located in the Northern Mesoregion of Minas Gerais. Located in the area of influence of the municipality of Montes Claros, it is a small municipality, classified as Sub-regional Center B (IBGE, 2018), housing 70,699 residents, according to data from the 2022 Census (IBGE, 2023c).

Figure 1 shows the location of both municipalities in the state of Minas Gerais.

**Figure 1.** Location of the municipalities of Governador Valadares and Janaúba, in Minas Gerais



Source: The Authors (2023)

In 2020, the Gross Domestic Product (GDP) of Governador Valadares was R\$ 6.04 billion (IBGE, 2020), which translates into a GDP per capita of almost R\$ 24 thousand, associated with a Human Development Index of 0.727 (IBGE, 2023a). The tertiary sector is the one with the greatest weight in the economy of this municipality, being responsible for around 85.2% of GDP, while industry accounts for 13.9% and the agricultural sector for just 0.9%.

In the case of Janaúba, in 2020 its GDP was R\$ 1.05 billion (IBGE, 2020), resulting in a GDP per capita of R\$ 16,320.53 associated with an HDI of 0.696 (IBGE, 2023b). The tertiary sector is the most representative for the municipal economy with a weight of around 87.7% of GDP, while industry and agriculture represent, respectively, 7.8% and 4.5%.

At the end of 2012, an advanced campus of the Federal University of Juiz de Fora was established in Governador Valadares, with several courses in the areas of health and applied social sciences, totaling approximately 4 thousand students. In 2014, work began on the construction of the university campus, however, work was halted and academic activities currently take place in different properties spread across the urban fabric of Governador Valadares (UFJF, 2022).

In the case of Janaúba, at the end of 2011 the creation of a campus of the Federal University of Jequitinhonha and Mucuri Valley was approved (UFVJM, 2017), which in 2019 had 4 courses, 240 places for undergraduate entry and 359 enrollments (UFVJM, 2019).

Despite the differences in scale, both the municipalities of Governador Valadares and Janaúba received a secondary campus of a federal university in the early 2010s, within the scope of policies to expand the federal higher education network. Furthermore, in both cases the services sector is more economically representative, making up more than 85% of the municipal GDP.

For this reason, the investigation now undertaken is based on the assumption that the impact of universities on the municipalities analyzed tends to be more evident on the economic variable “TVA defense, public education and health and social security” and consequently, on the “TVA for Services”.

#### 4.2 Methodological procedures

The bibliographical research focused on the bases Scientific Electronic Library Online (SciELO) and Google Scholar, focusing on the occurrence of the terms “universities” and “local and regional impact” in the “title” field. The Boolean operator “AND” was adopted, since it provides the intersection between the searched expressions and, therefore, directs the results to works that specifically address the local and regional impacts of universities.

From reading the summaries of the studies collected, those that addressed the economic impact of universities were selected, in order to build the theoretical foundation of the study. Throughout the writing, new successive searches were carried out following the same criteria, aiming to expand the range of discussion.

The documentary research involved collecting municipal information from the portal “IBGE-Cidades”, as well as gathering information about the “GDP” and “TVA for Services” of municipalities with the IBGE Automatic Recovery System (SIDRA).

The time frame considered for collecting municipal economic data consists of the period between 2002 (oldest year with data available for both municipalities) and 2020 (most recent year with data available for both municipalities, at the time of the research). The data were deflated for the base date 2002, according to deflator indices made available by IBGE (IBGE, 2023d).

To analyze to what extent the presence of a federal university is related to the variation in “TVA for Services”, as a consequence of the increase in “TVA defense, public education and health and social security”, the statistical method of Linear Regression with Dichotomous Variable was used.

According to Gujarati; Porter (2011, p.39), “regression consists of the statistical method that allows the study of the dependence of a given variable in relation to one (or multiple) explanatory variables, aiming to estimate the value of the first as a function of the second”.

However, sometimes the dependent variable is influenced by qualitative variables that must be included among the quantitative variables. These variables indicate the presence or absence of a certain quality or attribute, being “quantified” through artificial variables that assume values of “1” (indicating the presence of the attribute) or “0” (for his absence) (Gujarati; Porter, 2011).

In the present study, the TVA for Services was considered as the dependent variable, while the explanatory variable was “TVA defense, public education and health and social security”. The dichotomous variable adopted was “presence of a federal university”. Converging on what they point to Gujarati; Porter (2011), to obtain the regression, the value “0” (zero) was assigned to the years in which the municipalities did not have a university (2002 to 2012) and “1” (one) to the years in which universities were already present (2013 to 2020).

Based on Gujarati; Porter (2011); Hoffman (2016) and based on the criteria presented, the linear regression model represented by equation 1 was proposed.

$$\tilde{y} = \beta_0 + \beta_1 \cdot X + \beta_2 \cdot D + u \quad (1)$$

On what:

- y** = Dependent variable (TVA for Services)
- $\beta_0$**  = Intercept
- $\beta_1$**  = Significance of the statistical variable
- X** = Explanatory variable (TVA defense, public education and health and social security)
- $\beta_2$**  = Significance of the dichotomous variable
- D** = Dichotomous variable (“0” representing the years in which the municipalities did not have a university, or “1” for the years in which there was a university)
- u** = Standard error

After compiling and processing the data, the Microsoft Excel software ®, “Data Analysis” complement, was used to calculate Linear Regression with Dichotomous Variable. Based on Hoffmann (2016), the confidence level of 95% was adopted in this work. Therefore, only influence relationships with P-value <5% were considered statically significant. The degree of explanation of the regression is given by the Adjusted Coefficient of Determination (Adjusted R-squared or R<sup>2</sup>-Adjusted), and the closer to 100%, the greater the degree of explanation of the phenomenon depending on the variables.

Having characterized the investigation methodology, the next section presents and analyzes the data collected.

## 5 The direct economic impact of selected Minas Gerais universities

This section begins with table 2, which presents the values referring to “TVA defense, education and public health and social security” and “TVA for Services” between 2002 and 2020, for the selected municipalities. It is important to emphasize that the values were deflated for the year 2002.

**Table 2.** “TVA defense, education and public health and social security” and “TVA for Services” for the municipalities analyzed, between 2002 and 2020.

Year	Governador Valadares (MG)		Janaúba (MG)	
	TVA defense, education and public health and social security (R\$)	TVA for Services (R\$)	TVA defense, education and public health and social security (R\$)	TVA for Services (R\$)
2002	228,826,958.11	940,705,828.78	52,131,147.54	125,418,032.79
2003	218,934,434.21	936,907,834.98	49,733,480.84	121,936,306.79
2004	224,571,277.53	998,203,823.70	49,484,731.05	127,101,958.56
2005	230,921,180.48	1,002,576,667.51	50,975,623.42	133,354,696.27
2006	241,607,104.12	1,078,131,905.08	55,170,385.37	153,038,833.91
2007	259,236,275.02	1,123,971,781.81	58,335,700.16	166,823,284.66
2008	272,762,596.40	1,112,167,327.95	68,518,396.94	177,710,983.62
2009	276,745,225.11	1,150,362,334.36	66,215,736.93	170,491,763.70
2010	297,579,313.26	1,191,041,180.64	66,555,794.97	174,410,940.94
2011	301,565,453.91	1,205,244,094.69	68,134,180.98	183,232,708.02
2012	314,190,267.11	1,277,667,946.63	71,546,743.19	202,898,341.90
2013	328,299,232.93	1,354,729,472.79	77,494,970.18	213,376,697.65
2014	343,373,780.83	1,378,328,352.04	80,004,237.94	233,622,811.60
2015	358,147,576.30	1,394,337,209.67	83,082,412.17	242,531,837.85
2016	347,334,961.46	1,343,787,699.79	79,637,423.53	230,561,551.11
2017	362,419,133.54	1,368,918,456.98	85,743,948.13	238,699,561.43
2018	360,078,983.18	1,387,823,531.17	84,048,342.25	242,395,406.69
2019	353,028,291.00	1,439,135,613.68	83,320,253.14	255,846,127.66
2020	354,388,957.22	1,304,279,268.77	77,931,007.37	233,405,021.06

Source: IBGE (2020)

From the data presented in table 2, it is possible to infer that the variable “TVA defense, education and public health and social security” grew 54% in the municipality of Governador Valadares, between 2002 and 2020. In the municipality of Janaúba, growth was 49% in the same period. At the same time, the variable “TVA for Services” grew 53% in the municipality of eastern Minas Gerais between 2002 and 2020, while in Janaúba growth reached 86% in the period analyzed.

Therefore, although the variable “TVA defense, public education and health and social security” showed relatively similar growth in both municipalities, “TVA for Services” showed significantly more significant growth in Janaúba between 2002 and 2020.

In turn, tables 3 and 4 present the statistical summary of the calculation of Linear Regression with Dichotomous Variable for the two municipalities analyzed.

**Table 3.** Statistical summary of the calculation of Linear Regression with Dichotomous Variable for the municipality of Governador Valadares (MG).

Regression Statistics	
Multiple R	0,975910173
R-Squared	0,952400665
Adjusted R-squared	0,946450748
Standard error	38463111,28
Observations	19

ANOVA					
	gl	SQ	MQ	F	F of significance
Regression	2	4,73617E+17	2,36809E+17	160,0695756	0,0000000000026
Residue	16	2,36706E+16	1,47941E+15		
Total	18	4,97288E+17			

	Coefficients	Standad error	Stat t	P-value	95% lower	95% higher	Lower 95,0%	Higher 95,0%
Intersection	307549818,5	90483313,32	3,398967248	0,0036681513	115733763,1	499365873,9	115733763,1	499365873,9
TVA administration, defense, education and public health and social security	3,011549759	0,344307002	8,746699134	0,0000001710	2,28165152	3,741447998	2,28165152	3,741447998
Presence of UFJF	7163414,38	35847686,24	0,199829198	0,8441318056	-68830285,64	83157114,4	-68830285,64	83157114,4

Source: The Authors (2023)

**Table 4.** Statistical summary of the calculation of Linear Regression with Dichotomous Variable for the municipality of Janaúba (MG).

Regression Statistics	
Multiple R	0,98733588
R-Squared	0,974832139
Adjusted R-squared	0,971686157
Standard error	7632476,729
Observations	19

ANOVA					
	gl	SQ	MQ	F	F of significance
Regression	2	3,61023E+16	1,80511E+16	309,8657133	0,0000000000002
Residue	16	9,32075E+14	5,82547E+13		
Total	18	3,70343E+16			

	Coefficients	Standad error	Stat t	P-value	95% lower	95% higher	Lower 95,0%	Higher 95,0%
Intersection	-22462002,89	14411574,4	-1,558608537	0,1386474164	-53013175,83	8089170,054	-53013175,83	8089170,054
TVA administration, defense, education and public health and social security	3,022399535	0,232747593	12,98573914	0,0000000007	2,528996678	3,515802392	2,528996678	3,515802392
Presence of UFVJM	14305905,17	6046319,372	2,366051855	0,0309365307	1488280,69	27123529,65	1488280,69	27123529,65

Source: The Authors (2023)

As can be seen in tables 3 and 4, the proposed regression model has a high capacity to explain the relationship between the variables of the analyzed phenomenon, (Adjusted R<sup>2</sup> of 0.94 for Governador Valadares and 0.97 for Janaúba) and F of significance less than 0.05 in both cases. It is also verified that the dependent variable “TVA for Services” is significantly influenced by the explanatory variable “TVA administration, defense, education and public health and social security”, since in both cases the P-value for the latter is less than 5%.

However, in the case of the municipality of Governador Valadares, the presence of the Federal University of Juiz de Fora is not statistically significant (P-value > 5%) to explain the

behavior of the economic variables analyzed. In other words, the implementation of the UFJF campus in the city of eastern Minas Gerais did not influence in a statistically relevant way the evolution of “TVA administration, defense, education and public health and social security” and, consequently, of “TVA for Services”.

The same does not occur in the case of the municipality of Janaúba, in which the implementation of the campus of the Federal University of Vales do Jequitinhonha and Mucuri presented statistical significance (P-value < 5%) to explain the evolution of the variables “TVA administration, defense, education and public health and social security” and “TVA for Services”. In other words, the implementation of the UFVJM campus in Janaúba significantly influenced, in statistical terms, the growth of economic variables in the services sector.

In this way, applying the proposed regression model to data referring to the municipality of Janaúba, it is possible to estimate the influence of UFVJM on the economic variables selected for analysis, according to equation 2.

$$\hat{y} = 22.462.002,89 + (14.305.905,17 \times 0,03093653069) + (3,022399535 \times 1) + 7.632.476,73 \quad (2)$$

$$\hat{y} = 30.537.057,71$$

In effect, it is inferred that the installation of the UFVJM campus in the municipality of Janaúba was responsible for the contribution of approximately R\$ 30.5 million to “TVA for Services”, due to the increase in “TVA administration, defense, education and public health and social security”. Therefore, in the scenarios analyzed, it was found that the direct short-term economic impact resulting from the implementation of a university was more evident in the smaller municipality (Janaúba), than in the larger municipality (Governador Valadares).

In this sense, Vinhais (2013) problematizes that there is a tendency for universities located in smaller municipalities – as is the case of Janaúba – to have a greater impact on local expenses in the short term, which does not necessarily occur in universities located in larger municipalities.

Empirically, there is evidence that indicates that universities located in small communities, which attract students from abroad, generate relevant effects on spending, but have small impacts on knowledge. Those located in large communities, with more developed economies, generate important effects on knowledge, but minimal effects on local spending (Vinhais, 2013, p. 23).

In the same vein, when analyzing the regional insertion of Brazilian federal universities, Rolim (2018) also problematizes that a university, even a small one, has a more representative short-term economic impact in smaller municipalities than those generated by a large university in larger cities.



This is because in smaller cities the university ends up being the only provider of specialized services, the only provider of artistic shows, the major provider of health care and other services that the small size of local markets would not allow to be offered by the market (Rolim, 2018, p. 238).

Given this, it is reasonable to admit that in the context analyzed here, the assumptions postulated by Vinhais (2013) e Rolim (2018), according to which, smaller municipalities tend to perceive more immediately the direct economic impacts resulting from the implementation of a university.

Despite these findings, it is essential to note that the analysis undertaken here is not exhaustive, covering only one of the multiple ways in which a university impacts a given region. This is because, as problematized by Hoff; Pereira; De Paula (2017), universities has the capacity to impact a given region in a broader and difficult-to-measure dimension, involving subjective aspects related to teaching, research, extension, citizenship and cultural training.

## 6 Final considerations

The present work set out to investigate to what extent the implementation of a university had a direct short-term economic impact on the “Tax Value Added for Services” (TVA for Services), in the Minas Gerais municipalities of Governador Valadares and Janaúba, which received campuses of the federal universities of Juiz de Fora (UFJF) and Jequitinhonha and Mucuri Valley (UFVJM), respectively.

To this end, the statistical method of Linear Regression with Dichotomous Variable was used to estimate the impact of the presence of the university campuses of UFJF and UFVJM on “TVA for Services”, due to the increase in “TVA defense, education and public health and security social” in the selected municipalities.

In line with academic literature, it was found that in the smaller and more economically complex municipality – Janaúba – the direct economic impact resulting from the implementation of the UFVJM campus was more evident. On the other hand, in the largest municipality – Governador Valadares – any impacts associated with the implementation of the UFJF campus were statistically less representative.

However, it is essential to note that this scenario does not mean that the implementation of the UFJF campus did not have a positive impact on the municipality in eastern Minas Gerais. As pointed out in the literature, the lower direct economic impact of the university in Governador Valadares is probably related to the greater complexity and economic diversification of the municipality, which ends up diluting in the short term the externalities generated by the arrival of the university.

In view of this, recognizing that the availability of systematized data constitutes a

complicating element, new investigations that explore the long-term impacts arising from the implementation of universities both in the municipalities analyzed here and in others in similar situation.

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