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FISCAL IMPACT ASSESSMENT OF PARKS AT THE MUNICIPAL LEVEL: SERRA DO GANDARELA NATIONAL PARK AND BOA NOVA NATIONAL PARK

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ABSTRACT

This research evaluated the impact of parks created after the National System of Conservation Units (SNUC), in 2001, on the socioeconomic structure of municipalities with up to 200 thousand inhabitants. The objective was to verify whether these parks influence local economic development, using as cases the Serra da Gandarela National Park (Rio Acima, MG) and the Boa Nova National Park (Boa Nova, BA). The hypothesis is based on the idea that parks could boost the economic development of the surrounding populations. Using the synthetic control method, it was estimated how municipal taxes would evolve if the parks had not been created. The results gave different signals. In the case of Boa Nova, the hypothesis was confirmed, indicating economic benefits. However, in the case of Serra da Gandarela, there was a reduction in revenue, suggesting that the impacts of the parks depend on the local context and the way of implementation and use by the community.

Keywords: Parks, Municipal taxes, Synthetic control, Local economic development.

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INTRODUCTION

Conservation Units (UCs) are a specific type of protected areas, which aim to safeguard the representativeness of significant and ecologically viable portions of the different populations, habitats and ecosystems of the national territory and jurisdictional waters, preserving the existing biological heritage, guaranteeing traditional populations the sustainable use of natural resources in a rational manner (BRASIL, 2000). The parks make up one of the types of UC, classified as full protection, with the basic objective of "the preservation of natural ecosystems of great ecological relevance and scenic beauty, enabling scientific research and the development of environmental education and interpretation activities [...]" (BRASIL, 2000, p. 5).

This work evaluates Brazilian natural parks, from the perspective of public policies, in order to investigate whether they can act as possible instruments of local (municipal) development. The analysis aims to oppose approaches and conceptions, present in the discussion between environmental conservation and socioeconomic development – and to stimulate reflection on the role that PAs play in the country's economy (GURGEL et al., 2009; MARTINE; ALVES, 2015). The understanding that this type of protected area is a space that hinders enterprises, harming income generation and jobs, is outdated (ECODEBATE, 2011; LANDIM, 2023; SOUZA, 2017; WWF, 2017; QUADROS, 2019). Although they impose limits on the use and occupation of land on the surrounding communities and municipalities, the PAs can promote gains and advantages to these same communities, since they can trigger a series of activities derived from the environmental services and economic activities they guarantee and provide (XAVIER, 2018). The objective of this work was to analyze the impact of national parks created after the implementation of the National System of Conservation Units (SNUC), in 2001, and which have had, at least, for the years analyzed (2018, 2019, 2021 and 2022) a visitation of 1000 person/year on the socioeconomic structure of municipalities with up to 200 thousand inhabitants.

The hypothesis is that the presence of the park tends to be positive, highlighting that they can be considered as public policies to promote socioeconomic development. It is based on the premise that the park can act as an asset of this locality, by promoting socioeconomic benefits combined with environmental protection. It is argued that parks can be a means of generating resilient, inclusive development with links over all areas of the local economy – especially in smaller municipalities, in terms of population, and less complex. It is worth mentioning that these effects depend on both the quality of the park's

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administration and the context in which they are inserted. In each context, the interaction between the park and the local economy will occur in a specific way.

The analysis was developed from the application of the synthetic control methodology to estimate the counterfactual of how the sum of municipal taxes in municipalities without parks would have evolved. This is an unprecedented application of this methodology to evaluate the fiscal impact of parks on the municipal economy, since it is more frequent to use methods of environmental economic valuation, other econometric methods, or works aimed at an anthropological/historical approach. Its application is justified by establishing a common starting point that allows the comparison of very specific and distinct situations. With the chosen method, it is possible to test a hypothesis in quantitative terms, while at the same time it is possible to delve into qualitative aspects.

The municipality was the geographic and political unit to represent the place, based on two reasons: greater availability of municipal databases and importance in the federative composition of the country. A cut of 200 thousand inhabitants was defined based on the definition proposed in the survey "Regions of Influence of Cities" REGIC 2018 (IBGE, 2020), through which, given this population cut, the most influential municipalities were excluded. In this way, the premise is established that the smaller/less complex and influential the municipality, the greater the park's ability to influence the economy of that place (IBGE, 2020).

The indicator selected as the response variable was: Taxes – Total collection of municipal taxes (IPTU, ITBI and ISS), including active debt, fines and interest – R$, obtained from IPEADATA. It contains the taxes under the competence of the municipality: taxes, fees and improvement contribution. It is understood that part of the economic impact of the presence of the parks can be reflected in a variation in taxes at the municipal level[4]. Mendes et al. (2018) point out that tax collection is related to the financial capacity of the municipality and is the result of local tax policy, whose greater municipal economic dynamics tend to improve the capacity for revenue formation within the municipalities. To carry out this analysis, criteria were established that guided the choice of two parks: Serra da Gandarela National Park (Rio Acima, MG) and Boa Nova National Park (Boa Nova, BA).

[4] However, it should be considered that part of this effect of the parks, in terms of taxes, will not be made explicit, given that they impact taxes from other spheres, such as ICMS, which has great relevance in the Brazilian fiscal scenario. The idea was to filter for impacts more directly related to the municipal sphere.

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LITERATURE REVIEW

In Brazil, the local development agenda acquired greater relevance at the end of the 1990s, and is the result of important changes, such as the decentralization of planning and management of public policies, as well as the expansion of society's participation in the public sphere. (BUARQUE, 1999; COAST; KRONEMBERGER, 2016). This new panorama expanded the political and administrative prerogatives of the municipalities, as well as allowed their own taxation and, above all, increased the constitutional transfers of the Union and the States, enabling greater tax revenue for the municipal governments. This has brought greater responsibility to municipalities in promoting local economic development policies and public goods (GOMIDE; PIRES, 2014).

The municipal scale provides a great proximity between the decision-making bodies and the problems and needs of the population and the community. With this, greater direct participation of society is allowed, reducing the weight and natural mediations of the mechanisms of representation, strengthening the local power in the choice of its alternatives and in the decision about its destiny. However, the smaller the spatial scale of decisions, the greater the influence of local forces and the proximity of the power structure, with all the implications for the differentiated interests of society (BUARQUE, 1999).[5]

There are several types of municipal taxes in Brazil, each with a specific purpose and a different calculation basis: Urban Property Tax (IPTU): Tax on Services of Any Nature (ISS); Real Estate Transfer Tax (ITBI); Garbage Collection Fee: License Fee for Operation; Public Lighting Contribution (CIP) (SABBAG, 2011). There is a tendency for municipalities with lower revenues to have less capacity to implement public policies. Thus, these municipalities exhibit worse indicators of municipal development, indicating that the degree of financial autonomy impacts their ability to implement public policies that are more appropriate to the needs of the local population (GIOVANNI; MAGALHÃES, 2021).

The volume of taxes collected at the same time expresses the level (behavior) of municipal economic activity and a capacity of this entity, by its own means, to foster its local economy, through such resources. As local development advances, with the expansion and diversification of productive structures and the levels of per capita income of the population of the municipalities, the bases of taxation are expanded. In this way, the government's state capacity to collect taxes from the private sector is increased and, consequently,

[5] It is worth noting that these considerations apply best to small and medium-sized municipalities.

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strengthen the financing bases, which results in more local development. (GIOVANNI; MAGALHÃES, 2021).

In Brazil, parks have become important instruments for nature conservation and promotion of tourism activity (SALVIO; GOMES, 2021). Among the categories of SNUC UCs, park is a relevant field for studies and research on tourism and social development, as it aims to preserve biological diversity and natural landscapes associated with the purposes of recreation and ecological tourism in its territory (BOTELHO, 2018). Its areas belong to public domains; thus, possible private areas, included within its limits, should be expropriated (SANTOS et al., 2021).

Parks are constituted in places where there is generally a significant presence of natural resources, both in terms of forest and water remnants, as well as qualitative, which provide spaces for leisure, recreation and research. These last actions are configured from unusual territorial aspects, enhanced by the presence of the park. For these reasons, it is argued that the park is capable of generating interest on the part of the population and sectors of the economy. In this sense, the park is an opportunity to improve these elements of nature, becoming a factor in the generation of social well-being, by providing, regulating and conserving the ecosystem services present in it.

However, a problem that most of them face is the scarcity of human and financial resources to monitor and enforce regulations and standards (YOUNG et al., 2018). In addition, resource management sometimes encounters explicit opposition from local populations to the policies implemented. This occurs, especially, when these policies ignore pre-established institutions and regional needs. In this sense, three main fronts can be highlighted through which parks exert their potential effects on socioeconomic characteristics: Conservation; Nature and adventure tourism; Environmental Research and Education.

Ecosystem services encompass all goods, products, and services derived from ecosystems and that contribute to the well-being of human populations, and are defined as the set of benefits that people obtain from ecosystems (GUERRY et al., 2015). The "Millennium Ecosystem Assessment" document distinguishes four categories of ecosystem services: provision services (timber, seafood); regulation (climate, floods); support (pollination, pest control, food production); and cultural (inspiration and serenity in nature) (CHAN, et al., 2006). Such services are produced across a whole spectrum of ecosystems,

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and can be final (seafood) or intermediate (generation of habitats that support fish populations) (GUERRY et al., 2015).

These authors point out that the understanding of who impacts the generation of ecosystem services (suppliers and producers) – and who is benefited (beneficiaries and consumers) – makes it possible to assess the costs and benefits of a given policy, including the consequent ways of distribution among the parties involved or impacted. Institutions such as private property and access rights, together with the nature and services in question, configure the political context and influence the set of incentives on the use and provision, public or private, of ecosystem services. Understanding the institutional landscape and incentive structures can aid in more effective management and governance. Ecosystem services are scarcely provided largely due to the failure of markets and other institutions to provide adequate incentives to conserve and value them (CARPENTER et al., 2009).

With regard to parks, because they restrict the direct use of the resources contained in their area, their performance provides, more directly, support, regulatory and cultural services. On the first two, parks can contribute significantly to flood control, carbon capture/storage, water supply, air purification, pollination, erosion control, control of populations of potential pests and potential vectors of human diseases, retention of suspended solid particles, protection against wind and rain, maintenance of microclimatic balance, aesthetic and landscape enhancement of the place, as well as conservation and knowledge of biodiversity. Indirectly, by providing these services, the parks can enhance the provision services of their surroundings, thus benefiting economic activities that depend more on the various provision services. In smaller municipalities, all these factors become more important given a higher level of dependence on the elements of the territory (CUNHA; FERRAZ, 2019).

Tourism is a very important sector of the economy for Brazil, given its potential and its ability to reconcile environmental conservation with investments in the economy, with little impact on natural resources. It presents itself as a relevant sector in the development of a low-carbon economy (YOUNG et al., 2018). In general, the practice of tourism and recreation in natural areas produces benefits that relate to the possibility of increasing opportunities for the region.

Park tourism boosts the protection of natural and cultural heritage; it protects ecological processes, conserves bio and geodiversity; improves the quality of life of the

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community; promotes aesthetic values; stimulates the development of culture, arts and crafts; it raises the educational level of the local community by valuing its culture and the regional environment, among other benefits. However, tourism is considered as an activity that, at the same time, is the reason for several negative effects that need to be monitored, involving multiple social actors in this process (BOTELHO, 2018).

Ecotourism, a frequent type of tourism in the parks, is configured as a vehicle to finance conservation and promote the economic development of underdeveloped areas, benefiting local communities. The basic conditions for this practice of tourism translate into the existence of visitor centers, means for the interpretation of nature, trails, camping areas and accesses, signage, viewpoints, trained drivers and other support structures that will allow effective service. It is important to note that the most visited Brazilian parks are those that have a differentiated and more diversified structure (PERRY et al., 2015; XIAO et al., 2017). However, their structure still has weaknesses compared to other countries (roads, for example, can be significant in the diversity and number of visitors).

Using the MGM (Money Generation Model) model[6] , Young et al. (2018) estimate the impact of public use in PAs, presenting positive results for their presence in the region. With this model, these authors present direct and indirect impacts, through a multiplier that expresses such impacts, that is, tourism in PAs is analyzed throughout the sector's production chain, making it possible to understand the multiplier effects of the activity expressed in job creation, sales, remuneration and wages. In total, they obtained, as results, the following estimates: in 2016, 7 million visitors were registered in national parks, with economic impacts between 1.2 and 2.9 billion reais.

The planning of tourism in the parks demands a complexity in the relationship with service providers, tourist equipment and local infrastructure, a complexity that influences the local development process, as the tourism production chain is triggered by fostering a network of services, equipment and products that go beyond the limits of the park, as well as the municipalities covered by it. These parks can become the main attraction of a region, in which a series of developments depend on the decisions made by the management of public use, or on the dynamics of visitation – for example, seasonality due to a certain natural attribute. Visitation becomes a strategic way to protect nature, since the visitor can articulate the reality he lives (and the recurrent environmental problems and conflicts) with

[6] ECONOMIC IMPACT = number of visitors x average spend per visitor x multiplier.

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the need to protect natural resources, developing personal bonds of belonging to the UC (BOTELHO, 2018).

Fontoura (2014) points out that tourism contributes to the reduction of illegal activities such as hunting, deforestation, fires, although it can strengthen phenomena such as real estate speculation, land concentration, expulsion or marginalization of poorer and more vulnerable residents, as well as decharacterization of the natural landscape and disrespect for the limits of the Park. In addition, it can also produce negative effects in the locality that adopts it in the face of the increase in the consumption of soil, water and energy, the modification of the landscape, the increase in the production of waste, the loss of traditional values and the increase in prices that affects the local population (ZANIRATO, 2010).

Therefore, the parks present a relevant opportunity for the development of the sector for the country, not only because of their ability to attract tourists, but also because of the possibility of promoting a type of tourism that can benefit populations generally excluded from these processes, as in the case of traditional communities that inhabit the interior or surroundings of these areas (BRUMATTI; ROZENDO, 2020). According to these authors, the sustainable use of environmental and cultural heritage in parks should be based on the use of endogenous resources – also determined by the interests of local actors, which signal a new form of governance in the field of tourism management in PAs.

The CUs should promote the participation of society in the management processes, which occurs through the existence of management councils, which, in general, have an advisory character and are formed by members of civil society and representatives of government institutions (BRASIL, 2000). This type of mechanism enables the existence of a channel for the participation of society in the decision-making processes (MIRA; MARINE; LOBO, 2021).

Given the breadth of initiatives that can occur in the parks – together with the restriction of direct use of resources – the councils assume a very relevant role in the management of these PAs. As there is the possibility of developing activities such as tourism and research and activities to support them, the presence in the councils of groups that may have been prevented from making use of the park for extractive or agricultural purposes can be a way to allow and strengthen the insertion of these groups in other permitted activities, as well as in activities in the surroundings (BOTELHO, 2018).

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In addition to these groups, it is also worth mentioning others that are not necessarily part of the impeded sectors, but that also, by having a voice in the park's decisions, can obtain indirect benefits, through the way in which instruments such as management plan, zoning of the surroundings and even implementations of concessions and permissions are executed. By means of such instruments, it is possible to prevent situations in which the gains from such agreements are very concentrated or "leak" from the locality (BOTELHO; RODRIGUES, 2016).

The council is represented by various sectors of society, and is composed, when possible, of public and private entities, civil society organized on a parity basis (BRASIL, 2000). The responsibilities assigned to the members of the council vary between: monitoring the preparation, implementation and review of the management plan; seek the integration of the UC with its surroundings and with other units in the region; to foster the compatibility of the various social segments and their interests, bringing them closer to the UC; supervise the management of the unit when it is being shared with an OSCIP, among others (WENCESLAU, 2020). In the case of parks, the council can become a way to integrate the surrounding populations, both through participation itself, giving voice and decision-making capacity, and by allowing adjustments, so that they can make use of resources and obtain benefits, within the possibilities established by this category of UC, participating in public use, in tourism or visitation activities.

In view of these three main areas of the parks, one of the central points on local development is debated, when the question is asked how the characteristics inherent to the region can be valued to make its economy more viable, favoring the entire population – especially the most vulnerable. In other words, how can the value of the region be increased (enhanced) to make its economy more viable, in the sense of mitigating poverty and inequality, how can parks contribute to this?

METHODOLOGY AND DATA PROCESSING

There are several studies in the literature[7]which, based on the cost-benefit analysis, seek to measure, monetarily, the importance of PAs, calculating the benefits that possible positive externalities bring in comparison to other projects not carried out, due to the restriction established on the use of resources in that area due to PAs. However, this

[7] GEF/UNDP, 2011; DUNWIDDIE; SHAW, 2013; SEE; ULIANA; ARANA, 2023; CASTRO; CASTRO, 2014; CARNEIRO, 2017, among many others.

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method is not able to establish a controlled comparison between places with and without CU, in order to isolate the effect of the presence of CU (as a treatment) in relation to other factors, in order to verify whether CU is really an influencing factor (a cause) of alteration in some selected socioeconomic factor. Similarly, there are few studies that compare a 'before' and an 'after' of the implementation of a park, or that compare affected groups with groups not affected by the impacts of the park.

The choice to create and manage PAs in specific locations may be based on technical, social, political, economic, and environmental factors. For this reason, as the choice of municipalities covered by the CUs is not random, it is expected that the treated localities will have different characteristics from those not treated. Thus, empirical methods based on simple comparisons of means between the group of units affected by the intervention and the group of those not affected would lead to biased estimates of supposed impacts (MARTINI et al., 2018).

The synthetic control method was created for case studies, and is suitable for when there are few treated units, or when there is no untreated unit that provides a good comparison with the treated unit. It is assumed that a combination of untreated units is better counterfactual to the treated one than any other individually. In determining the weightings applied to each combination, the method makes use of measurable characteristics of all the units available for analysis. The intention is to simulate, based on a combination of information observed from untreated units, the same trajectory prior to treatment that was observed in the beneficiary unit (ELLERY JR. et al., 2018). In other words, a set of weights is defined that, when applied to the selected control units, results in an optimal estimated counterfactual for the unit that received treatment. This counterfactual, called "synthetic unit", aims to estimate the behavior of the unit in question in the absence of treatment. The control units selected would be those that most closely resemble the characteristics of the unit treated in the pre-treatment period (MARTINI et al., 2018).

It is assumed that a weighted average of control units could construct the potential outcome of the unit treated in the absence of treatment – or, at least, approach this hypothetical outcome. Thus, the differences that may be observed between the treated unit and its counterfactual, after the intervention, could be attributed to the effect of the treatment, thus measuring the impact of the public policy. Therefore, the objective of the procedure is to find the approximate trajectory of the indicator of interest that the treated unit would probably have followed if it had not undergone the intervention. The trajectory of

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the synthetic control is projected in the post-treatment period and compared with the trajectory of the treated unit. The difference between these two trajectories is understood as the effect of the treatment (MARTINI et al., 2018).

Next, the criteria for selecting the parks and, consequently, the treatment units (municipalities) of the model are explained:

1. The municipality, where the park is located, cannot have another park created after the SNUC in its territory, so that it is possible to evaluate, in isolation, the effect of the park treated by the methodology.
2. The park must belong to the federal or state authorities;
3. The park must have visitation estimates above 1 thousand people for the years: 2018, 2019, 2021 and 2022, so that there is a non-zero effect of tourism on fiscal impact;
4. The park must occupy, in terms of the municipality's area, a percentage above 5% so that the presence, in terms of area, is significant, and the effects of possible ecosystem services are not zero;
5. The park was created between 2008 and 2016, so that it is possible to guarantee a good margin of time, making it possible to build a 'before' and an 'after', elements necessary for the operation of the synthetic control model (MARTINI et al., 2018).

Generally, the reference municipality is the one that has the headquarters, with the main entrance, with entrance fees, administrative infrastructure and visitor registration. Therefore, the municipalities used as a reference were those where the headquarters are located. Considering these criteria, five parks were identified[8]. Among these parks, the two with the highest visitation values were chosen, given the relevance of tourism for the analysis: PARNA Serra do Gandarela and PARNA Boa Nova.

Chart 1 summarizes the selected variables, used for the construction of the base and execution of the synthetic control models.

Frame 1: Summaries of the variables used in the synthetic control model.

Name	Description	Source	Kind
Presence Parks	Binary variable, indicating whether there is a Park created after the SNUC in the municipality	Variable created from the base of the Center for	Explanatory Variable (treatment)

[8] Cunhambebe State Park (Mangaratiba – RJ); Serra do Gandarela National Park (Rio Acima – MG); Serra da Esperança State Park (Guarapuava – PR); Boa Nova National Park (Boa Nova – BA); State Park (Pedra Selada – RJ).

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		Metropolitan Studies / CEM	
Municipal taxes	Total collection of municipal taxes (IPTU, ITBI and ISS), including active debt, fines and interest - R$ - It encompasses the taxes under the competence of the municipality: taxes, fees and improvement contribution. For the years 2002 to 2004, the difference between budget revenue and the sum of current revenue and capital revenue is due to the deductions related to Fundef. Thus, budget revenue = current revenue (-) deductions current revenue (+) capital revenue.	Institute for Applied Economic Research - RECPROPCH	Response Variable
Municipal taxes (lagged)	Total collection of municipal taxes (IPTU, ITBI and ISS), including active debt, fines and interest - R$ - It encompasses the taxes under the competence of the municipality: taxes, fees and improvement contribution. For the years 2002 to 2004, the difference between budget revenue and the sum of current revenue and capital revenue is due to the deductions related to Fundef. Thus, budget revenue = current revenue (-) deductions current revenue (+) capital revenue.	Institute of Applied Economic Research – RECPROPCH, built by the author	Construction variable
Municipal GDP	Municipal GDP - taxes on products - R$ (thousand), at 2010 prices	Brazilian Institute of Geography and Statistics - IMPPIB	Construction variable
Surface water	Water surface area in each municipality from 1985 to 2020	MAPBiomas – Aug/2021 – Collection 1.	Construction variable
Total Population	Total population of the municipality in the reference year (Source: IBGE):	IBGE	Construction Variable
Urban population	Urban population of the municipality in the reference year (Source: SNIS/IBGE):	SNIS/IBGE	Construction Variable
Effective Cattle Herd	Cattle herd by municipality.	IBGE	Construction Variable
Municipal Emissions (CO2)	Municipal net emissions (tCO2e) (emissions – removals) arising from activities under the category of Change and land use	SEEG - GREENHOUSE GAS EMISSIONS ESTIMATION SYSTEM	Construction Variable
Average yield of agricultural production	Ratio of production measured in kilograms to production area in hectares (Kilograms per Hectare)	PAM-IBGE	Construction Variable
Homicide Rate (100,000 Inhabitants)	Death due to external or unnatural causes, regardless of the time between the injurious event and the death itself, is categorized as a consequence of injury caused by violence (accidents, homicides, suicides or suspicious death). In this case, the rate per 100 thousand inhabitants is calculated by dividing the main indicator (number of homicides) by the total population in question, and this result is multiplied by 100 thousand.	IPEADATA	Construction Variable
Pop. 2001-2018	Annual municipal population	IBGE	Construction Variable
VAB Industry	Gross Value Added of Industry in the municipality	IBGE	Construction Variable

Source: Prepared by the authors.

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Mechanisms can be understood as intermediate results in a causal pathway, as a result that, because it is affected by the treatment, impacts the ultimate result of interest (FERRARO; HANAUER, 2014). In this regard, it aims to verify how much the situation of local development can be attributed to the presence of parks, seeking to elucidate and describe the causal pathways from which parks influence the quality of local development. Chart 2 lists some of the possible mechanisms that may result in impacts on the collection of taxes under municipal competence and, consequently, on local economic dynamics. Such mechanisms are categorized according to sector/aspect of the socioeconomic structure and classified as positive or negative.

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Frame 2: Mechanisms of interaction between parks and municipal taxes

Sector/Aspect	Positive Effect	Negative Effect
Tourism	Diversification of the economy and improvement of tourist support infrastructures, thus benefiting the local community. Recreational activities in natural areas can be seen as opportunities for socioeconomic transformations of a given local community (PALMA, 2004). Community-based tourism activity presents itself as an opportunity to rescue ties with the territory, strengthen identity and sociocultural diversity, enabling territorial/local development (BETTI; DENARDIN, 2013).	Model privileging medium and large entrepreneurs prevents the insertion of local populations in the economic circuit of tourism. This can lead to income concentration, segregation, and expulsion of populations from valued locations, as well as changes in local cultural patterns (BETTI; DENARDIN, 2013). It can produce negative effects in the locality, due to the increase in the consumption of soil, water and energy, the modification of the landscape, the increase in the production of waste and the loss of traditional values (ZANIRATO, 2010).
Agricultural	Agricultural irrigation sources (rivers and springs) (NETTO; OF ASSIS; DE AQUINO, 2016). Increased efficiency in production, due to the restrictions on land use imposed in order to maintain the level of productivity prior to the creation of the park, which restricted the supply of land.	Restrictions on the use of land and resources to properties located around the UC.
Trade	An increase in the flow of people who go to the place can generate an increase in sales, with growth in the number of establishments, employment and income.	Smaller establishments may not resist competition from larger establishments, which can also lead to the mischaracterization of the type of local production and culture and "outflows" of resources from the locality.
Housing	Appreciation of the land located around the park can favor landowners with increased income (ARAÚJO PEREIRA; TREDEZINI, 2011).	Real estate speculation, which leads to a process of land concentration and expulsion of the poorest population. The valorization also implies greater difficulty for the poorest to obtain access to land and, consequently, housing.
Population	Environmental education, research carried out by universities, inspection, improvements, among others; increased protection against crime; the improvement of air quality (PALMA, 2004) Air quality, climate regulation, greater predictability of precipitation, erosion, flood and	Restrictions on access to locations and resources. Impediments to the execution of certain activities generated in an authoritarian manner by the park administration.

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	flood control. All these elements can result in lower expenses related to control, prevention, maintenance, health, and repair, increasing the general disposable income of the population.	
Water supply	Protection of springs, rivers and aquifers, ensuring the availability of water in quantitative and qualitative terms.	Restrictions on activities (fishing, for example).

Source: Prepared by the authors.

The choice of the parks category occurred because it is an area, with uses foreseen in the SNUC, such as tourism, leisure and scientific research. In other words, the choice is justified by the combination of public use and full protection of nature in the same area, although it entails restrictions on the use of the territory, preventing the realization of economic activities and, eventually, leading to the expulsion of populations that live in the area designated to the park.

As positive impacts on the local economy, one can talk about the generation of direct and indirect jobs. Direct jobs include those created by park management, such as park rangers, maintenance workers, and visitor managers, while indirect jobs include those created by local businesses, such as jobs in hotels, restaurants, and tourism companies, for example. However, it is worth noting that the positive impacts on municipal tax collection may vary depending on the location and size of the park, as well as the internal and external infrastructure (accessibility), in addition to the services available in the region (SOUSA GIMENES et al., 2019).

Tourism is one of the main sources of income generated by the parks. The increase in the number of visitors can lead to an increase in revenue from sales taxes, lodging, and tourist activities, as well as generate jobs and income for the local community[9]. However, parks can reduce economic activity and revenue by prohibiting direct uses in the area, negatively impacting all those who work in the agricultural and extractive sector. Another point of caveat is that, if the tourism sector is concentrated in a few groups or people, the presence of the park can accentuate inequalities, since it will restrict a sector that is usually relevant in most municipalities and will privilege one in which there would be few actors involved.

The presence of a park can also increase the real estate value in the surrounding area, contributing to the increase in the collection of related taxes such as property tax. However, this appreciation can bring harmful side effects, such as the concentration of real

[9] Resulting in an increase in collection in other taxes not considered in this work, such as ICMS.

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estate and the expulsion or segregation of the poorest portions of the municipality. Along the same lines, harmful tourism can lead to the saturated use of the territory, as well as of resources, and sometimes lead to a process of elitism. It is important to note that the positive impacts of parks on municipal revenue can be affected by factors such as the seasonality of tourism, the quality of local services, and the municipality's ability to attract investment and develop new business opportunities.

The reason for choosing parks created after the SNUC was due to the understanding that the objectives would be better determined and, for this reason, more homogeneous, mitigating particularities generated in the process of creating and implementing a park. With the law, the modus operandi for the creation of a CU became more standardized, considering that the functions of each category of CU were established, as well as the processes that lead to its creation. At the same time, this criterion establishes a time frame, since the SNUC was implemented in 2000, reducing the risk of carrying out analyses of the creation of PAs for different periods, with very different political and economic conjunctures.

The geographic unit chosen to represent the place was the municipality, mainly due to two reasons. The first is related to a greater availability of municipal databases, allowing a greater range of variables to be incorporated into the analysis – an important aspect for the construction of the model, as well as for complementary analyses. The second is more focused on the conceptual scope, since the municipalities, after the 1988 Constitution, assumed greater importance in the federative composition, acquiring greater representation in the country's institutionality. This allowed greater autonomy of action of the municipalities, with a greater capacity for political action. In this sense, there is a close interaction between the municipality and the park, given that both are closely linked to the territory (NEVES, 2012; AFONSO, 2002).

The filter for municipalities with up to 200 thousand inhabitants reinforces this argument, based on the premise that, in these municipalities, such interaction is even stronger, since there would be a lower level of complexity in the socioeconomic structure, with fewer activities in dispute with the park, which, therefore, would have greater power of influence on the economic dynamics of the municipality (IBGE, 2020). The intersection between park and local social phenomena is dependent on population size. It is worth remembering the relevance of other factors, such as the size of the municipality's territory area or the size of the park's area, which are evidently significant.

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The survey "Regions of Influence of Cities" REGIC 2018 (IBGE, 2020), classifies municipalities according to their position in the country's urban hierarchy. In this research, the country's urban hierarchy was stratified into four levels, with two or three sublevels in each: metropolises (large national metropolis, national metropolis, and metropolis), regional capitals (A, B, and C), subregional centers (A and B), and zone centers (A and B). Finally, there are the local centers, which are represented by the rest of the municipalities, whose importance does not go beyond the municipal limits. Based on this classification, the cut for municipalities below 200 thousand inhabitants excludes all metropolises, as well as all regional capitals A and B. Thus, it maintains the less complex municipalities that exert a lower degree of influence and attractiveness over other municipalities, whose effect of the park, by premise, is evaluated as potentially stronger. According to this classification, the two municipalities, Rio Acima and Boa Nova, are classified in the class: Local Center.

The municipalities of Rio Acima (MG) and Boa Nova (BA) were considered the treatment units of the models, as they met all the requirements that classify a unit as treated. For each model, the municipalities in the same state as the treated municipality were selected as able to be part of the comparison group, for the formation of the control unit (synthetic municipality).

The intervention is defined as the presence of a park created after the SNUC, open to visitation and occupying at least 5% of the municipality's area – the latter with up to 200 thousand inhabitants. The variable of interest Y will be the sum of municipal taxes per capita, in order to control the value of municipal tax revenues by the population size of the municipality. Thus, there is an indication of the municipal competence revenue available to each person in the municipality.

a) Yjt - sum of municipal taxes per capita of the municipality j in period t;
b) Y1tI - the treatment unit in which the intervention took place, that is, those in the municipalities of Rio Acima and Boa Nova;
c) YjtN - control units that did not undergo the intervention;
d) τ1j = Y1tI - Y1tN - difference between the total municipal taxation per capita after the intervention in relation to this same unit of interest, if it had not received the intervention (synthetic municipality);
e) $\hat{Y}$1tN = ∑ wjYjt,J+1 j=2 - the estimate of the counterfactual of the total municipal taxation per capita that the municipalities would have received, if they did not have the parks (this did not exist);

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f) WJ - weight of each control unit in the formulation of synthetic municipalities;
g) V1 - weight of each variable in the control units for the formulation of synthetic municipalities[10].

RESULTS

RIO ACIMA (MG): PARNA SERRA DO GANDARELA

The municipality of Rio Acima is located in the Metropolitan Region of Belo Horizonte, state of Minas Gerais, 39 km from the capital. It occupies an area of 229,812 km², having an average elevation of 756 meters. (SOTERO et al., 2016). The Serra do Gandarela National Park, created in 2014, is a relevant environmental conservation area in the Iron Quadrangle and in the southern portion of the Espinhaço Chain, 40 km from Belo Horizonte (MG). The area is important both for mining (mainly iron ore) and for storage and as a source of water for Belo Horizonte (DENNISHYDE, 2021).

With 31,128 hectares, the park aims to ensure the preservation of samples of the canga formations of the Iron[11] Quadrangle, including the rupestrian fields, the remnants of semideciduous forest, the aquifer recharge areas, among others (ISA, 2023). The park is based in the municipality of Rio Acima and usually receives a significant number of visitors. Access to the park is easy due to several roads built and maintained by mining companies in the region (DENNISHYDE, 2021). The portion of the PARNA, contained in the municipality of Rio Acima, occupies an area of 6,373,725 hectares, representing 27.86% of the total of the municipality

Its creation did not meet the technical recommendations and the desires of the social movements involved. In addition, the creation did not comply with the demand of communities in the region for the creation of a Sustainable Development Reserve (RDS) complementary to the National Park area. As a result, there was an advance on areas of the park, in which these communities develop traditional activities. In this way, the creation of a category of full protection made the local community vulnerable, since it established a territorial use incompatible with the development of traditional activities, such as beekeeping and plant extractivism – also depriving these communities of the use of

[10] The realization of the synthetic control model occurred in the R software, through which the Synth packages were used, developed by Abadie, Diamond and Hainmueller (2011).
[11] The ferruginous yokes are located on the tops and slopes of the mountains, being a type of ground cover composed of iron. As they are porous, they function as important areas for the infiltration of rainwater into the aquifers.

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resources. On the other hand, the area destined for iron extraction by Vale's Apollo project, valued at around R$ 4 billion, was excluded (EVANGELISTA, 2015; ISA, 2023).

Table 1 shows the means of the covariates used in the model for the treatment unit (the municipality of Rio Acima), the control unit (Rio Acima synthetic) and the sample (all the municipalities in the database). The values of the synthetic and treated groups were close in the following variables: Total population (Poptotal_imputado"); sum of taxes of municipal competence per capita ("Somatributosmunicipal percapita (lagado)"), homicide rate ("homicidio_imputado").

Table 1: Mean of the model covariates for the treated municipality (Rio Acima) and for the Synthetic municipality.

Covariate	Treated Medium	Synthetic Medium	Sample Mean
Poptotal_imputado	9.300,3	6.128,6	10.613,1
Pourbana_imputado	8.108,8	3.461,8	7.336,6
Renagro_imputado	14,1	5,6	4,5
GDP per capita	0,878	4.1	0.697
EliquidasCO2_imputado	-15.514,8	-1.731,9	-2.220,5
homicídio_imputado	19,8	24,2	21,8
rebanho_imputado	889,833	33.150,4	25.598,7
GVApercapita	4,8	32,6	2,9
Somattributesmunicipal per capita (lagged)	1.321,0	1.214,2	103,7

Source: Prepared by the authors.

The optimization process generated the weights for the construction of the synthetic unit, as described in Table 2. The variable with the highest percentage (and, therefore, with the greatest importance) was the lagged variable of the response variable (sum of municipal taxes), with 63.3%, followed by the GVA of industry per capita, with 20.4%. The others did not have a 5% stake.

Table 2: Weights of the covariates used in the construction of the synthetic municipality.

Covariate	Weight
Poptotal_imputado	0.023
Pourbana_imputado	0.016
Renagro_imputado	0.004
GDP per capita	0.045
EliquidasCO2_imputado	0.026
homicídio_imputado	0.016
rebanho_imputado	0.030
GVApercapita	0.204
Somattributesmunicipal per capita (lagged)	0.633

Source: Prepared by the authors.

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Table 3 presents the municipalities that were selected by the model to compose the synthetic municipality (control), with their respective weights. The municipalities of Tapira (64.3%) and Antônio Dias (35.7%) make up the control.

Table 3: Weights of the municipalities that make up the control unit (synthetic).

Municipality (code)	Weight (composition in control)
Tapira	0,643
Antônio Dias	0,357

Source: Prepared by the authors.

Graph 1 presents the trajectories over the selected period (2008 to 2018) of the treated unit and the synthetic control for the response variable: Sum Municipal taxes per capita, showing the difference in the trajectory of this variable, after the creation of the park, in 2014. The Y axis represents the sum of municipal tax collection divided by the population size of the municipality; the X axis represents the temporal variable, in the years 2008 to 2018; the continuous line indicates the real data for the municipality of Rio Acima; and the line with dashes, the synthetic unit. Finally, the dashed vertical line points to the moment when Park was implemented. It is noted that the lines are close together, which indicates an adjustment in the pre-treatment period between the treatment unit and the synthetic unit, although it is not a perfect adjustment. In addition, it is pointed out that there was a downward trend in tax collection over the period analyzed[12].

A reasonable difference is perceived after the temporal delimitation of the intervention. By visualizing the trajectory of the counterfactual, it is noted how the trend of municipal revenue for Rio Acima would be, if the park had not been implemented. In other words, the dashed line expresses what would have happened to the collection of municipal taxes if the PARNA had not been created. It was found that there would be a higher collection without the existence of the park, reaching, around 2017, a peak difference in the values of the response variable of approximately 500 (R$/pop). Throughout the post-implementation period of the park, the trajectory of the treated unit was always below the trajectory of the control unit, indicating a higher potential collection, in a scenario without the park. This result indicates that the reduction in revenue may be associated with the implementation of the park.

Graph 1 :Variable trajectory Sum of taxes *per capita* (full line – treated unit versus dashed line – synthetic control).

[12] The values were deflated based on the last year of the series (2018).

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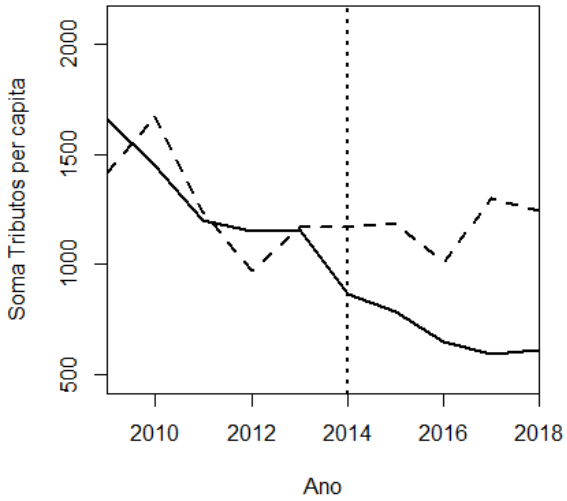
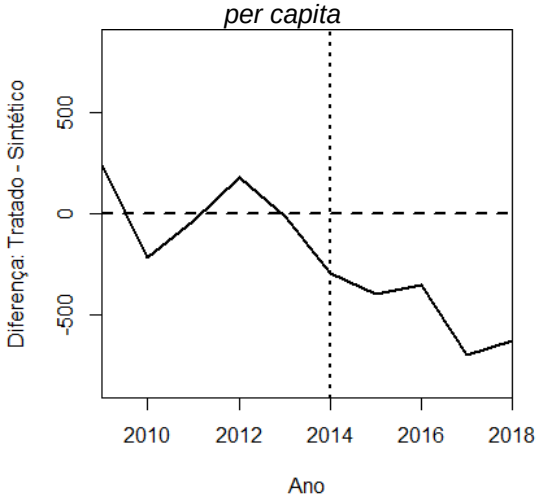


Source: Prepared by the authors.

In Graph 2, the difference between the sum of taxes per capita in the pre- and post-treatment period is emphasized by showing the discrepancy between the values of the treated group and the synthetic group. The Y axis in this graph indicates the result of the difference in tax collection between the units, and the X axis the temporal unit. In this case, it is possible to see, with greater emphasis, that the difference is accentuated during the post-treatment period. The estimated difference in the sum of municipal taxes per capita, in relation to the synthetic municipality of Rio Acima, reaches a peak of -500 (R$/person), considering the years 2014 to 2018, with a downward trend until 2016, which was accentuated after that year – probably due to the economic crisis that the country went through. Until 2016, the difference is less than 500, exceeding this value after that year. Once again, this discrepancy indicates that the difference between the values of the variable sum of taxes per capita may be associated with the presence of the park.

Graph 2: Difference, between the real and the synthetic, for the values of the variable Sum municipal taxes *per capita*



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Source: Prepared by the authors.

BOA NOVA (BA): PARNA DE BOA NOVA

The municipality of Boa Nova has an area of 857 km², 480 km from the state capital. The low level of implementation and tourist incentive by local management and State and Federal agencies – means that Boa Nova and its UCs do not have visibility in the set of tourism routes in the state of Bahia (NUNES, 2019).

The Boa Nova National Park, created in 2010, together with a Wildlife Refuge, aims to protect an important area in the transition between the Caatinga and the Atlantic Forest[13]. It is located in the municipality of Boa Nova, in the Southwest Region of Bahia. The region is one of the richest in birds in Brazil. This makes Boa Nova an important destination for birdwatching tourism. In the municipality, there is a reasonable tourist infrastructure, including hotels and well-qualified guides (DENNISHYDE, 2022).

The Park occupies an area of 11,971.95 hectares of the total municipality of Boa Nova, which is equivalent to 99% of the total area of the park, as well as 14.04% of the total area of the municipality[14]. It is located further east of the municipality, distributed in non-continuous areas, with two parts occupying the limits of the municipality. Among these parts, there are areas of REVIS Boa Nova. The park is not yet fully structured (land regularization) (DENNISHYDE, 2022; ICMBIO, [n.d.]), with park attractions still on private properties.

The area was created with the aim of fully protecting and regenerating the natural ecosystems of the transition between the Atlantic Forest and the Caatinga; ensure the maintenance of viable populations of endangered bird and mammal species; maintain and recover springs and watercourses; enable the development of environmental education and interpretation activities, recreation in contact with nature and ecological tourism; and to allow the development of scientific research (ISA, [n.d.]).

Table 4 shows the means of the covariates used in the model for the treatment unit (the municipality of Boa Nova), the control unit (synthetic Boa Nova) and the sample. The means for the treated unit and the synthetic unit were similar for all variables, indicating a good fit of the model, although the values of the variables water surface

[13] The high-altitude forest that lies between these two important biomes is known locally as Mata de Cipó (ICMBIO, [n.d.]).
[14] The municipality of Boa Nova has 848,857 km².

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(supagua_imputado) and net emissions from change and land use (EliquidasCO2_imputado), for the treated unit and the synthetic unit, were different.

Table 4: Mean of the model covariates for the municipality treated (Boa Nova) and for the synthetic municipality.

Covariate	Treated Medium	Synthetic Medium	Sample Mean
Poptotal_imputado	19656.857	19013.617	21385.494
Pourbana_imputado	5618.000	5619.918	11818.830
Renagro_imputado	2.185	2.184	1.765
GDP per capita	0.107	0.107	0.472
ElíquidasCO2_imputado	-19702.857	5739.129	16795.252
supagua_imputado	41.995	462.958	929.344
homicídio_imputado	11.517	11.978	17.858
rebanho_imputado	25088.571	25013.349	24375.639
GVApercapita	0.088	0.126	0.968
SpecialTributospercapitaLagged	48.950	48.929	121.407

Source: Prepared by the authors.

Table 5 describes the estimated weights for the covariate used in the model for the construction of the synthetic municipality. The variable GDP per capita (93.6%) had the highest weight, indicating greater relevance in the construction of the synthetic unit.

Table 5: Weights of the covariates used in the construction of the synthetic municipality.

Covariate	Weight
Poptotal_imputado	0
Pourbana_imputado	0.015
Renagro_imputado	0.003
GDP per capita	0.936
ElíquidasCO2_imputado	0.
supagua_imputado	0
homicídio_imputado	0.
rebanho_imputado	0.001
GVApercapita	0.016
SpecialTributospercapitaLagged	0.029

Source: Prepared by the authors.

Table 6 shows the municipalities that were selected by the model to compose the synthetic municipality (control), with their respective weights. Five municipalities obtained a significant value of participation in the composition of the synthetic municipality, with Mirante being the most representative: the value of the weight was 45.3%, making up almost half of the synthetic unit.

Table 6: Weight of the municipalities that make up the control unit (synthetic).[15]

[15] Other municipalities presented values above zero, but below one.

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Municipality (code)	Weight (composition in control)
Vantage point	45,5%
Ribeirão do Largo	13,3%
Maracás	7,6%
Monte Santo	7,6%
Caetanos	6,9%

Source: Prepared by the authors.

Graph 3 shows the trajectories of the treated unit and the synthetic control over the selected period for the response variable: Sum Municipal taxes per capita, showing the behavior in the trajectory of this variable after the creation of the park in 2010. The dashed line expresses what would have happened with the collection of municipal taxes if the PARNA of Boa Nova had not been created.

It is noted that there is an adjustment in the pre-treatment period between the treatment unit and the synthetic unit, indicating a similar behavior, although it is not a perfect adjustment, because the lines are not overlapping – they separate into small sections of the trajectory. In the post-treatment period, the lines separate. The line of the treated unit shows a high growth rate until 2012, thus separating itself from the dashed line of the counterfactual. After that, it falls, but throughout the period it remains above the dashed line until 2017, when they meet. Soon after, the treated unit line is below the control unit line. This trajectory indicates a positive influence of the park on the sum of taxes per capita over a large part of the period analyzed. The presence of the park would have positively impacted the tax collection of municipal competence. On the other hand, in 2014-15, there is a sharp drop in the trajectory of taxes for the unit treated, which made the lines meet in 2017, signaling that the influence of the park becomes, in that year, nil. Afterwards, the line of the treated unit is below the line of the control unit, signaling a possible negative effect.

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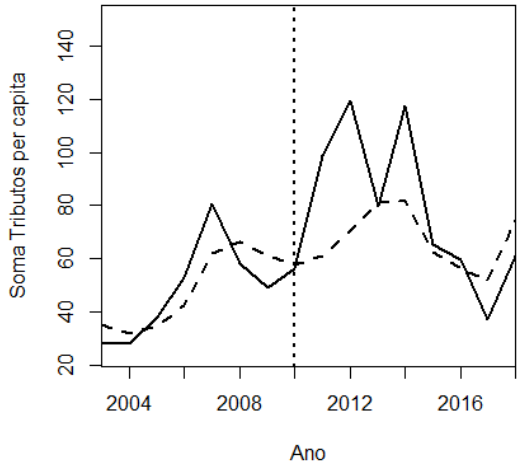
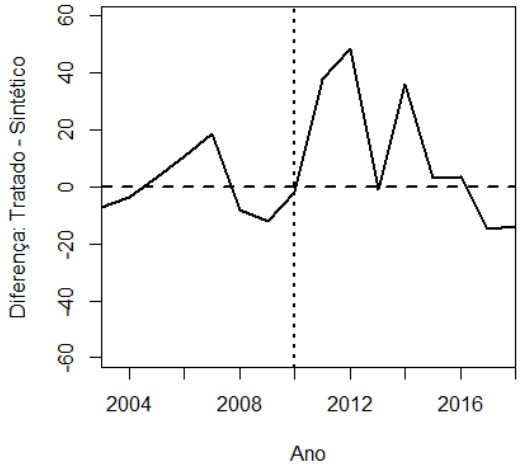
Graph 3: Variable trajectory Sum of taxes *per capita* (full line – treated unit versus dashed line – synthetic control).



Source: Prepared by the authors.

In Graph 4, this difference is highlighted by showing the discrepancy between the values of the treated group and the synthetic group. In that case. It is possible to see that the difference is accentuated during the post-treatment period, with two maximum points above the maximum presented in the pre-treatment period. In view of this, the estimated difference in the sum of municipal taxes per capita in relation to the municipality of Boa Nova reaches a peak of approximately 40 (R$/person), considering the years 2010 to 2013, when it falls. For almost the entire period – except for the last two years (2017 and 2018) – the difference is positive, signaling that the park had a positive impact on municipal taxes in the period after its creation until 2018.

Graph 4: Difference, between the real and the synthetic, for the values of the variable Sum municipal taxes *per capita*.



Source: Prepared by the authors.

DISCUSSION

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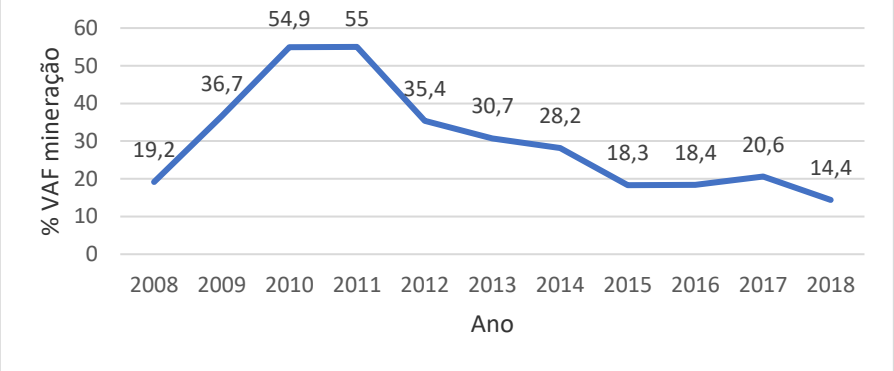
UPSTREAM

The creation of the park took place under criticism that the project that guided the boundaries of the area would serve the economic interests of mining companies much more than the environmental interests of preservation (PORTO, 2014). From 2014/15 onwards, mining has shown a drop in production in the country. As a result, mining companies in Brazil reduced expenses, based on the decrease in the number of employees. Another reflection of the crisis was the reduction in wages, which showed a nominal loss of 20.1% in 2015 (ALMEIDA, 2017). In Graph 5, based on the indicator of participation of the municipal Fiscal Value Added (VAF),[16] there is a sharp drop in the presence of the mining and quarrying industry in the economy of Rio Acima from 2012 onwards, with the lowest value in the series for the year 2018.

Graph 5: Evolution of the participation of the mineral extractive industry in the Fiscal Value Added of the municipality of Rio Acima (%).



João Pinheiro Foundation - FJP (2023).

In addition to this drop in the VAF of the mineral industry, there is a drop in the value added of the industry in general – including the mineral industry – for the same period, as can be seen in Chart 6 . It is noted that, after a sharp growth until 2011, there is a period of oscillation – in 2015, it suffers a sharp reduction. It is important to highlight that the service sector, predominant throughout this period, is also experiencing a reduction. This sector has shown a downward trend since 2008, although it has always remained above industry.

Graph 6: Evolution of the value added of the sectors: agriculture, industry, and services in Rio Acima (R$).

[16] The VAF of a municipality corresponds to the value that is added (added) in the operations of input/output of goods and/or provision of transport and communication services in its territory, in a given calendar year. It reflects the potential that the municipality has to generate revenues and is the parameter for the distribution of 75% of the ICMS/IPI share, in proportion to the participation of each municipality in the total VAF (FJP, 2023; SEF/MG, 2023).

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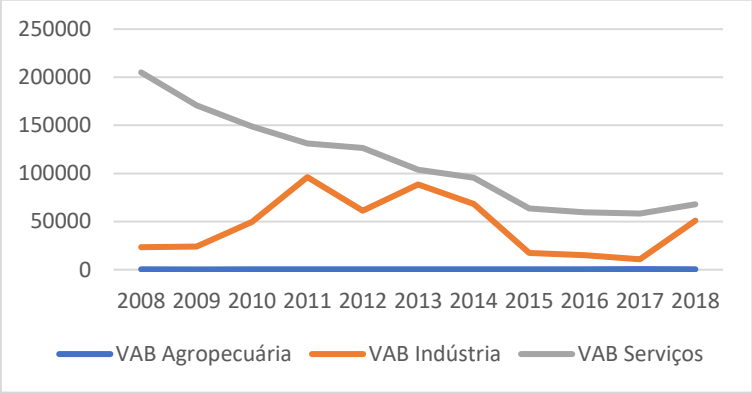
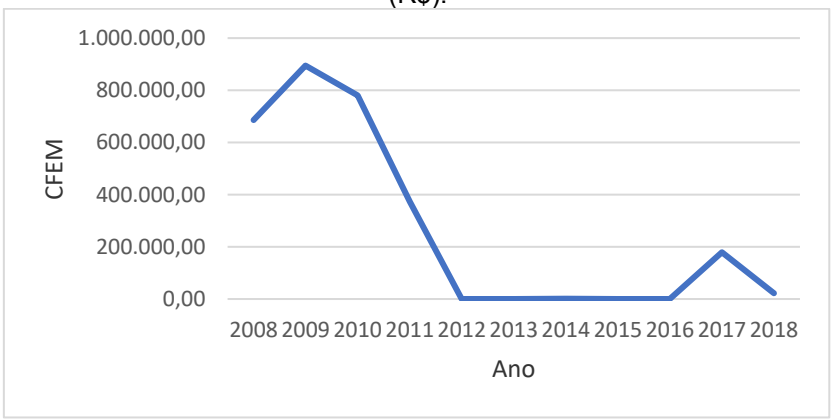


IBGE (2023).

The drop in the mining and quarrying sector was reflected in a sharp reduction in the financial compensation for mineral exploration (CFEM),[17] as shown in Graph 7. It is worth mentioning that the values of this contribution are low, given the volume of production, as the rates that are levied are very small. In comparison with the CFEM values, the values of the ecological ICMS of the municipality are presented (Graph 8), which has the presence of the park as an important generating factor. It can be seen that the amounts increase in the period and exceed the amounts collected by CFEM.

Although the park has resulted in a loss in the collection of tax revenue under municipal competence – and mining seems to bring benefits – on other fronts, the park may gain an advantage in terms of its ability to positively influence local development. This can be better highlighted when listing negative points to the environment and health that mining implies – in addition to the fact that the economic gains of this sector are concentrated.

Graph 7: Evolution of the Collection of Financial Compensation for Mineral Exploration (CFEM) in Rio Acima (R$).



João Pinheiro Foundation - FJP (2023).

[17] The Financial Compensation for Mineral Exploration – CFEM is the financial compensation paid by mining companies to the Union, States, Federal District and Municipalities for the economic use of mineral resources in their respective territories. The calculation basis is the gross revenue from sales operations, deducting only taxes levied on marketing (AMIG, 2023).

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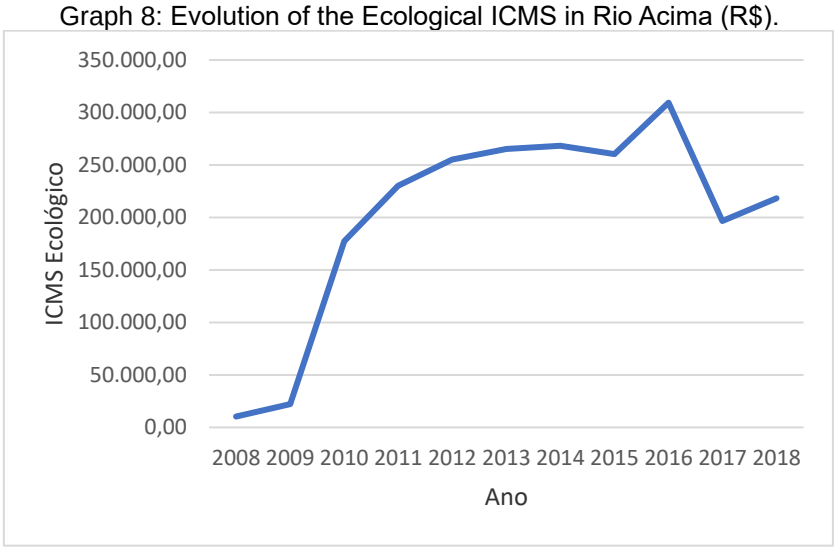
Graph 8: Evolution of the Ecological ICMS in Rio Acima (R$).



João Pinheiro Foundation - FJP (2023)

The reduction in the level of economic activity of the main sector of the municipality – on which it is dependent – implies a drop in revenue, as shown in Graph 9. From 2014 onwards – after two peaks of growth, in 2010 and 2013 – there is a significant decline, reaching the lowest values in the series.

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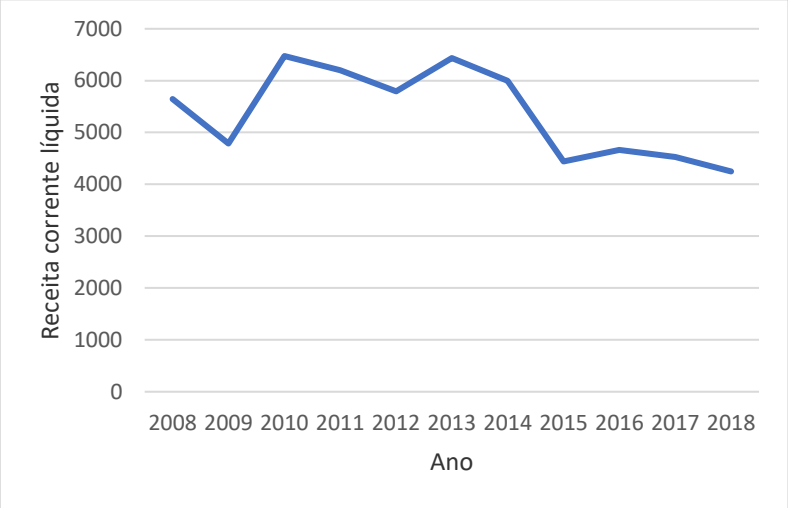
Graph 9: Evolution of net current revenue in Rio Acima (R$).



João Pinheiro Foundation - FJP (2023).

In short, the economy in Rio Acima went through a process of reduction over the period analyzed, a fact that can also be seen from most of the indicators presented – with the exception of the Ecological ICMS, which showed growth. In view of this depletion of the main economic activity – and with the presence of the park – tourism becomes a relevant sector to compensate for the revenue losses resulting from the decrease in mining activity. Stimulating tourism, with the park as a pillar, can become a fundamental alternative to the municipality's economy. If environmental externalities are considered, the balance of the possible new economy of the municipality based on tourism may surpass the old economy, based on mining.

Mining activity – although generally limited to much smaller areas, compared to the agribusiness average, for example – has a very significant environmental impact, both during the operation and extraction phase and in the later phases, due to the dams created to store the tailings. The latter, in addition to interfering in the dynamics of local land use, bring a risk to the surroundings, due to the possibility of contamination of the soil and water resources, as well as damage to people, in terms of housing and production – (G1, 2015; BH, 2015).

Mining generates few direct jobs, which usually require highly qualified labor, thus increasing the concentration of income (COELHO, 2012). With the infrastructure of the mining region, the short-term profit is destined only to the mining companies, which, in this way, will be the only ones to intend to invest in the region. In this way, the local population is involved in an "oredependence", which allows for greater tolerance on the part of the

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population in the face of damages, not only environmental, but also social (COELHO, 2012).

In a context of dependence of the municipality on mining, the latter can lead to higher levels of collection of various taxes because it is the main (or even the only) driving force of the economy. Any movement that acts as a brake on this activity can harm this process, as seems to have been the case with the implementation of the park. However, if, on the revenue side, there seem to be positive effects – even if dependent on external factors and unrelated to the location, there are a series of problems that mining entails, entailing a set of expenses to deal with the effects of these problems.

The municipality of Rio Acima, in the period analyzed, went through a crisis in its main economic sector, mining, with a drop, starting in 2014, explained by the reduction in external demand (end of the commodity high cycle). In addition, there was the beginning of the depletion of mines in the region, as well as an increase in both social pressure against this activity and greater environmental protection. The latter culminated in the creation of the park. Possibly, the park inhibited mining production and aggravated the drop in the collection of municipal tax revenues.

This indicates not only a high dependence/influence of the municipality's economy in relation to mining activities, but also the presence of efforts to avoid their negative effects on the environment. It is likely that, during this period, possible positive effects of the park on commerce and services had not yet occurred – a fact that weakens other activities, preventing both the public and private sectors from carrying out actions in favor of the park and associated sectors. In this sense, it is possible that the park has intensified the downward trend in revenue, due to the decrease in mining, aggravating the situation with its presence.

It is concluded that, in Rio Acima, due to the historical dependence, the mining activity exerts a strong influence on the local economy, thus impacting the municipal tax collection, since it leads to a greater volume of services and activities carried out in the municipality. Based on this argument, the explanation is adopted that the park was, for the period analyzed, a factor that inhibited mining and, consequently, tax collection. Therefore, it was identified that there is an established opposition between the park and the mineral extractive industry sector; Factors that weaken mining were also identified and that may pave the way for a potential more prominent effect of the park with regard to fiscal and other derived socioeconomic impacts.

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Industry, commerce and services are scarce in Boa Nova. In the seat of the municipality, the main sources of regular income are public jobs, as well as pensions and direct income transfer programs. As a result, the scarcity of employment and income opportunities makes individuals seek activities involving the land and its natural resources (NUNES, 2019). The predominance of these sources of income indicates a picture of a very economically vulnerable municipality.

Boa Nova is located in a region rich in biodiversity, its water potential and its natural beauty, which confers tourist potential, with possibilities for the development of ecological and rural tourism and the development of sports activities (CELES, 2016). Such natural characteristics made it a priority region by governmental and non-governmental environmental entities for the creation of UCs. The area of the municipality under analysis had been impacted by deforestation, fires, cattle trampling and extraction of firewood and wood. Among the most threatened plant formations was the Mata de Cipó, vegetation that was not very resilient to degradation and separation into small fragments. In addition, the region stands out in the avifauna conservation scenario for having a great diversity of birds (the place is inserted in the important national and international birdwatching routes) (NUNES, 2019).

This type of tourism was a relevant factor for the definition of the National Park and Wildlife Refuge categories. However, although it has this faunal potential, the city does not have adequate infrastructure to receive many tourists. Since the period of the creation of these PAs, in 2010, little has been done with regard to the infrastructure of the PAs. Both lack a management plan to order the tourist use of the areas; land regularization of the entire park area; and a greater number of specialized personnel. In addition, there is no camping area, parking lots, information centers for tourists, ICMBio headquarters in the municipality and accommodations (NUNES, 2019).

Between 2005 and 2010, the period of the proposal to create both PAs, Boa Nova had agriculture and mineral and vegetable extraction as its economic base – therefore, the level of dependence of the population on the land and its natural resources was great. Among the socioeconomic activities carried out at the time of prospecting, the following stood out: rock extraction; animal husbandry; coffee production; hunting; extraction and sale of wood; family farming; pig farming. Although the area chosen for the implementation of the PAs presents a scenario of intense anthropization and the presence of a population

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contingent highly dependent on the land and its resources, there was a favorable opinion regarding the creation of the PAs.

The territorial scenario of the CUs of Boa Nova assumes a complex configuration, in view of the historical, economic and social contexts of which they are part. Decades ago, the area was socially formed based on a population highly dependent on natural resources and land, with no apparent alternative for economic expansion and investments by the public and private sectors, with consequent degradation of vegetation via deforestation for animal husbandry and planting, hunting, mineral extraction, etc. (CALHEIROS, 2011; NUNES, 2019). In summary, it is configured as an isolated region, far from large centers, historically poor and outside the main tourism routes. However, in view of this situation, it is understood that the PAs may have had significant relevant impacts.

To assess the importance of each sector in the municipal GDP, Graph 10 presents the gross value added (GVA) for the agriculture, industry and services sectors. By observing the trajectories of these indicators, it is noted that the GVA of services assumes a preponderance in the economy of Boa Nova in the period evaluated, with a growth trend that led to a detachment of the GVA of agriculture. The services sector grew between 2003 and 2013, starting to fall from 2014 onwards. The agricultural sector fluctuates throughout this period and, after a period of decline until 2007, shows a significant increase in 2011, but in 2012, the values already show a considerable reduction. This oscillation can be explained by reasons internal to the characteristics of the sector (such as record or very low harvests) and by the presence of the park and the fauna reserve, revealing possible adaptations of production to the restrictions imposed by the PAs. Thus, it is noted that services gained prominence in the economy of this municipality in the period. Part of this growth may be related to the creation of the park, since such growth intensifies slightly after 2010 (the year of implementation of the PARNA).

Graph 10: Evolution of the value added of the sectors: agriculture, industry and services in Boa Nova (R$).

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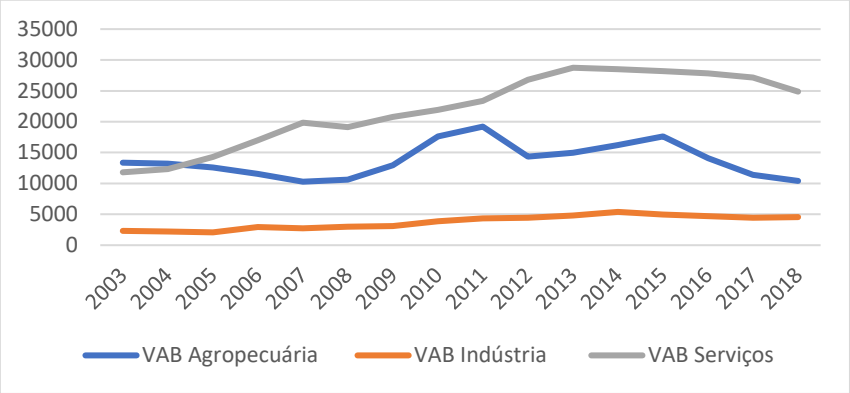

Source: IBGE (2023).

Based on the results of the model, positive effects of the park on tax revenues under municipal competence were found, indicating that the park brings tax benefits to the municipality that, in turn, can be translated into social, economic and cultural benefits, with improvements in the living conditions of the population in general, such as health, education and infrastructure. The results found in the synthetic control model – complemented by contextualizations of the municipality and descriptive analysis of socioeconomic indicators – indicated an effect, albeit subtle, of the park on the local economy. Such an indication can be approached from the perspective that, without the park on site, some ecosystem/environmental services would occur, but without the same intensity and direction in the destination and allocation of resources and benefits – while others, as already mentioned, would not occur.

Therefore, it is argued that parks could produce a surplus, insofar as the amount of wealth generated by the process will be greater than the amount spent on it. This would indicate a process of change and economic structural growth based on the use of the existing potential in a given territory, in which the determining factors are the leadership capacity of the process itself "from the inside out" and the mobilization of local potential and resources, in order to favor increasing yields and the creation of positive externalities (ARAÚJO, 2014; BRAGA, 2002).

CONCLUSION

This work consisted of an evaluation of Brazilian natural parks, from the perspective of public policies, investigating whether they can act as possible instruments of local (municipal) development. The analysis was developed from the application of the synthetic

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control methodology to estimate the counterfactual of how the sum of municipal taxes of municipalities would have evolved without the presence of parks.

According to what was postulated in this work, parks could be a way to carry out development through the activation of endogenous resources capable of both creating a virtuous process and establishing autonomous actions (FERRARINI, 2012). This would occur because the park would be able to enhance not only the characteristics of the place, with the use, execution and valorization of local resources, but also the ability to control the accumulation process, allowing the generation of increasing incomes, from the use of available resources and the introduction of innovations, ensuring the creation of wealth and improvement of well-being (ARAÚJO, 2014).

The enormous variability of the parks in terms of both natural and social attributes has brought a difficulty to the analysis regarding the possibilities of comparisons and categorizations. However, this same variability was an indication that parks add unique elements that can become sources of value creation, either because they are tourist attractions or because they are configurations of nature that provide stocks and flows of natural resources (CARVALHO BARROS; LEUZINGER, 2021). In this sense, parks are related to the idea of local development as the process of taking advantage of the comparative and competitive advantages of a locality.

The proposed hypothesis came true for the PARNA of Boa Nova, presenting a positive result. However, with reservations, since this park, in a period of economic crisis, presented a negative result in collection. On the other hand, it is not confirmed for PARNA Serra do Gandarela, since there are indications that the park has caused a loss to revenue. However, there are also caveats in this result, given that there is a presence of the mining sector to the point of making it dependent on the performance of this sector. Regarding this dependence, the park seems to have been an element of opposition to this sector – above all, environmentally, acting as an instrument of containment to mining activities. This means that the park has met its main objective: the conservation of the natural resources of a given area, given that mining is an activity with a high environmental impact. The main thing to highlight is that the possible fiscal effects that the park promotes are highly dependent on the context and, therefore, can have different meanings. The negative effect, in terms of revenue in one context, can mean positive effects in other aspects. The negative effect on the park's revenue – derived from the fact that it inhibited mining – can be seen as a positive effect, since it curbed the use of resources with private gains – prioritizing the

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occurrence of positive externalities, which positively impact a greater number of people on other fronts.

Finally, this work sought to bring inputs for the expansion of discussions on possible solutions so that the Brazilian socio-environmental potential is converted into positive impacts, encompassing different agents and listing benefits to be reaped with the development of the chain related to the parks. With this, it is intended to strengthen the virtuous cycle in which parks can play a role of extreme social and economic relevance, which can be enhanced with structuring and coordinated public policies.

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