EFFECTIVENESS EVALUATION REPORT

Credit and guarantee: a cost-effectiveness analysis of BNDES's countercyclical support in Covid-19 crisis

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The Brazilian development bank

THE BRAZILIAN DEVELOPMENT BANK

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Executive summary

This report evaluates the impact of the BNDES countercyclical action for micro, small and medium-sized enterprises (MSME) in the Covid-19 crisis. The policies assessed were the Emergency Credit Access Program (FGI PEAC, in Portuguese), in its guarantee modality, which provided guarantees for non-earmarked loans through the Investment Guarantee Fund, and the BNDES Credit Small Enterprises line (CPE, in Portuguese), which offered loans via authorized financial institutions (a second-tier model of funding). These actions accounted for about two-thirds of the BNDES's countercyclical activities in 2020, and its instruments tend to remain in the list of forms of support to the Bank's MSMEs, which justifies the choice of these actions for evaluation. The cost-effectiveness analysis of these forms of support is the main objective of this report. The main results obtained were:

- The FGI PEAC and the CPE were effective in acting on the survival of the supported companies: the FGI PEAC reduced the probability of death by 47%, while the CPE reduced by 37%. In addition, both actions had positive and significant impacts of the same magnitude, 7% on formal employment and 19% on Payroll.
- The analysis of heterogeneous effects showed that smaller and younger firms (usually more restricted to credit) tended to be the most impacted by the countercyclical instruments of the BNDES, as expected.
- The cost-effectiveness analysis revealed that the aggregate net effect of FGI PEAC varied between BRL -1.3 billion and BRL 6.2 billion over all calculations, while that of CPE varied between BRL 1.3 billion and BRL 1.4 billion. This comparison was based on the estimates of total additional Payroll and expected tax costs of each intervention and, therefore, did not consider several benefits arising from the emergency action (collection generated by the survival of the firms, reduction of government expenses with unemployment insurance, maintenance of human capital in the firms, among others).

Together, these results suggest that, in the Covid-19 crisis, one of a very different nature, the innovative performance of the BNDES via FGI PEAC revealed a greater net aggregate impact than the traditional performance via CPE's non-earmarked credit transfer. This greater impact should be associated, among other factors, with the design of the FGI PEAC, based on a Federal Government's higher risk appetite for the coverage offered by the FGI, which seemed to be compatible with the severity of the crisis. On the other hand, the CPE

complemented the BNDES's performance in the micro-enterprise segment, since this segment was not included in FGI PEAC's target audience, and its effects were not associated with a fiscal cost to the Federal Government.

Finally, it is important to note that this report does not intend to find out which form of support (via credit or via guarantee) is the most effective in any general context. In the light of the evidence presented, it can be said that credit and guarantee should be seen as effective and complementary instruments for a development bank to act countercyclically in the MSME segment – especially in severe crises, when the government needs to have several instruments to combat company mortality and sustain employment. In particular, the dose of treatment seems very relevant in the case of FGI PEAC. As the amount of risk coverage offered by the FGI is a fundamental variable to unlock the credit supply to MSMEs in a crisis context, its calibration must be done to maximize the policy cost-effectiveness measures.

1. Introduction

The number of development banks has been increasing since the 2008 crisis. Today, there are 553 development banks in the world, operating in 160 countries, with a 10% share in global investment (XU *et al.*, 2021). Development banks are considered an important tool of countercyclical policy, enabling economies to return to full employment in moments of crisis (GUTIERREZ et al., 2021).

The BNDES is the main development bank in Brazil. In the Covid-19 crisis, it was triggered to act in a countercyclical way.[1] This type of action, as its name suggests, is related to the economic cycle, being usually measured by the output gap – that is, by the gap between actual gross domestic product (GDP) and potential GDP. Considering an average of seven estimates, the Brazilian output gap hit a negative record in the second quarter of 2020, with effective GDP 12% below potential GDP, characterizing that context as the most recessive since data were made available for this variable in the Brazilian economy.

In times of crisis, it becomes particularly difficult for micro, small and medium-sized enterprises to obtain new loans (GERTLER; GILCHRIST, 1994). Uncertainties about the

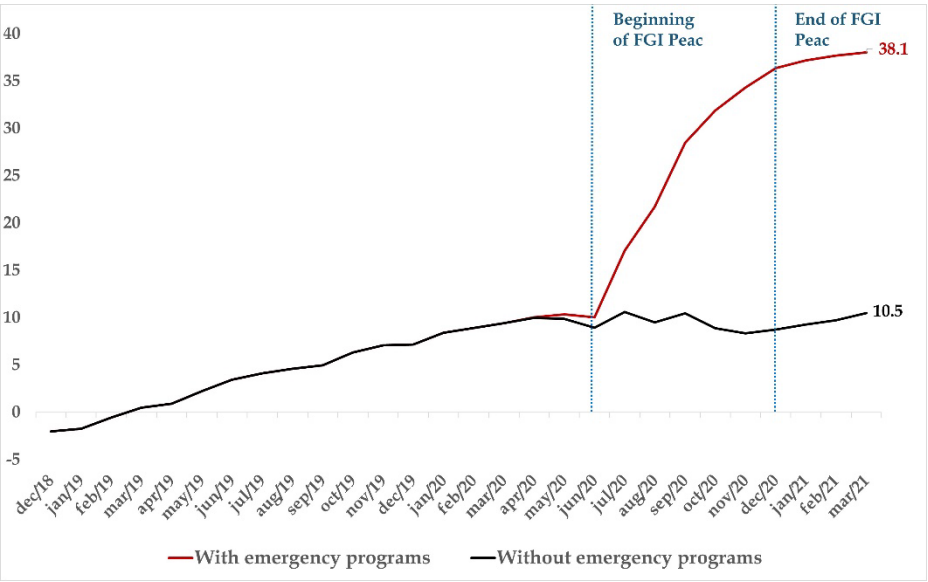
[1] BNDES had already acted in a countercyclical way in the 2008 crisis. Machado, Grimaldi e Albuquerque (2018) evaluate the impact of BNDES countercyclical credit response to the financial crisis.

direction of the economy increase the risk of default, generating uncertainty for financial institutions, which adopt stricter credit approval criteria as a precautionary measure. As a result, smaller firms become credit constrained, reducing employment and economic activity.

In the Covid-19 crisis, the BNDES was called upon to carry out several emergency actions. This countercyclical action involved substantial values: BRL 154.8 billion, or the equivalent of 2.1% of the country's GDP (BARBOZA *et al.*, 2021). Only two types of support accounted for almost two-thirds of the Bank's emergency action.[2] The first was the Emergency Credit Access Program (FGI PEAC, in the acronym in Portuguese), based on guarantees, which enabled BRL 92.1 billion in loans to more than 114,000 companies. The second was the BNDES Credit Small Enterprises (CPE, in the acronym in Portuguese), which comprised BRL 7.2 billion transferred in credit operations for more than 25 thousand firms.

Together with other programs implemented by the Brazilian government, the BNDES actions enabled a strong growth in the credit portfolio for MSMEs (Graph 1). Amidst what seemed to be the biggest crisis of all time, credit not only kept flowing to smaller firms, but there was a large amount of additional support, with the aim of avoiding company mortality and reducing the effects of the recession on employment and wages.

Graph 1 – Annual growth of the credit portfolio for MSMEs in Brazil



Source: Own preparation based on data from the Central Bank of Brazil (BCB, 2021).

[2] BNDES acted as a financial agent of the Federal Government in other emergency credit programs for MSMEs of the Federal Government, as in the cases of the Emergency Job Support Program (Pese) and Peac-Maquininhas.

What was the impact of the BNDES emergency actions for MSMEs on the survival and employment of supported firms? In particular, what was the impact of the action through guarantees (FGI PEAC) in the face of the action of granting non-earmarked credit via transfer of funds (CPE) to smaller companies? What was the cost-effectiveness of each of these instruments? The purpose of this report is to answer these questions.

In general, this report is part of a wide literature that investigates the effects of credit instruments (KERSTEN *et al.*, 2017) and guarantee instruments (BRAULT; SIGNORE, 2020) for MSMEs. In particular, this report advances a literature on the impacts of the BNDES on the Brazilian economy. Barboza et al. (2020) review seventy studies on the Bank and point out that one of the main gaps in this literature concerns cost-effectiveness analyses – precisely what is intended here.

Several studies have attempted to measure the impact of the BNDES on employment and on the mortality of companies. In the vast majority of cases, positive effects of the Bank's action were found (COELHO; DE NEGRI, 2010; EHRL; MONASTERIO, 2019; GRIMALDI *et al.*, 2018; MACHADO; PARREIRAS; PEÇANHA, 2011; MAFFIOLI *et al.*, 2017; MARTINI *et al.*, 2021; RIBEIRO; DE NEGRI, 2009; SILVA; SACCARO, 2021; TABAJARA, 2019; TAVARES, 2019).[3]

What differentiates this work from the others mentioned is that: (i) this is the first one that evaluates the effects of the BNDES within the scope of a countercyclical action; (ii) this is the only one that performs a cost-effectiveness analysis of the Bank's performance; (iii) this is the only one to make a cost-effectiveness analysis for two types of intervention of the institution, via credit and via guarantee. In addition, unless mistaken, this is the first evaluation of a public guarantee scheme in Brazil.

This work is organized into seven sections, including this introduction. Section 2 presents the two countercyclical actions of the BNDES in the Covid-19 crisis evaluated in this work. Section 3 discusses the empirical methodology used to verify the impacts of FGI PEAC and CPE, in addition to presenting the databases and dealing with the implementation of the methods. Section 4 presents the descriptive statistics. Section 5 discusses the effectiveness of the two emergency actions. Section 6 analyzes the cost-effectiveness of the support and, finally, section 7 presents the considerations about the evaluation.

[3] Only Pires and Russel (2017) reached inconclusive results.

2. The BNDES countercyclical support in the Covid-19 crisis

Smaller companies are less likely to have access to formal financing (BECK, 2007). In Brazil, there is evidence that small and medium-sized companies are credit constrained (AMBROZIO *et al.*, 2017). Annually, 38.6% of Brazilian firms do not carry out any credit operations in the Brazilian financial market (DE NEGRI *et al.*, 2019).

BNDES seeks to alleviate credit constraints (a market failure), as this has negative consequences for economic development. As MSMEs do not have all the desired resources to make investments, the marginal product of capital of these companies tends to be greater than their opportunity cost. Thus, there must be an economic gain in increasing the capital of these firms to the optimum level. This may allow MSMEs to expand, improving resource allocation, with effects on competition, innovation and employment (OECD, 2018).

Before discussing how the BNDES can be effective in alleviating the credit constraint problem, it is important to understand the reasons that can lead banks to credit rationing for smaller companies. In general, the problem may occur because: (i) assessing the risk of smaller companies is more difficult and the information may not be reliable; (ii) there are fixed transaction costs that may make low value operations unprofitable; (iii) smaller companies have more difficulty in presenting guarantees; (iv) high interest rates, such as those in Brazil, worsen the quality of the pool of credit claimants (adverse selection) and generate incentives for riskier investment choices (moral hazard); and (v) there is a lack of adequate funding for longer-term operations. Given these possibilities, even projects with a positive net present value would no longer be financed, making companies credit constrained (STIGLITZ; WEISS, 1981).

In its routine operations, the BNDES supports smaller companies in two main different ways. First, through financial agents, in indirect operations: as the BNDES does not have bank branches scattered throughout the country, this modality allows better capillarity to the support provided by the institution. Through this modality, the credit rationing can be attacked because the BNDES funding reduces, in several cases, the interest rate of the operation, in addition to being more suitable for longer-term operations. The second main form of the BNDES support for smaller companies is through the granting of guarantees for access to credit, with the management of the Investment Guarantee Fund (FGI), created in 2009. In this modality, it is the provision of guarantees that allows credit to flow from

financial agents to previously credit constrained companies.

At the beginning of the Covid-19 crisis, the few surveys available at the time suggested a complicated situation for smaller companies. One of these surveys, carried out by the Brazilian Micro and Small Business Support Service (SEBRAE), based on interviews with 6,100 micro and small entrepreneurs, concluded that: (i) 59% of businesses had been completely interrupted, and 30% partially interrupted; (ii) on average, entrepreneurs would be able to operate that way for another 23 days without going bankrupt; (iii) 55% of companies needed loans to avoid layoffs; and (iv) only 11% of entrepreneurs who tried to obtain loans had obtained the intended credit (SEBRAE, 2020). To react to this situation, the BNDES changed its credit and guarantee instruments to engender a countercyclical action, enabling access to credit for smaller companies.

In March 2020, modifications were announced in the CPE, an existing support instrument at the BNDES. The validity of this emergency action would last until the end of 2020. Before the pandemic, this credit line was only accessible to companies with annual gross operating revenue of less than BRL 90 million (micro and small companies). With the crisis, the CPE incorporated medium-sized companies, that is, companies with annual gross operating revenue between BRL 90 million and BRL 300 million. The credit limit was set at up to BRL 70 million per beneficiary every 12 months (before, the limit was BRL 10 million). The financing period remained up to sixty months, with up to 24 months of grace period. The interest rate charged to the borrower was composed of three parts: (i) financial cost based on the fixed rate of the BNDES (TFB, in Portuguese), the long-term rate (TLP, in Portuguese) or the Selic rate; (ii) 1.25% p.a. of the BNDES remuneration rate; and (iii) rate of remuneration of the financial agent negotiated between the financial institution that transfers the BNDES resources and the client. As it is a non-earmarked credit, there was no requirement for an investment project to carry out the operations.

In a context of a sharp drop in revenues, as was the case at the beginning of the pandemic, the existence of non-earmarked credit was seen as paramount for the survival of MSMEs and, consequently, for the maintenance of jobs in firms affected by the pandemic. In this sense, this intervention had as main objectives to reduce the mortality and increase the employment level of the supported firms.

FGI PEAC was established by Provisional Measure (MP, in Portuguese) 975, of June 1, 2020, representing the availability of Treasury guarantees through the FGI for loans to

small and medium-sized companies (that is, with revenues above BRL 360 thousand and less than or equal to BRL 300 million).[4] The BNDES's performance occurred in the role of FGI administrator, focused on the execution of the program, following conditions defined by the Federal Government through the Legislative and Executive branches, including with regard to the definition of its target audience (which considered complementarity of performance with other emergency programs).

To support PEAC, FGI had its usage rules changed and the Treasury was authorized to transfer BRL 20 billion to said fund until December 31 (in consecutive tranches of BRL 5 billion, contributed as the previous tranches were consumed). These BRL 20 billion could be used to guarantee loans in the proportion of 20% of the amounts contracted with medium and large companies and 30% of the amounts contracted with small companies, which could generate a leverage of almost five times the amount contributed by the Treasury, enabling almost BRL 100 billion in credit.

The guarantees granted by the FGI under the PEAC met the following conditions, cumulatively: (i) coverage of 80% of the value of the credit, per credit operation, considering only the principal of the debt; (ii) maximum limit of BRL 10 million for the sum of the amounts of the credit in operations guaranteed by FGI PEAC for each borrower, by financial agent; and (iii) minimum limit of BRL 5 thousand for the amount of the credit in each operation guaranteed by FGI PEAC. The grace period for operations was a minimum of six and a maximum of 12 months, and the total term for payment of the loan was established between 12 and 60 months. The interest rate for loans contracted with the program guarantee was negotiated between the company and the financial agent. However, the average rate practiced by each financial agent in its portfolio could not exceed 1.0% per month, under penalty of reduced coverage of the program. The recovery of the credit backed by the FGI was the responsibility of the financial agent. Table 1 summarizes the conditions of FGI PEAC in relation to the previous conditions of FGI.

The general objective of FGI PEAC was defined as follows in its theory of change framework: "to make small and medium-sized companies access credit, with a view to preserving jobs and income during the health crisis". The specific objectives were defined

[4] Subsequently, with the conversion of the Provisional Measure into Law 14,042, of August 19, 2020, the contracting of operations by large companies was also allowed, provided that they acted in the sectors of the economy most impacted by the pandemic (listed in Ordinance 20,809, of September 14, 2020) and assumed the commitment to maintain jobs for two months from the date of contracting the operation, with a limit of 10% of the capital paid in by the Federal Government to guarantee loans from large companies. However, this evaluation did not consider transactions with large companies in the analysis.

as: to soften the negative effects (i) on employment and income in supported companies and (ii) on the mortality of supported companies. These objectives are in line with what was defined by the program creation law.

Table 1 – FGI PEAC conditions *vs.* previous FGI conditions

Condition	FGI	FGI PEAC
Possible takers	MSME, self-employed truck driver (only for the acquisition of road goods) and Individual Micro Entrepreneur (MEI, in Portuguese)	SMEs, associations, foundations, cooperatives, except for credit, and large companies (and may consume a maximum of 10% of the program's assets, provided they belong to one of the sectors listed in Ordinance 20,809/2020 and that they assume a commitment to maintain employment for two months)
Interest rate cap	No	Yes (1% p/m.)
Coverage per operation	10% to 80%	80%
Stop-loss	7%	Weighting from 20% to 30%, depending on the size of the supported company
Requirement of minimum guarantees	Personnel of the controlling partners and, for operations with a guaranteed value greater than BRL 3 million, also real guarantees	None
Max Limit	BRL 10 million of value guaranteed by National Register of Legal Entities (CNPJ, in Portuguese)	BRL 10 million in financing by CNPJ/financial agent
Grace period	Depends on the line	6 to 12 months
Total term	Depends on the line	12 to 60 months

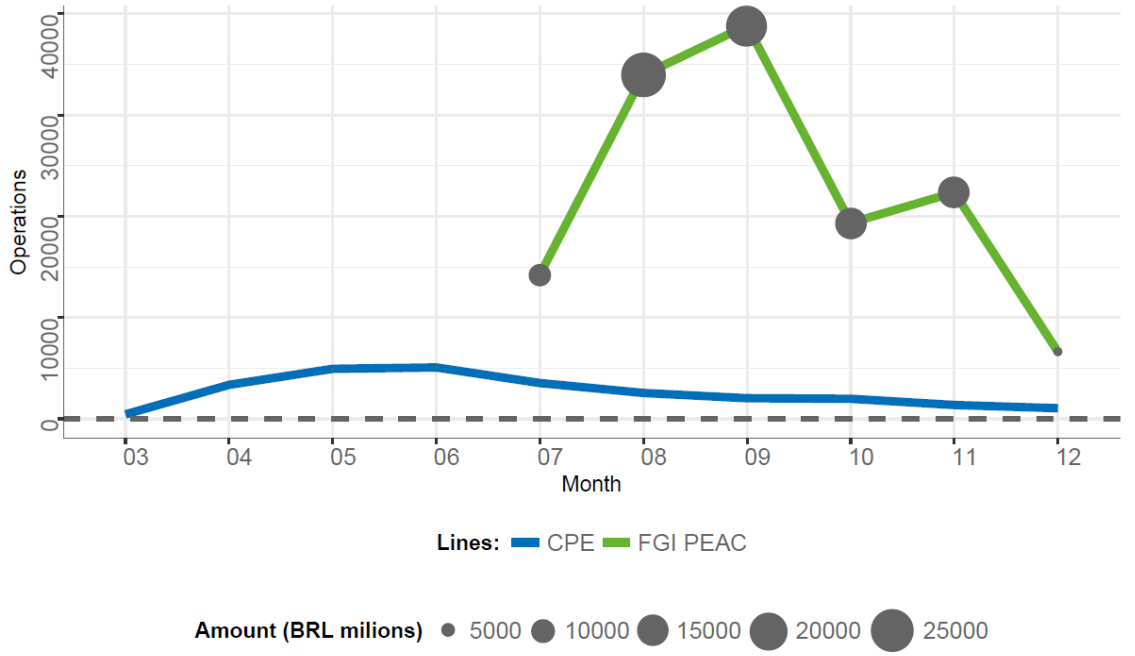
Source: Elaborated by the authors.

Note: the limit of 1% per month of the interest rate is in relation to the average interest rate of each financial agent. The FGI stop-loss before PEAC is 7% of the guaranteed values, while that of FGI PEAC is 20% to 30% of the released values.

As a result, in 2020, the BNDES carried out operations with more than 25 thousand companies in the CPE modality, and more than 114 thousand companies in FGI PEAC. The total amount of credit contracted in these modalities was, respectively, about BRL 7.2 billion and BRL 92.1 billion. These data show, together, a significant performance in terms of volume of financial support and number of companies supported (in total almost BRL 100 billion and approximately 140,000 companies).

Graph 2 shows the performance of the two instruments in a monthly frequency in 2020. It is observed that the launch of FGI PEAC in July coincided with a slowdown in hiring by CPE. For CPE, the month with the highest number of operations was June, while for FGI PEAC, this occurred in September.

Graph 2 – Credit Acceleration - month-over-month (2020)



Source: Elaborated by the authors.

Thus, it is noted that these forms of support seem to have played an important role in improving the conditions for credit access in 2020, although this statement needs to be better qualified. Improved access was seen as a condition for the instruments created to achieve their effectiveness in terms of preserving economic agents (survival) and consequent protection of jobs and income (objectives common to both supports). Therefore, it is possible to evaluate the relative effectiveness of these instruments and advance towards the discussion of relative efficiency, based on a cost-effectiveness analysis of the two forms of intervention.

3. Methodology

3.1. Empirical strategy

The objective of this evaluation is to measure the impact on employment, Payroll and survival of the supported firms of each of the emergency instruments evaluated: FGI PEAC and CPE. The main challenge to measure causal effects of each of the evaluated supports is the presence of a possible selection bias in the treated sample, given that the supports were launched in a non-experimental context.

To capture the most isolated effects of the interventions evaluated, this study uses the

conditional difference-in-differences method to matching based on the propensity score.[5] The hypothesis for estimating the impact is that, in the absence of support, the firms treated would have parallel trajectories in relation to the trajectories of the control group with regard to the variables of interest for estimation.

In addition to controlling for observable variables that can explain participation in each of the supports, the econometric approach adopted controls for time fixed unobservable factors of firms. This is possible due to the presence of longitudinal data from treated and control groups before and after treatment.

The effects of the support instruments evaluated are estimated based on a regression version of the difference-in-difference estimator, specified in the first difference (due to the fact that we have only two periods),[6] as it follows:

$$\text{i)} \qquad \Delta Y_i = \alpha + \beta D_i + \gamma \mathrm{X}_i + \Delta \varepsilon_i$$

in that ΔY_i is the change in a given outcome of interest between the periods defining before (2019) and after participation in the support (2020); D_i is the dummy of treatment, which assumes 1 for firms supported by the evaluated instrument or 0, if contrarily; X includes controls for access to other forms of support by the firm; and $\Delta \varepsilon_i$ is the term of errors in the equation of differences. We are interested in the estimates of β, which capture the average effect of treatment on the treated.

Regressions based on the above model were estimated by ordinary least squares (OLS) method for continuous outcome variables such as employment and Payroll. For the survival variable, the effects of the treatments considered were estimated by Logit model,[7] considering data only from the paired sample.

3.2. Data

The data used in this evaluation refer to the universe of Brazilian formal firms which were active in the evaluation period, according to data from the Board of Members and Managers (QSA, in Portuguese) of the Federal Revenue Service.

The main source of data for this evaluation is the Annual Social Information List (RAIS, in Portuguese) of the Ministry of Labor and Social Security (MTP , in Portuguese).[8] RAIS

[5] For more details, see Heckman, Ichimura, and Todd (1997).
[6] For more details of this specification of the difference-in-difference model, see Angrist and Pischke (2009).
[7] More details on the logit model can be seen in Cameron and Trivedi (2005).
[8] This work used the microdata identified in the RAIS, made available by the Ministry of Economy through a technical cooperation agreement.

is an administrative record of the Federal Government and is the main source of information on the Brazilian formal labor market. This study used the RAIS databases from 2018 to 2020.[9] The RAIS indicators were used to generate the explained variables of interest in the estimation models and provided control variables for the pairing stage.

The effects of each of the supports on the following outcome of interest variables were estimated:

- Admissions: logarithm of the total number of employees admitted to all establishments belonging to the root of National Register of Legal Entities (CNPJ, in Portuguese) in 2020.
- Separations: logarithm of the total number of dismissed employees in all establishments belonging to the root of CNPJ in 2020.
- Payroll: logarithm of the sum of remunerations (in BRL) in December 2020.
- Employment: logarithm of the number of employees with active bond on December 31, 2020 in all establishments belonging to the root of CNPJ.
- Wages: logarithm of the average remuneration (in BRL) in December 2020.
- Employment variation: (number of employees in 2020 – number of employees in 2019) / [(number of employees in 2020 + number of employees in 2019) / 2]
- Employment volatility: modulus of the rate of change in employment.
- Firm's death: dummy if the company went from positive employment in 2019 to zero in 2020: 1 for firms that died under this definition; or 0 for surviving firms.

The BNDES data from operations contracted at CPE and data from operations contracted with guarantees from FGI PEAC were used to identify the firms treated in each of the supports evaluated. Data from firms supported by the BNDES with other support instruments were collected to control for other support in 2020. The list of companies supported by the Emergency Employment and Income Maintenance Program (BEm Program) was obtained from the Ministry of Economy.[10]

In addition, this study used data from several sources for the pairing step, aiming to obtain comparable companies based on a more consistent set of information possible. For

[9] For this evaluation, a specific basis was generated to serve as a preview of RAIS 2020, built internally based on the monthly employment information data from the General Register of Employees and Unemployed (CAGED, in Portuguese) of the MTP.
[10] A total of 1,162,104 firms received support from this program. More details at: https://servicos.mte.gov.br/bem/.

example, 2010 data from the Municipal Human Development Index (MHDI) of the United Nations Development Program (UNDP) were used[11] and data on the set of firms that carried out export or import operations in 2019 from the Secretariat of Foreign Trade (SECEX, in Portuguese). These bases were consolidated to generate the data set used in the estimation of empirical models.[12]

3.3. Matching

The first step for estimating the difference-in-difference method, as specified above, consists of measuring the propensity score:

$$\text{ii)} \qquad P\,(\mathrm{X}_i) = Pr[Di\ =\ 1[\mathrm{X}_i]$$

in which $P(\mathrm{X}_i)$ the probability of a given firm i to receive support from any of the instruments ($D_i = 1$), conditional to a vector of observable characteristics X.

The propensity score for each of the instruments evaluated was estimated using a logit model. In this model, the firm's participation in the evaluated treatment is regressed according to a series of control variables, which include the trajectory of the company's employment level from 2018 to 2019, its age and dummies related to the sector cluster to which it belongs, the region of Brazil where its headquarters are located and its size group in terms of number of employees, as defined below. In addition, other control variables specific to each program were included,[13] chosen by an automated covariate selection procedure using the Automated Model in R for Impact Verification (MARVIm).[14] Based on this, it is possible to estimate a probability for each firm (treated or not) to participate in each of the evaluated instruments.

The second step consists of estimating regressions to capture the effect of the BNDES support via FGI PEAC or CPE on the firms' indicators of interest. The estimated propensity score in the first stage is used to restrict the sample, using the nearest-neighbor

[11] For more details, see: https://www.br.undp.org/content/brazil/pt/home/idh0/rankings/idhm-municipios-2010.html.

[12] In the database, considering the pure support of each program and the combined support, it was identified that 74.8% of the firms received support via BNDES Credit Small Enterprises and 82.7% of the firms received support via FGI PEAC. In terms of value released, on the same basis of comparison, 85.9% of the amount related to BNDES Credit Small Enterprises was identified, and 83.7% of the amount related to FGI PEAC.

[13] For the CPE, the average time of employment in the firm and dummies of participation in the Simples Nacional, belonging to the sections of administrative activities and complementary services (Section N) or other service activities (Section S) of the National Register of Economic Activity (CNAE), and if the firm is an exporter. For the FGI PEAC, the average time of employment in the firm, belonging to the sections of manufacturing industries (Section C); commerce; repair of motor vehicles and motorcycles (Section G) or transportation, storage and mail (Section H) of the CNAE, and the proportion of workers in the occupational group of commerce and services in relation to the total number of workers in the firm were included.

[14] This evaluation model is based on data science and applies the methodologies described above through automated routines. More details on MARVIm can be found in Grimaldi et al (2018), available at: https://web.bndes.gov.br/bib/jspui/handle/1408/15800.

matching method.[15] In this method, an unsupported firm is selected for each supported company, whose estimated propensity score is as close as possible to the propensity score of the supported company. As a result, unsupported companies that are not matched with a supported one are excluded from the sample. This procedure tends to build homogeneous control and treatment groups in relation to the observable characteristics.

In order to give overweight to some variables that tend to be more relevant in determining participation in treatment, the matching procedure was done separately in a set of blocks.[16] These blocks were generated based on the combination of four variables below, resulting in a total of 240 blocks.[17]

- Sector clusters: firms were associated with one of three clusters, called "growth", "intermediate" and "restriction", using the classification used in BRAZIL (2021), based on National Register of Economic Activity (CNAE, in Portuguese) and employment performance during the pandemic.
- Age groups: according to the distribution of this variable by quartiles in the population verified in the 2019 RAIS, firms were associated with one of four groups, called "up to 3 years", "3 to 8 years", "8 to 17 years" and "more than 17 years".
- Groups of employees: based on its number of employees in December, firms were grouped into one of four groups, called "up to 9 employees", "from 10 to 50 employees", "from 50 to 249 employees" and "250 or more employees".
- Regions of Brazil: based on the municipality of its headquarters.

After pairing, the blocks are gathered in a single database for model estimation.

[15] For more details on PSM implementation, see Caliendo and Kopeinig (2008). The choice for this method was due to data processing reasons, given the large number of observations that would potentially serve as control at the RAIS base, if other pairing methods were chosen, such as the Kernel method, for example.

[16] As Caliendo and Kopeinig (2008) emphasize, this approach is preferable in cases where the effects are expected to be heterogeneous in certain groups. The authors discuss the alternative ways of overweighting some relevant variables to explain participation.

[17] Of these blocks, 239 contained a positive number of companies; 236 blocks had at least one company supported by FGI PEAC, and 193 blocks had at least one company supported by BNDES Credit Small Enterprises. The block with more companies, both in total terms and in number of treated by FGI PEAC, refers to the one with headquarters in the Southeast region, intermediate cluster, size of up to nine employees and age group of 3 to 8 years (respectively, 239,680 companies in total and 5,416 supported by FGI PEAC). The block with the highest number of treated by the BNDES Credit Small Enterprises refers to the one with headquarters in the South region, intermediate cluster, size of up to nine employees and age group of 3 to 8 years (1,583 companies).

4. Descriptive analysis

This section describes the firms identified in the consolidated database, which includes firms exclusively supported by CPE (total of 16,138) and companies exclusively supported by FGI PEAC (total of 91,374). In addition, firms supported by both CPE and FGI PEAC (total of 2,722) were identified. Finally, companies not supported by any of the instruments (total of 2,785,040) were surveyed for comparison purposes.[18] Statistics on the frequency of firms are presented for most relevant categories. The tables for each cutout are in the appendix of this report.

In terms of regions of Brazil, support via CPE was more concentrated in the South region, while support via FGI PEAC – on the same basis of comparison – was more common in the Southeast region. Regarding distribution by size, the two instruments tend to support relatively more firms of up to nine employees. In terms of CNAE sector, the two supports were more common in section G, which is trade sector. Regarding the distribution of support by the CNAE sector clusters proposed by BRAZIL (2021), the firms treated in both instruments were more present in the intermediate sector (adding each pure support with the combined support).

Descriptive statistics of the firms identified in the database are shown in Table 2. The mean and standard deviation of the variables of interest in the period prior to treatment are computed for firms that received support from CPE and FGI PEAC. For comparison purposes, the same statistics were computed for firms that did not receive any support. In general, the data show that firms supported by FGI PEAC tend to have a greater size in terms of employment variables, Payroll and survival than companies supported by CPE, in addition to lower mortality rate. Table 2 also reveals that, for any support categories, data from unsupported firms tend to have lower means for all variables.

[18] It was decided to maintain the division of firms into four categories in this section to avoid double counting problems in the total support by categories, as will be presented below.

Table 2 – Descriptive statistics - pre-treatment period (2019)

Variable	Statistics	CPE	FGI PEAC	None
Admissions (sum)	Mean	10.1	21.0	5.2
	Standard deviation	168.2	109.7	85.8
Shutdowns (sum)	Mean	8.9	18.5	4.9
	Standard deviation	168.2	102.9	83.1
Payroll (December)	Mean	33,643.6	81,072.7	26,394.6
	Standard deviation	157,611.2	327,097.5	945,343.4
Employees (December)	Mean	16.3	39.7	11.0
	Standard deviation	67.9	164.8	217.6
Employees (average)	Mean	16.0	38.8	11.0
	Standard deviation	72.5	160.8	216.7
Employees (rate of change)	Mean	0.6%	1.4%	-10.8%
	Standard deviation	56.8%	48.5%	64.2%
Employees (volatility)	Mean	32.8%	28.1%	33.0%
	Standard deviation	46.4%	39.5%	56.2%
Death	Mean	3.1%	1.7%	5.9%
	Standard deviation	17.3%	13.0%	23.6%
Wages (December)	Mean	1,669.2	1,787.0	1,442.5
	Standard deviation	863.2	975.8	1,186.2

Source: Elaborated by the authors.

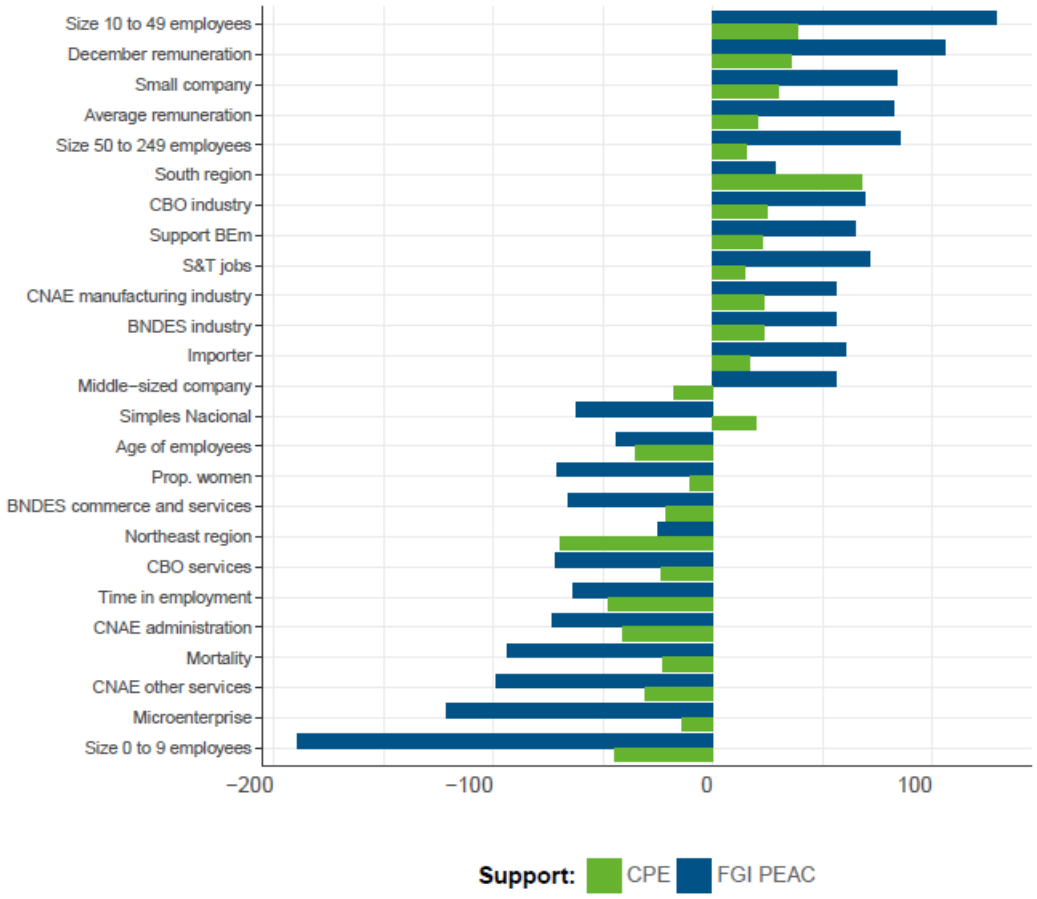
Note: the mortality of the firms was calculated in the variation from 2019 to 2020.

The last stage of this analysis seeks to identify the profile of the company supported by each program through the difference of the averages of its variables compared to companies without any support. This exercise was performed considering the pre-treatment period. In this sense, the Student's t-test is useful to verify, for a set of indicators, the difference in means between two groups – treated *vs.* controls.[19]

Graph 3 summarizes the results of this test. Firms supported by the instruments evaluated tend to have the following characteristics in relation to those not supported: they are larger companies, with higher average remuneration, more concentrated in the manufacturing industry, have younger employees and workforce with less time in employment than the unsupported ones. The differences between the firms supported by each instrument are, mainly, a greater concentration of medium-sized companies supported by FGI PEAC and a greater concentration of companies that joined Simples Nacional supported by CPE. These differences corroborate the tendency of firms supported by FGI PEAC to have a larger size, on average, than those supported by CPE, as previously identified.

[19] According to the t-test, the null hypothesis is that the difference between the means of the two groups is zero. The alternative hypothesis is that the difference is different from zero, regardless of whether it is greater for the treated or controls.

Graph 3 – Mean-differences T-tests



Source: Elaborated by the authors.

Note: The 25 variables with the highest t indicator in module are represented in the sum of the tests of mean differences considering the two instruments – CPE and FGI PEAC. These variables better identify the differences in profile between those supported by each instrument and those not supported by any instrument.

5. Results

5.1. Impact estimates

This section presents the impact estimates of each of the instruments evaluated. The estimated results are presented in the form of graphs.[20] Graph 4 presents the estimated coefficients, the confidence interval and the level of significance obtained for each regression of the CPE effects. Graph 5 shows the effects of FGI PEAC support.

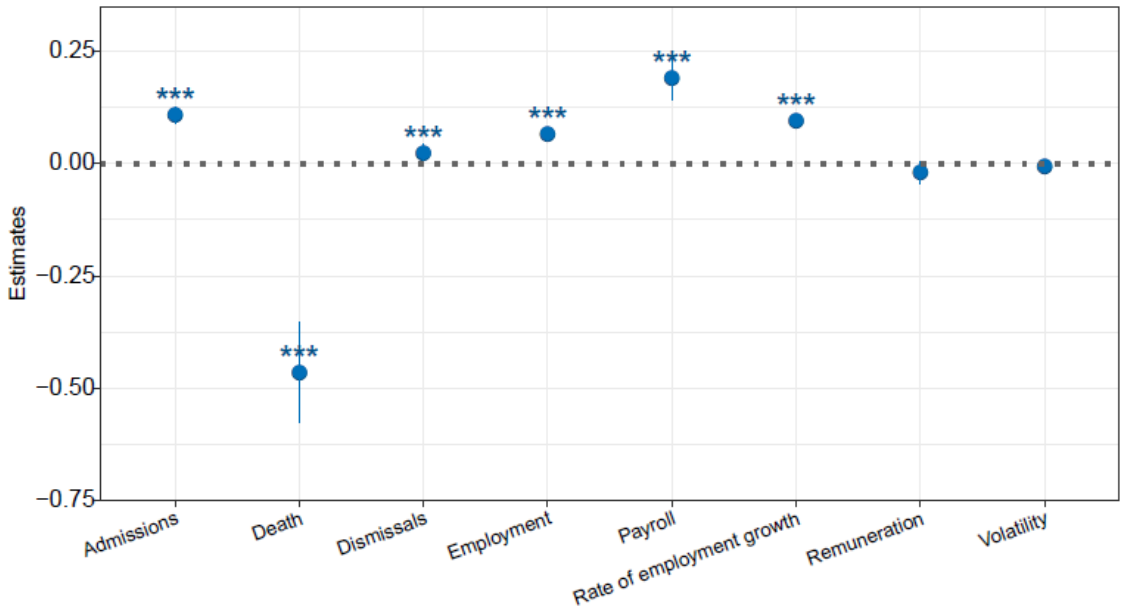
The results show that CPE had important marginal effects in reducing the probability of death (-37%) [21] compared to unsupported firms. The program had positive effects on jobs

[20] The tables with the estimated results are in the appendix.

[21] In all analyses of mortality, the marginal effects were computed by the exponential of the parameter estimated by regression minus 1.

– both in logarithm (+7%) and in rate of change (+10%) –, and a more positive effect on admissions (+11%) than on dismissals (+2%), which should be associated with the observed employment growth. In addition, there was an increase in the Payroll (+19%). The estimated effects on average remuneration and volatility in employment are not statistically distinct from zero.

Graph 4 – Impact estimates (CPE)

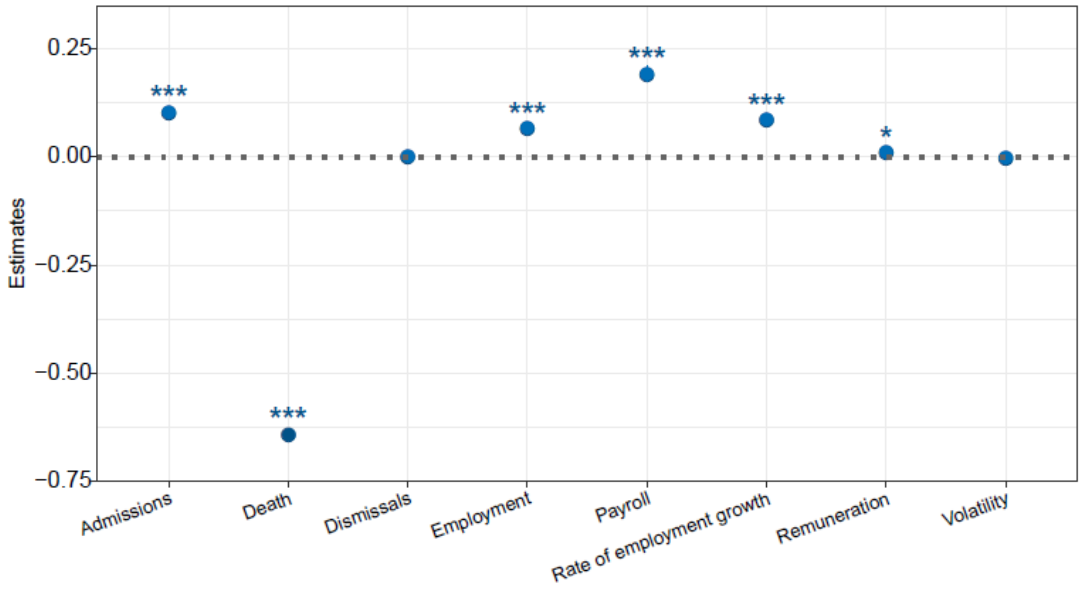


Source: Elaborated by the authors.

Note: The graph shows the estimated coefficients, the confidence interval and the level of significance for each regression of the CPE support on the variables of interest. *p<0.1; **p<0.05; ***p<0.01.

FGI PEAC, in turn, also had effects on reducing the probability of death of supported companies (-47%), in addition to positive results on jobs – both in logarithm (+7%) and in variation rate (+9%) –, as well as on admissions (+10%), with no effect on dismissals. In addition, positive effects on the Payroll (+19%) and the average remuneration (+1%) were identified. The effects on dismissals and volatility in employment were not significant.

Graph 5 – Impact estimates (FGI PEAC)



Source: Elaborated by the authors.

Note: The graph shows the estimated coefficients, the confidence interval and the level of significance for each regression of the FGI Peac support on the variables of interest. *p<0.1; **p<0.05; ***p<0.01.

The results suggest that the positive effect on the Payroll by both instruments was derived from increased employment opportunities. Similarly, the positive effect of employment was derived from the relative increase in the margin of admissions, since no significant effects of reduction of dismissals were obtained. In turn, these results may be associated with the observed reduction in the probability of death.

It is important to highlight that, in general, FGI PEAC and CPE verified similar effects on the indicators of interest, both in terms of individual significance as well as the magnitudes obtained. The main difference was a greater effect of FGI PEAC in reducing the probability of death (by 10 percentage points).

Additionally, it should be noted that, in order to attribute causality to the estimated results, it is necessary that the firms belonging to the two treatment statuses in each evaluation are statistically similar in terms of their observable variables. Pairing quality tests (sample balancing tests) show that these properties are satisfied in the estimates, as shown in the appendix of this report. In addition, regarding the assumed hypothesis of parallel trends in the counterfactual scenario, there is strong evidence of its validity in the data used in the estimates, based on the empirical strategy adopted. The trajectories of treated and matched controls present parallel trends before participation in the evaluated supports, as shown in the graphs in the appendix of this report.

5.2. Heterogeneity

This section aims to verify possible heterogeneities of the impact of the supports evaluated on the firms. Three possible sources of heterogeneity were considered: the size of the firms, their age (variables that act as proxies of the degree of credit restriction at the firm level)[22] and their sectoral cluster (proxy variable of conjunctural restriction). To observe the heterogeneities, the same regressions of the previous section were estimated for subsamples according to: (i) the four age groups; (ii) the four size groups; and (iii) the three sector clusters, categories defined in the matching stage.

In general, the results obtained in all groups considered maintained the signs observed in the general estimates presented in the previous section. The heterogeneities were manifested in the magnitudes and significance of the effects estimated in the three variables.

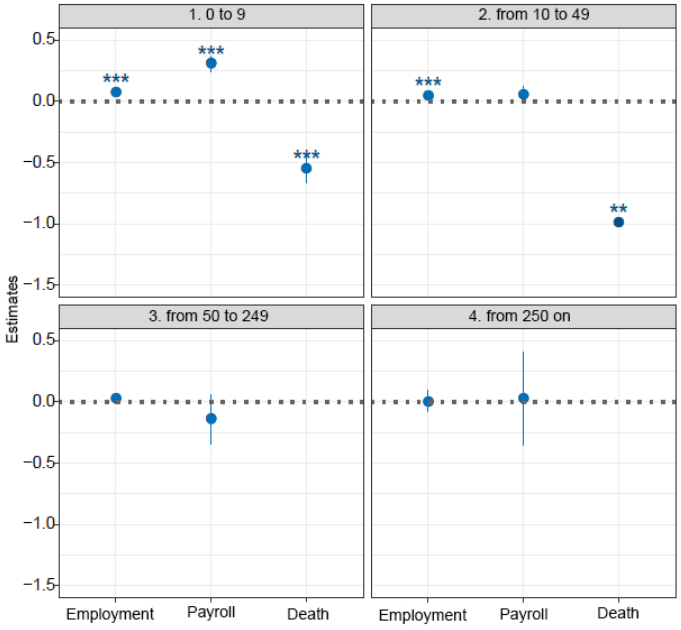
The first heterogeneity identified by the analysis refers to the size of the firms. As shown in Graph 6, in relation to the variable Payroll, the CPE only presented statistically significant effects for the group of 0 to 9 employees (+31% compared to unsupported firms). The effect on employment was significant in the 0-9 group (+8%) and 10-49 employees (+5%). The same was true for the probability of death of the firm (-42% and -63%, respectively). In short, the effects of the CPE were concentrated in companies with up to 49 employees.

Regarding the FGI PEAC (according to Graph 7), this program also had statistically significant results for the probability of death in the two groups mentioned (respectively, of -50% and -65%). The same was true for the Payroll (+34% and +7%, respectively). In the case of employment, there was a significant effect in all groups (from smallest to largest, +9%, +5%, +4% and +2%). It is important to highlight that the effects on employment and Payroll were greater in the groups of smaller firms.

The results allow us to conclude that, while the CPE performs better in the total approach, the FGI PEAC presents better indicators in the size approach, which is due to its greater effectiveness on the generation of employment in larger companies.

[22] See Gertler and Gilchrist (1994) for discussion of size and Fort et al (2013) for age proxy.

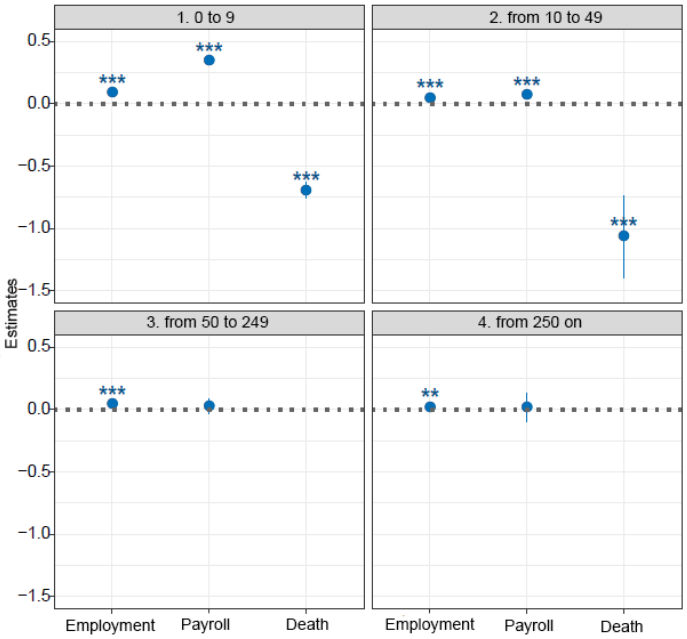
Graph 6 – Impact estimates (size groups, CPE)



Source: Elaborated by the authors.

Note: The graph shows the estimated coefficients, the confidence interval and the level of significance for each regression of the CPE support on the variables of interest. *p<0.1; **p<0.05; ***p<0.01. Estimates for death in sizes above 50 employees were omitted because they resulted in coefficients outside the scale of the graph and not significant.

Graph 7 – Impact estimates (size groups, FGI PEAC)



Source: Elaborated by the authors.

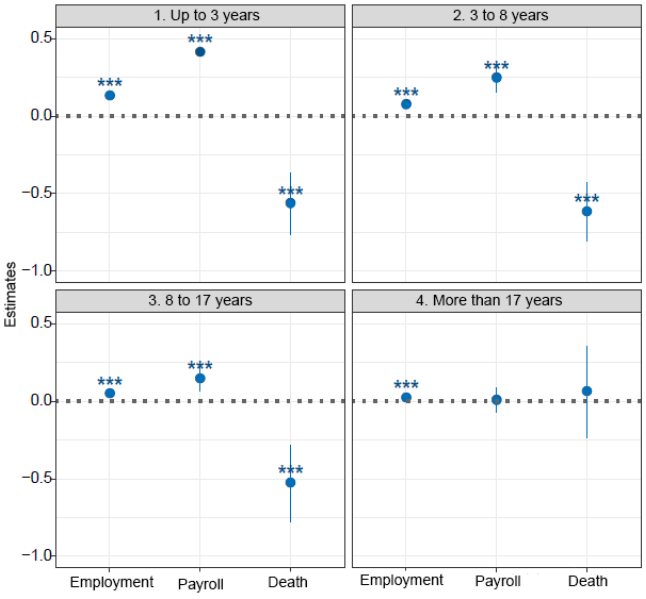
Note: The graph shows the estimated coefficients, the confidence interval and the level of significance for each regression of the FGI PEAC support on the variables of interest. *p<0.1; **p<0.05; ***p<0.01. Estimates for death in sizes above 50 employees were omitted because they resulted in coefficients outside the scale of the graph and not significant.

The second source of heterogeneity observed concerns the age of the supported firms. As shown in graphs 8 and 9, the CPE had a statistically significant effect on firm mortality in the "up to 3 years" (-43%), "3 to 8 years" (-46%) and "8 to 17 years" (-41%) age groups, compared to unsupported firms. In the same groups, there was a significant effect on the Payroll (respectively, of +41%, +25% and +15%). The effect on employment was significant in the four groups (from the youngest to the oldest firms, +13%, +7%, +5% and +3%).

The FGI PEAC showed significant results in all variables and in all groups considered. In the case of the probability of death of the firm, the effects were -50%, -47%, -45% and -53% respectively from the youngest to the oldest firms. For the Payroll, the estimated effects were +36%, +24%, +16% and +11%. In the case of employment, the estimated effects were +12%, +8%, +6% and +4%. It is important to note that the impacts on employment and wages in both instruments were greater for younger firms. It is noted, for the two support instruments, that the effects are decreasing, in all variables, throughout the age and size of the firms.

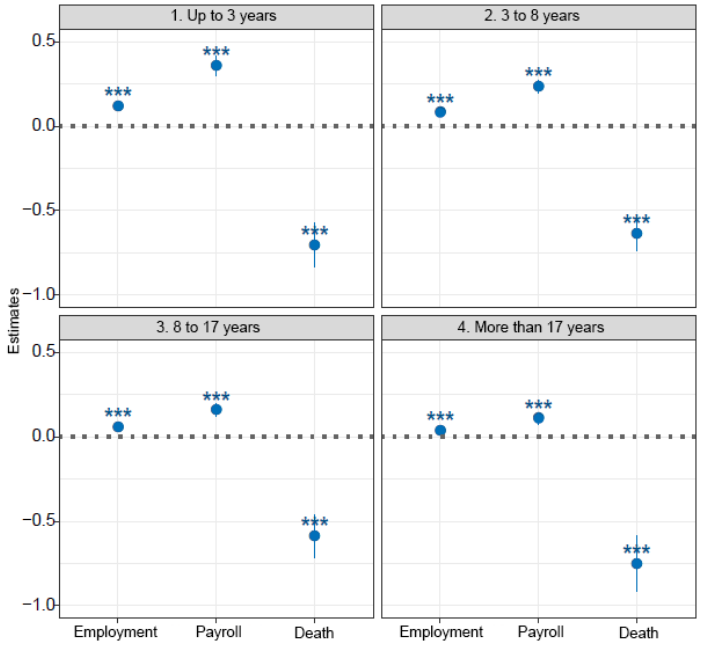
This result tends to favor the view that the support instruments promoted the relief of credit restriction, since the literature points out that age and size are important proxies for credit restriction.

Graph 8 – Impact estimates (age groups, CPE)



Source: Elaborated by the authors. Note: The graph shows the estimated coefficients, the confidence interval and the level of significance for each regression of the CPE support on the variables of interest. *p<0.1; **p<0.05; ***p<0.01.

Graph 9 – Impact estimates (age groups, FGI PEAC)

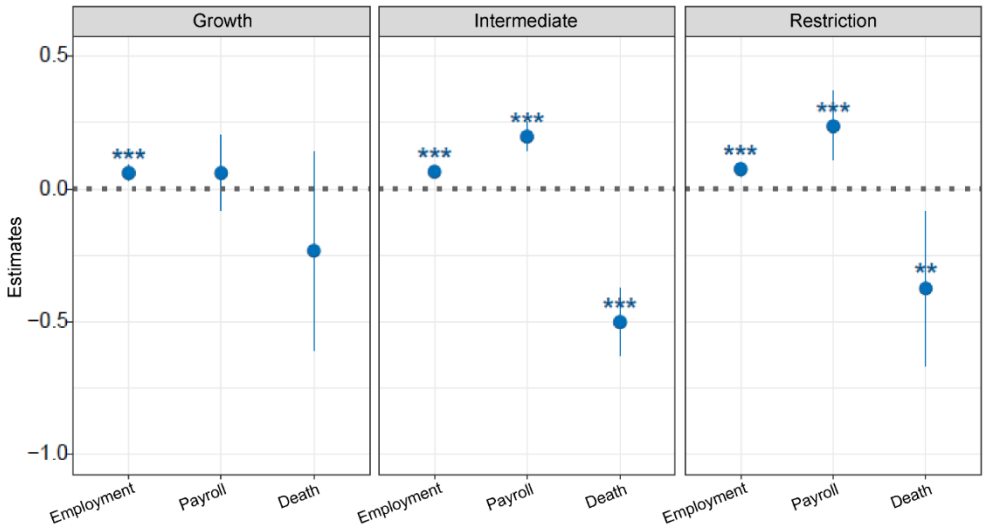


Source: Elaborated by the authors. Note: The graph shows the estimated coefficients, the confidence interval and the level of significance for each regression of the FGI PEAC support on the variables of interest. *p<0.1; **p<0.05; ***p<0.01.

The last source of heterogeneity observed is related to the sector clusters of firms' performance in relation to their employment throughout the pandemic. In this opening, the CPE had a statistically significant impact on the "restriction" and "intermediate" groups for the probability of death (respectively, -31% and -39%) and for the Payroll (+20% and +24%), compared to untreated firms. For employment, there was a significant impact on the "restriction", "intermediate" and "growth" groups (+6% in the last group and 7% in the others).

The FGI PEAC had a significant impact on all estimates made. For the probability of death, the estimated impacts for the "restriction", "intermediate" and "growth" groups were (-40%, -48% and -45%). For the Payroll, it was obtained, respectively, +15%, +20% and +17%. For employment, the effects were +6%, +7% and +8%.

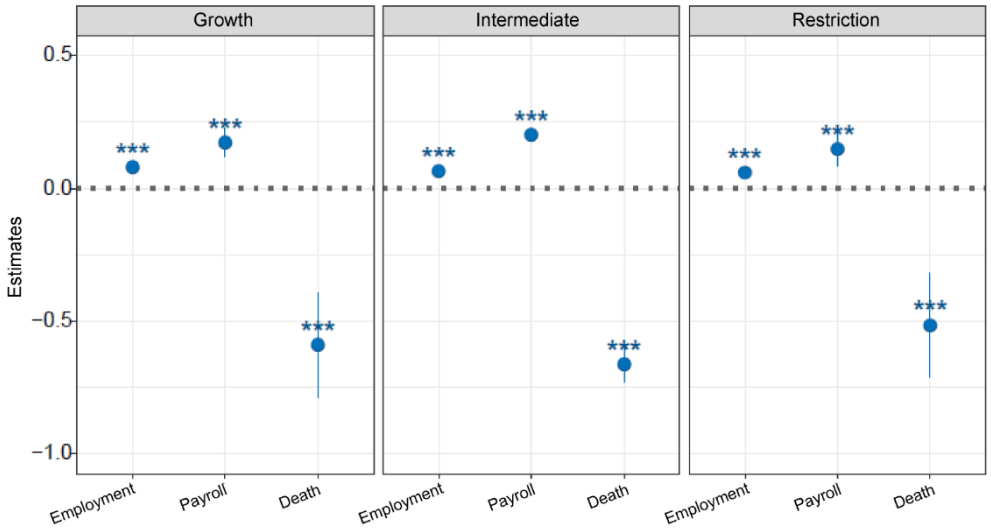
Graph 10 – Impact estimates (sector *clusters*, CPE)



Source: Elaborated by the authors.

Note: The graph shows the estimated coefficients, the confidence interval and the level of significance for each regression of the CPE support on the variables of interest. *p<0.1; **p<0.05; ***p<0.01.

Graph 11 – Impact estimates (sector *clusters*, FGI PEAC)



Source: Elaborated by the authors.

Note: The graph shows the estimated coefficients, the confidence interval and the level of significance for each regression of the FGI PEAC support on the variables of interest. *p<0.1; **p<0.05; ***p<0.01.

5.3. Robustness

To verify whether the results obtained hold with small variations in the treated sample, an alternative matching exercise was performed. In this exercise, we sought to identify the effect of the support of each BNDES emergency program considered in the evaluation, excluding from the sample the firms that obtained support from both instruments

simultaneously. Likewise, each treated one was matched with a firm without any emergency support from the BNDES.

The results maintained the same statistical significance and the same signals obtained previously. There were small differences in the magnitudes of the estimated effects, which did not exceed one percentage point. These differences are repeated in heterogeneities. The only highlight is a greater variability in the estimated parameters on the probability of death of companies, especially in support by the CPE. There was no clear direction of this greater variability, but this exercise observed milder impacts of this program on the mortality of younger firms.

6. Cost-effectiveness analysis

This section proposes an economic evaluation of the MSME support instruments evaluated in this report. The objective is to perform a cost-effectiveness analysis (CEA) of those instruments.

This type of analysis aims to compare public policy alternatives with the same objective. Its implementation is based on obtaining relative cost-effectiveness measures of the instruments in terms of their main impact variable, in this case, employment and additional income generated by the supports evaluated. However, this type of analysis is not able to inform the economic and social viability of the instruments analyzed (objective of the cost-benefit analysis – CBA).

Specifically, this section compares the aggregate additionality obtained by each of the instruments with their respective estimated fiscal costs for the Treasury.[23] The section first presents the methodological approaches used, then shows the cost-effectiveness estimates obtained and then brings a sensitivity analysis of the results.

6.1. Aggregate effectiveness

6.1.1. Methodological aspects

To calculate the aggregate effects of the instruments evaluated on employment and income, some definitions and assumptions are necessary:

- Main impact variable: formal employment of firms.

[23] It should be noted that the values obtained refer to projections with the specific purpose of providing inputs for the cost-effectiveness analysis within the scope of this evaluation. The calculation of the fiscal costs of each of the supports evaluated must be obtained through its own methodologies to be defined by the teams/competent bodies responsible, which is outside the scope of this report.

- Representative firm: it is the firm with average characteristics between the treated group of each instrument. The average values of this firm are used to extrapolate the individual effects to the whole treated group.
- Effect observation interval: variation in employment observed in the period 2019-2020 (position of the stock of employees at the end of each year of the companies).
- Base date for aggregate effects: period after the end of the term of the instruments evaluated – December 31, 2020.
- Assumption of yearly effects: the estimated additional employment values generated labor income in the 12-month period in the effect observation interval – and can be converted into an additional annual Payroll.
- Assumption for monetization of effects: the effects on employment can be converted into monetary terms using as a proxy for additional income the average remuneration of workers.

Based on these definitions, the comparison, in monetary terms, of the aggregate effects of each instrument with their respective costs was made through the total additional Payroll of each support due to the estimated impacts on employment.

From a theoretical point of view, the additional Payroll (AP) of each of the instruments can be broken down as follows:

$$\text{iii)}\ AP = AP_{mi} + AP_{me}$$

in which AP_{mi} is the additional Payroll associated with the employment effect at the intensive margin (quantity of jobs in a given firm); and AP_{me} is the additional Payroll associated with the effect on employment in the extensive margin (number of existing firms or probability of survival).[24]

In addition to the effects on supported firms, the program can generate effects derived from additional income (in the counterfactual sense) by the instruments – here called "induced effects".

[24] The *APmi* is calculated based on the estimated additional employment in the average treated firm. The AP*mi* is the product between additional employment, average annual compensation in supported firms, and the number of firms supported. As for *APm*e is calculated based on the aggregate additional survival rate. Thus, *APm*e is the product between the total Payroll of the treaties and the additional survival rate.

Therefore, the total additional Payroll (TAP) of each of the emergency instruments is given by:

$$i) \qquad TAP = AP + IAP$$

In this equation, the additional Payroll in the set of firms supported (according to equation III) by the instrument and IAP is the Payroll induced by the additional consumption shock generated by the AP, obtained by an input-output approach.

The input-output model is a tool for analyzing productive relations in an economy. With it, we can estimate the potential impacts (direct and indirect)[25] on the productive activity from exogenous demand shocks. In this evaluation, the AP of each support instrument was considered an exogenous demand shock to obtain the IWB.[26]

To obtain the input-output model estimates four main databases were used: Input-Output Matrix (2015), National Accounts System, reference 2010, for the year 2018 (SCN 2018), Family Budget Survey (POF 2017-2018) and National Household Sample Survey (PNAD 2018), all produced by the Brazilian Institute of Geography and Statistics (IBGE).[27]

6.1.2. Additional Payroll

Using the estimates in the previous section for the impact of FGI PEAC support on the Payroll and the probability of death of companies, the aggregate effects on the intensive and extensive margin of employment were calculated. Table 3 shows the results of the aggregations for FGI PEAC and CPE. Additionally, the values obtained from the IWB and TAP in the last two columns of the table are shown.

The results show that FGI PEAC has a higher TAP and total additional employment than CPE, mainly because it is an instrument with a greater number of supported companies, considering that the magnitudes of the average effects of the two instruments tended to be similar.

[25] The direct effect refers to the production necessary to meet the initial shock and the indirect refers to the production necessary to meet the intermediate consumption of the activities to fulfill the initial production and the result of subsequent intersectoral interactions. For the present study, the demand for household consumption was considered endogenous to the model, according to the Leontief-Miyazawa model, which considers that household consumption should be described as a function of household income, thus defining that household income is a function of the production of the sectors.

[26] This model assumes the existence of overcapacity in all sectors and unemployment or underemployment of factors of production valid for the Brazilian economy. This hypothesis tends to be valid considering the period under analysis and the relative size of the estimated shock in the economy.

[27] The first database is the input-output matrix released by IBGE for 2015, which was updated to 2018 values. The second database was used to verify the consistency of the others. Finally, POF and PNAD were used for the breakdown of household, consumption and income-related information, respectively. More details on the methodological procedures adopted here can be found in the appendix of this report.

Table 3 – Total additional Payroll

Emergency Action	N	Total additional employment	AP-MI (BRL million)	AP-ME (BRL million)	AP (BRL million)	IWB (BRL million)	TAP (BRL million)
FGI PEAC	**114,531**	**317,789**	**7,998.9**	**2,198.6**	**10,197.5**	**3,465.3**	**13,662.8**
CPE	**25,210**	**28,650**	**656.5**	**221.1**	**877.6**	**304.8**	**1,182.4**

Source: Elaborated by the authors.

Note: The additional Payroll was obtained based on the sum of the intensive and extensive margins. Total additional Payroll = additional Payroll + induced Payroll.

6.2. Costs

6.2.1. Cost estimate – FGI PEAC

As already mentioned, FGI PEAC relied on contributions from the Federal Government to compose the fund's segregated equity in order to cover any losses in guaranteed operations. These contributions totaled BRL 20 billion in 2020 and were distributed in tranches of BRL 5 billion over the months of the program's validity.

Although the contributions represent a fiscal cost to the Treasury at the time of its execution, the expected fiscal cost of the program depends on possible returns to the Federal Government of resources not committed to guarantees granted by FGI PEAC. In turn, these returns depend on the potential loss with honor payments in the contracted operations and other components, such as financial income from investments of the fund's resources and administrative expenses.

The cost simulation presented here considers the contributions made by the Federal Government in FGI PEAC and the simulated returns of program resources to the Federal Government.[28] The fiscal costs of the program were calculated based on the expected surplus projections of the fund's equity at the end of the term of the contracted operations. The cost projection methodology was based on the simulation of the fund's redemption flows over the term of FGI PEAC until its liquidation, considering the conditions established in Law 14,042, and do not contemplate any extension of the program. These flows were obtained based on financial revenues projected by term structure of interest

[28] It should be noted that this is a simulation of FGI PEAC in relation to amounts and periods of honor payments.

rates on December 31, 2020 – the base date for the program's expected fiscal cost estimates.[29]

Due to the difficulties involved in predicting the expected volume of default of the program, three default scenarios were simulated in terms of the financial volume of honors to be paid by FGI PEAC:[30] (i) base scenario: BRL 12.2 billion; (ii) optimistic scenario: BRL 8.8 billion; and (iii) pessimistic scenario: BRL 19.6 billion. The default scenarios were simulated with illustrative situations in terms of amounts and periods of occurrence of coverage. In addition, the calculations were made considering the assumption of about 25% credit recovery rate.

The main variables of interest for redemption projections are: (i) asset adjusted for reductions[31] and (ii) minimum capital.[32] Based on the simulations of these variables, it is possible to make simulations of the fund's annual redemptions in a given period, through the difference between adjusted asset and minimum capital.

From the above calculation, the net redemption flows were brought to present value for the said base date by using the term structure of interest rates itself. Based on this, the simulated fiscal cost of the program was calculated by the difference between the Treasury contributions and the projected redemptions, both in present value, as shown in the equation below:

$$V) \qquad \text{Fiscal cost}_t = \text{Contributions}_t - \text{Redemptions}_t$$

Table 4 presents the simulations of fiscal costs, considering the scenarios described above. It is observed that, in the base scenario, the simulated fiscal cost of the program is approximately BRL 9.9 billion, while in the pessimistic scenario this number approaches BRL 15 billion. On the other hand, the optimistic scenario brings a cost of approximately BRL 7.5 billion.

[29] This base date was chosen because it is the end date of the program and, concomitantly, the only period available in the data to observe the effects on employment.

[30] The scenario analysis approach was adopted due to the uncertainty involved in the projection of its results, which are strongly related to the level of loss with default of guaranteed operations. The inducing role of the program in relation to access to credit and the emergency context in which it operates compromise the determination of parameters to estimate the expected value of losses.

[31] Referring to contingencies and withholdings for other expenses.

[32] In this simulation, in a simplified manner, it was considered as the minimum between the limit available for coverage (LAC) and the combined exposure of the operations (guaranteed balances of all operations).

Table 4 – FGI PEAC Expected Tax Cost Simulations

	Pessimistic	Base	Optimistic
Contributions	20,135	20,135	20,135
Redemptions	5,134	10,280	12,670
Tax cost	**15,001**	**9,855**	**7,465**

Source: Elaborated by the authors.

Note: variables in BRL million.

Base date of the simulations: December 31, 2020.

6.2.2. Cost estimation – CPE

The BNDES CPE cost approach is based on estimates of the expected fiscal cost to the Treasury. Since the CPE is an emergency credit line from the BNDES, without any financial subsidies (explicit), the calculation methodology was based on estimates of any credit subsidies[33] (implicit) expected at the time of approval of each CPE operation. Consequently, the CPE fiscal cost approach is based on an eventual difference between the funding cost faced by the Treasury and the financial cost of the BNDES in the loans granted.[34]

To define a proxy for the funding cost of the Treasury, a cost approach was used from an economic perspective, as done in Machado et al. (2018) for PSI costs. In this line, the funding cost was defined based on the forward structure of interest rates, derived from the indicative rates of negotiation of federal public bonds (ETTJ) for each date on which operations were approved during the term of the line, as well as the term conditions of the operations carried out. As regards the financial cost of the BNDES operations, it was calculated based on the funding allocated to each approved loan in the period from March to December 2020.

Of the BRL 7.2 billion in financing contracted at CPE, BRL 3.9 billion had Selic funding. Considering that the Selic corresponds to the Treasury's funding cost, the implicit subsidy estimated by the methodology is zero, and it is unnecessary to carry out the calculation for this group of operations. On the other hand, the remaining portion of BRL 3.3 billion is composed of credit operations with institutional funding, subject to implicit subsidies,

[33] For more details on the distinction between subsidies on Treasury loans to the BNDES, see the National Treasury Subsidy Bulletin under the PSI and the BNDES loans. Available at: https://sisweb.tesouro.gov.br/apex/f?p=2501:9:::9:P9_ID_PUBLICACAO:42608.

[34] It was considered that: (i) the basic remuneration charged by the BNDES serves to cover operating costs; and (ii) the risk remuneration serves to cover the expected loss due to possible default in operations.

among other reasons, due to the transition rule adopted for TLP.[35]

It should be noted that this portion fully uses funding with TLP cost, although the credit operations have been carried out using both the TLP and the fixed rate of the BNDES (TFB).[36] Considering that the TFB is calculated based on the financial equivalence of the TLP itself, the calculation of the subsidy for an operation in TFB presents an identical result to the calculation of an operation in TLP carried out on the same date and with the same characteristics of volume and term.

In this sense, it was decided to project the flows of all operations considering the TLP of the allocated funding, regardless of whether the credit operation is contracted in TLP or TFB. As a result of the entire cash flow projection of credit operations having been made based on the TLP, the ETTJ derived from the indicative rates of trading of the National Treasury notes – Series B (ETTJ-IPCA) was used in the calculation of the funding cost of the Treasury.

The methodology used involved the following steps: (i) generation of simulated payment flows for each operation based on the established financial conditions (terms and rates) on the approval date; (ii) aggregation of these flows by date of approval of operations; (iii) obtaining, for each approval date, a vector with the discount factors for the vertices of each flow, based on the ETTJ-IPCA; (iv) obtaining the present value (PV) of the flows for each approval date; (v) calculating the fiscal cost based on the difference between the approved value and the present value of the flow for each approval date, according to the following equation:

VI) $Fiscal\ Cost = \sum_t Approved\ amount - \sum_t PV(Payment\ flow)$

in which $\sum t$ *Approved amount* is the sum at t (approval date) of the approved value of operations and $\sum_t$ PV *(Approved amount)* is the sum of the respective payments in present value. Comparing the total approved amount with institutional funding with the total

[35] For a smoother transition from TJLP to TLP, Law 13,483 of 21 September 2017 established that there would be a five-year NTN-B real interest rate reduction factor, called alpha (α). This factor is valid for one year and rises progressively until 2023, when the TLP-Pre will equal the real interest rate of NTN-B. In 2020, the alpha applied was 0.74. For more details on TLP, see: https://www.bndes.gov.br/wps/portal/site/home/financiamento/guia/custos-financeiros/metodologia-de-calculo-da-tlp/.

[36] For MSMEs, the BNDES also offers the possibility for the client to opt for TFB, in order to protect it from market variations throughout the contract. The TFB is calculated by the BNDES according to the term characteristics of the operations and based on the marginal market conditions for the realization of theoretical swap of funding in TLP for a funding at a fixed rate, and the resulting mismatch is dynamically mitigated by the treasury team of the BNDES.

present value of the flows over the term of the line, a (negative) tax fiscal cost of BRL 168.1 million is obtained in amounts as of December 31, 2020.[37] Therefore, the comparison of the flows meant a fiscal revenue rather than a cost.

It is important to note that the estimates of fiscal cost depend on the average term of CPE operations. As the TLP is fixed based on the five-year vertex of the ETTJ-IPCA and this curve tends to be positively inclined, longer operations tend to present flows that, applied to this methodology, would be brought to present value by higher interest rates. Thus, longer operations would tend to have higher Treasury funding costs, which would imply higher implicit fiscal costs. However, CPE operations tend to be relatively shorter, with an average term of approximately four and five years, so as not to generate relevant differences between the Treasury's funding costs and the financial cost of the BNDES.

It is also worth noting that the methodology that defines the TLP definition implies a lag, to the extent that the TLP (i) has a monthly term and (ii) is calculated based on the average of the last three months of the five-year vertex of the ETTJ-IPCA multiplied by a reducer ("alpha"). In this sense, in scenarios of falling rates, the TLP may eventually be set at levels higher than the marginal cost of funding faced by the Treasury, leading to the result obtained in the present year, even if the alpha of the period was less than one.

6.3. Cost-effectiveness estimates

Table 5 compares the cost-effectiveness measures of FGI PEAC and CPE, based on the net present value (NPV) indicator, which measures the difference between the total additional Payroll and the fiscal cost (both in present value). In the comparison between the two kinds of support, FGI PEAC presented a NPV higher than CPE (BRL 3.8 billion vs. BRL 1.4 billion). This result is mainly associated with the scale and size of the average firm used for the aggregate calculations, which tend to be higher in FGI PEAC than in CPE.

Table 5 – Calculation of net present value (FGI PEAC and CPE)

Indicator	FGI PEAC	CPE
Total additional Payroll (BRL million)	13,662.77	1,182.44
Fiscal cost (BRL million)	9,855.21	-168.10
NPV (BRL million)	**3,807.56**	**1,350.54**

Source: Elaborated by the authors.

[37] The values of the tax cost for each month of validity of the CPE were updated by the IPCA so that the calculation of total tax costs had as base date December 31, 2020, end of the period of validity of the emergency line.

6.4. Sensitivity analysis

In order to assess the robustness of the results verified in the previous subsection, a sensitivity analysis was performed (Table 6). Two sources of variations were raised. The first considers the three possible scenarios for the cost of FGI PEAC, as presented in the cost section of FGI PEAC. This analysis shows that the NPV of FGI PEAC ranges between approximately BRL -1.3 billion (pessimistic scenario) and BRL 6.2 billion (optimistic scenario).

Table 6 – Sensitivity analysis to cost scenarios (FGI PEAC)

Indicator	Scenario		
	Pessimistic	Base	Optimistic
Total additional Payroll (BRL million)	13,662.8	13,662.8	13,662.8
Fiscal cost (BRL million)	15,001.0	9,855.2	7,465.0
NPV (BRL million)	**-1,338.2**	**3,807.6**	**6,197.8**

Source: Elaborated by the authors.

The other sources of variation come from interval bands that are related to the impacts estimated by each of the instruments. The base column considers the estimated coefficient considered in the previous analysis. The upper band considers the impact as the sum between the estimated coefficient and a standard deviation related to the same coefficient, both for employment and for firm mortality. The lower band considers the impact as the estimated coefficient minus one standard deviation related to the same coefficient.

For this analysis, in relation to FGI PEAC, the fiscal cost foreseen in the base scenario was adopted. According to the sensitivity analysis, the NPV of FGI PEAC varies between BRL 3.7 billion and BRL 4.1 billion throughout all calculations performed (Table 7). This analysis showed that the estimates of the NPV of FGI PEAC tend to be more sensitive to the cost scenarios related to the variations in the measures of the aggregate impacts.

Table 7 – Effectiveness band sensitivity analysis (FGI PEAC)

Indicator	Band		
	Bottom	Base	Upper
Total additional Payroll (BRL million)	13,546.7	13,662.8	13,908.6
Tax cost (BRL million)	9,855.2	9,855.2	9,855.2
NPV (BRL million)	3,691.5	3,807.6	4,053.3

Source: Elaborated by the authors.

The sensitivity analysis with interval bands of the additional Payroll for the CPE showed that NPV can vary between BRL 1.3 billion and BRL 1.4 billion throughout all calculations performed.

Table 8 – Effectiveness band sensitivity analysis (CPE)

Indicator	Band		
	Bottom	Base	Upper
Total additional Payroll (BRL million)	1,134.4	1,182.4	1,237.0
Tax cost (BRL million)	-168.1	-168.1	-168.1
NPV (BRL million)	1,302.5	1,350.5	1,405.1

Source: Elaborated by the authors.

7. Considerations on the evaluation

7.1. Department of Effectiveness and Economic Research

This report evaluated the impact of the BNDES's countercyclical action for MSMEs in the Covid-19 crisis, focusing on the actions of FGI PEAC and CPE. These two forms of intervention accounted for two thirds (65.4%) of the countercyclical action of the BNDES in 2020 and are policy tools that tend to remain in the Bank's support to MSMEs.

In the first months of the pandemic, it was expected that the crisis would have a strong impact on the labor market, as a result of the destruction of jobs and the mortality of companies, generating a drop in payroll. In March 2020, estimates for Brazilian unemployment rate reached 25% of the workforce.

Due to the importance of MSMEs in the dynamics of job creation and their lower chance of survival in crisis situations, as they have less access to credit, the BNDES emergency actions were mainly proposed to modify this scenario. Both CPE and FGI PEAC aimed to preserve this segment of companies, in order to positively affect employment and income in supported firms.

This report investigated whether FGI PEAC and CPE were effectively able to achieve their intended objectives. The methodology used here sought to deal with sample selection bias problems to obtain the impact estimates of each of the BNDES supports.

The results suggest that both FGI PEAC and CPE were effective in reducing the mortality of supported companies. While FGI PEAC reduced the probability of death by 47%, CPE

reduced it by 37%. In addition, both actions had positive and significant impacts on formal employment and on the Payroll, of very similar magnitudes. Consequently, based on this evidence, it is not possible to state that one action was more effective than the other in terms of increased employment and income when comparing the average effects of the actions in the supported firms.

The report also investigated whether there are heterogeneous effects of the two forms of support, according to: (i) the size of firms, (ii) the age of firms; and (iii) the impact of the Covid-19 crisis on the firms' sector. In general, the results in all groups maintained the signs observed in the aggregate estimates. As expected, the smallest and youngest firms (usually the most credit constrained) were more impacted by the countercyclical tools of the BNDES.

These results represent an advance in the literature on the effects of the BNDES. First, because the report investigates the effects of the Bank on a broad set of companies' labor market indicators. Second, because it did so in the context of a countercyclical action of the BNDES, something hitherto non-existent. Third, because it analyzed such impacts for two different forms of action with the same objective: via credit (CPE) and via guarantees (FGI PEAC), inspecting heterogeneous effects of each form of support.

The main outcome of this report concerns the expected cost-effectiveness analysis of the two support tools. This is important for two reasons. First, to compare the relative aggregate effectiveness of public policy alternatives with the same objective. Second, because the evidence that a certain BNDES program had a positive effect on some variable should, when possible, be complemented with analysis that takes into account the costs of public policy alternatives. Cost-effectiveness analysis fills the gap in the discussion of alternatives. Incidentally, this type of analysis is a gap in the empirical literature on the BNDES and is scarce in the evaluation literature of public policies in Brazil.

Before proceeding, it is important to recognize the complexity involved in the cost-effectiveness analysis, which implies the need for choices by the researcher (for example, which impacts to consider, how to calculate the expected costs in present value, which assumptions to consider, among others). Thus, it was decided to present the results of the cost-effectiveness analysis in intervals given by the analysis of sensitivity, considering possible cost scenarios, scenarios of effects and different sample cutouts – thus avoiding

numbers that sound extremely and unduly accurate.

In addition, it should be noted that the cost-effectiveness analysis has the characteristic of being context-dependent. That is, the calculations were made considering the date of December 31, 2020, the day scheduled for the closure of the two BNDES supports. At that date, the macroeconomic conditions of the country were specific to an atypical context of reduced long-term interest rates. As a result, the results of the cost analysis depend to a large extent on the macroeconomic boundary conditions.

That said, the work suggests that the NPV of FGI PEAC ranged between BRL -1.3 billion and BRL 6.2 billion throughout all calculations, while the NPV of CPE ranged between BRL 1.3 billion and BRL 1.4 billion. This result shows an expected cost-effectiveness value of the FGI PEAC higher than that of the CPE, which occurs due to the relevant scale difference between the two instruments and the difference in the profile of the supported average firm.

While CPE affected about 25,000 companies, FGI PEAC affected more than 114,000 – a 4.5 times greater reach. While CPE generated 29,000 additional jobs, FGI PEAC generated 318,000 – an 11 times greater reach. Therefore, if the countercyclical action of the BNDES had depended only on CPE, perhaps the impact of the crisis on the labor market would have been much greater. On the other hand, the PEAC had a subsidy from the Brazilian Treasury, while the CPE had no explicit subsidy and was able to generate effects without generating tax cost (*ex-ante*) according to the estimates presented.

Finally, it is important to note that this report did not intend to uncover which form of support (via credit or via guarantee) is most effective in general. Strictly speaking, the results of this work should be seen as follows: in the Covid-19 crisis, a crisis of a very different nature from all the previous ones, the innovative performance of the BNDES via FGI PEAC, with a design of high risk appetite, compatible with the severity of the crisis, proved to have a much greater aggregate impact and a little more cost-effective than the performance of CPE.

Before concluding, it is important to mention that the study considers the tax cost of the BNDES support, but disregards tax benefits arising from this action. A firm that survives because of the countercyclical policy of the BNDES, either via FGI PEAC or via CPE, generates a tax collection sequence by the government that would not occur if the firm had succumbed to the pandemic. This effect should not be overlooked in the long term.

In addition, the study also does not consider that the employment maintained by the Bank's action generates the maintenance of the human capital of the affected workers, which could be lost in case of firms' death in the pandemic.

For the future, and in the light of the evidence presented, it can be said that credit and guarantees should be seen as useful and complementary tools for future countercyclical actions – especially in severe crises, when the government needs several policy tools to sustain employment. In particular, as the availability of a public guarantee increases access to credit for firms, but also implies a greater risk of default by companies (precisely because of the public guarantee), the calibration of the FGI's risk coverage must be done in order to maximize the cost-effectiveness of public policy.

7.2. Operations and Digital Channels Division (ADIG)

The countercyclical actions promoted by the BNDES according to the cost-effectiveness analysis presented, either by innovation via FGI PEAC or through CPE, reinforce the importance of the indirect model of the BNDES as a credit diffuser in the traditional ways of targeted transfer and more recently via credit guarantee fund in the non-earmarked credit segment. Currently, the financial agents accredited by the BNDES have an automatic online digital platform for credit request and approval that allows greater speed in disseminating or guaranteeing credit via the banking network with more than fifty financial agents.

The study pointed out an aspect that was treated only as a hypothesis after the adoption of the TLP, the ability of the indirect model of the BNDES to be effective at a time of economic crisis, and not only replace source or generate a crowding out process of private resources. As evidenced by the study, the credit for directed turnover and the free resources guarantee fund were effective in reducing the probability of company deaths and generating employment and income.

It is worth noting that, in addition to the role of credit diffuser, another important characteristic of the indirect model can be inferred from the study: the performance in market failures, which tend to be amplified in times of crisis.

The difficulty of access to credit by MSMEs is recognized worldwide as a problem that requires action through public policy, even in an economic scenario considered normal. This occurs due to information asymmetry, absence of credit history, greater perception

of risk and transactional cost, difficulty in offering guarantees, among other factors. The World Bank (2015) estimates that between 55% and 68% of small and medium-sized enterprises in developing countries do not have access to credit or have access below their capacity, which generates a credit gap between USD 0.9 trillion and USD 1.1 trillion. Also according to the World Bank (2015), more than half of the countries have a public guarantee policy aimed at accessing credit for smaller companies, including several developed countries, and the number is increasing. The BNDES's performance in the execution of public policies aimed at promoting access to credit through the granting of guarantees has a relevant history, involving the structuring and management of credit guarantee funds for MSMEs. This trajectory began in 1998 with the structuring and the beginning of the operation of the Guarantee Fund for the Promotion of Competitiveness (FGPC), undergoing important evolution with the creation of the Investment Guarantee Fund (FGI) in 2009.

The crisis triggered by the Covid-19 pandemic aggravated the difficulty of accessing credit, due to uncertainties about the direction of the economy and the increased perception of default risk, resulting in the adoption of emergency stimulus measures of enormous size to seek to stabilize the credit market, with the socioeconomic objective of preserving employment and income by several countries. In Brazil, the Emergency Credit Access Program (which, in its form of guarantees, was operationalized through the FGI PEAC) is one of the several measures introduced in this context, with the objective of facilitating access to credit and preserving economic agents due to the economic impacts resulting from the Covid-19 pandemic to protect jobs and income.

FGI PEAC contributes to mitigate the worsening of the chronic problem described of access to credit, especially in the case of small and medium-sized companies. With explicit federal subsidy, many financial institutions were able to leverage resources for borrowers with greater difficulty in accessing credit, by mitigating credit risk in the context of a serious macroeconomic crisis (which generates more financial insecurity and greater rigidity of credit approval). The participation of credits supported under the program in granting credit to small and medium-sized borrowers during the second half of 2020 was extremely relevant, reaching, in the case of working capital concessions with free resources and a term of more than 365 days carried out in the second half of 2020, more than 52%.

The study pointed out an important effectiveness of the FGI PEAC, with significant

impacts on the survival of supported firms, employment and Payroll, in addition to the cost-effectiveness trend, even without considering several benefits arising from the program's actions (collection, reduction of public spending such as unemployment insurance, maintenance of human capital, among others).

On the other hand, the traditional credit performance, through the CPE, was effective in the employment, income and survival of companies more restricted to credit without the perspective of fiscal cost, on the contrary, financial simulations indicated that the instrument may also generate tax revenue. Note that the average cost with which the BNDES resources, in the indirect modality, reach financial agents is close to the rates practiced in the market. However, the BNDES operates with heterogeneous financial institutions. The largest commercial banks, in addition to having deposits, can raise at rates very close to the forward structure of the economy. On the other hand, credit unions and medium-sized banks are unable to raise at the same rates or at the same volume as large financial institutions.

During crisis, the capital market faces liquidity problems and the cost of funding increases. This aspect favors the increase in demand for the BNDES resources, promoting liquidity to authorized financial institutions at a cost that accompanies the forward structure of the economy and is related to the term demanded by the end client.

In short, through the results presented, the indirect model of the BNDES, operated by ADIG, in addition to the historical role of being a diffuser of targeted credit, has effective lines and products for the survival of companies and job creation, with an anti-cyclical response to the health crisis of Covid-19. In addition, the study reinforced the role of this model by mitigating the credit constraint, providing guarantees and liquidity to banks to act at the tip with micro, small and medium-sized companies.

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Appendix A

A.1. Profile of the firms in the data

Table A.1. – Number of firms by category of support and region of Brazil

Region	CPE	FGI PEAC	CPE and FGI PEAC	None
Midwest	1,842	8,125	273	251,251
Northeast	850	12,762	135	461,495
North	347	4,357	46	111,631
Southeast	5,574	43,165	1,086	1,360,265
South	7,525	22,965	1,182	600,398
TOTAL	**16,138**	**91,374**	**2,722**	**2,785,040**

Source: Elaborated by the authors.

Table A.2 – Number of firms by support category and cluster of CNAE sectors

Cluster of CNAE sectors	CPE	FGI PEAC	CPE and FGI PEAC	None
Growth	1,749	13,068	463	420,894
Intermediate	12,205	68,635	1,982	2,034,193
Restriction	2,184	9,671	277	329,953
TOTAL	**16,138**	**91,374**	**2,722**	**2,785,040**

Source: Elaborated by the authors.

Table A.3 – Number of firms by support category and size groups

Size groups (RAIS)	CPE	FGI PEAC	CPE and FGI PEAC	None
a) 0 to 9	11,747	48,830	1,327	2,349,874
b) from 10 to 49	3,886	30,495	966	372,635
c) from 50 to 249	452	9,390	319	51,769
d) from 250 on	53	2,659	110	10,762
TOTAL	**16,138**	**91,374**	**2,722**	**2,785,040**

Source: Elaborated by the authors.

Table A.4 – Number of firms by support category and age groups

Age groups (RAIS)	CPE	FGI PEAC	CPE and FGI PEAC	None
1. Up to 3 years	3,221	13,439	338	589,795
2. 3 to 8 years	4,846	25,510	761	780,342
3. 8 to 17 years	4,287	25,972	788	661,997
4. More than 17 years	3,784	26,453	835	752,906
TOTAL	**16,138**	**91,374**	**2,722**	**2,785,040**

Source: Elaborated by the authors.

Table A.5 – Number of firms per CNAE section and distribution by category of support

CNAE Section	Section Name	CPE	FGI PEAC	CPE and FGI PEAC	None
A	Agriculture, forestry and fishing	85	586	21	21,425
B	Extractive industries	25	221	4	5,537
C	Manufacturing industries	2,418	15,073	612	272,161
D	Electricity and gas	5	21	0	1,123
E	Water and sewage	41	378	5	7,372
F	Civil Construction	545	4,665	131	123,626
G	Commerce	7,582	43,398	1,206	1,146,692
H	Transportation	973	5,863	141	125,388
I	Accommodation and food	1,369	5,278	127	225,841
J	Information and communication	323	2,055	102	44,537
K	Financial activities	78	374	8	24,104
L	Real estate activities	113	596	11	30,463
M	Professional activities	657	3,050	100	129,131
N	Administrative activities	655	4,429	118	281,015
O	Public administration	0	1	0	57
P	Education	374	1,875	39	72,866
Q	Health	475	2,124	56	119,321
R	Culture	144	464	16	30,439
S	Other services	276	921	25	123,681
T	Domestic services	0	2	0	261
Total		**16,792**	**16,138**	**91,374**	**2,785,040**

Source: Elaborated by the authors.

Note: Section U, International Organizations, was discarded from the database because it did not contain any company supported by CPE or FGI PEAC.

A.2. Quality of the matching

A first point of the analysis refers to the quality of the balancing of the treated and control sample in each evaluation performed, that is, in the cases of FGI PEAC and CPE. Hence, it is necessary that the firms belonging to both groups (treated and control) in each evaluation are statistically similar in terms of their observable variables.

In this sense, it is important to adopt an indicator that allows comparing each sample of firms in relation to their variables. This evaluation adopted the indicator of normalized mean differences, which, for each variable chosen, is a scale-free measure, which is equivalent to the difference in the mean of the individuals in the treatment group (t) and the individuals in the control group (c), divided by the square root of the mean of the variances within each group.[38]

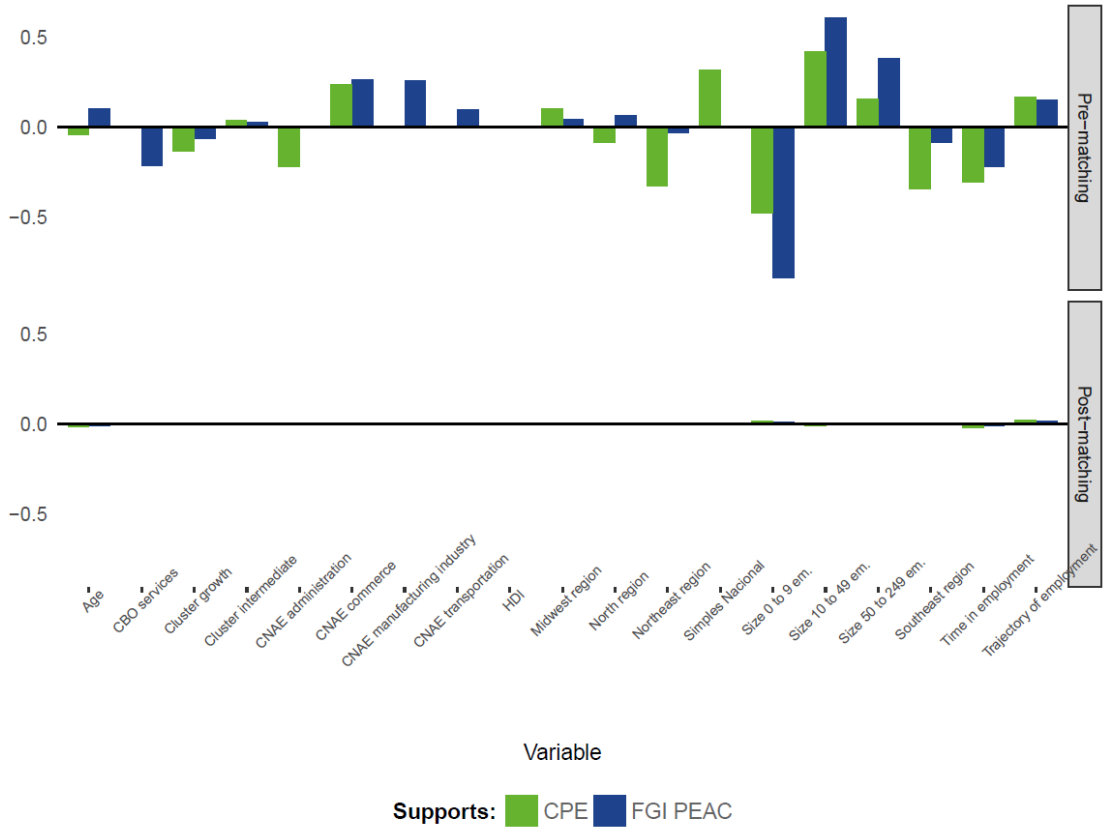
$$\hat{\Delta}_{ct} = \frac{\overline{X_t} - \overline{X_c}}{\sqrt{(s_t^2 + s_c^2)/2}} \quad (7)$$

Graph A.1 shows the difference in normalized averages between the firms of treated and control groups for a number of control variables at each evaluation. The upper graph refers to the firms in the original database (pre-matching), while the lower graph already considers the sample with matching in observable variables and trimming of firms located in a common support region in relation to the probability of being treated. The green bars represent the differences in normalized means of firms supported and not supported by the CPE, while the blue bars refer to the same exercise related to FGI PEAC support.

As can be seen, in the pre-matching it is possible to verify that both kinds of public support present bias for the industrial sector and for firms of 10 to 249 employees. Specifically in the case of CPE, there is a regional bias towards firms based in the South. In the post-matching sample, however, the magnitudes of the normalized difference indicators for all variables in all exercises were greatly reduced. In any variable the normalized difference reached the level of 0.05, which suggests that the procedures adopted were able to minimize the bias associated with pre-matching differences in observable variables.

[38] More details on the normalized averages indicator can be found in Imbens and Rubin (2015). Regarding the evaluations on the BNDES support to companies, this indicator was used by Grimaldi et al. (2018) and by Martini et al. (2021).

Graph A.1 – Normalized differences of control variables



Source: Elaborated by the authors.

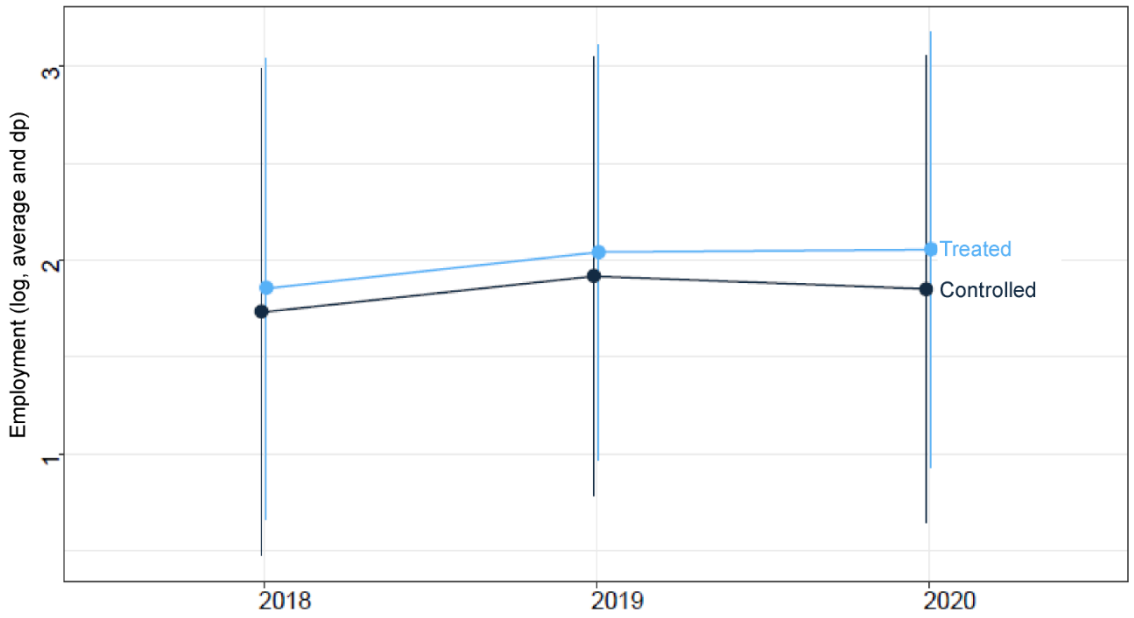
A.3 Employment trajectory

The identification strategy is based on the hypothesis that, in the absence of intervention, the firms belonging to the treatment and control groups would have followed parallel trajectories in the outcomes of interest. Therefore, in order to infer causality in relation to the estimated effect of treatment on these results, it is necessary to seek some evidence that both groups, on average, would have parallel trajectories in the absence of intervention.

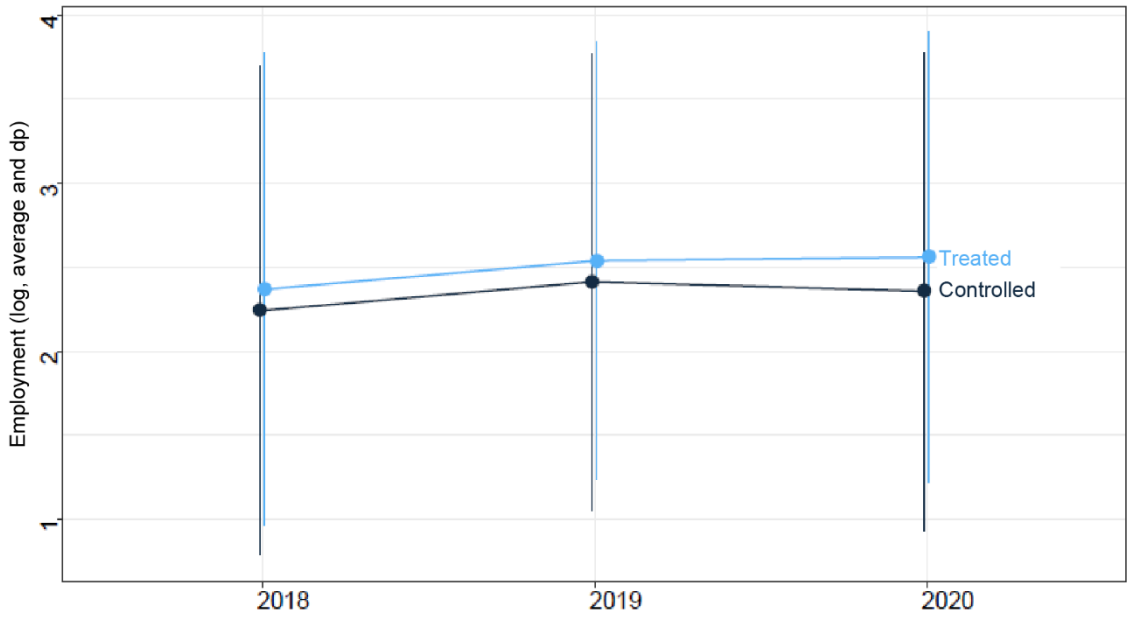
Graphs A.2 and A.3 below show that there is evidence that treated and untreated firms would follow parallel trends in employment. For both CPE and FGI PEAC, the firms of the treatment and control groups had a similar average growth trajectory of the number

of employees from 2018 to 2019, after the matching. In 2020, the trajectories of the two groups diverged: while the treated groups kept their employment constant, those of the control group registered a decrease in the number of employees.

Graph A.2 – Employment trajectory (CPE, log)



Graph A.3 – Employment trajectory (FGI PEAC, log)



A.4. Estimation of induced effects

A.4.1. Consumption of households

For this work, a matrix of household consumption by income groups was built, matching the data from the Household Budget Survey (POF 2017-2018) with the data from the Supply and Use Tables (TRU) and the Integrated Economic Accounts (CEI). The first step is the application of a translator between the classification of products used in the POF and the classification of the System of National Accounts (SNA).

Then, this matrix must be compatible with the aggregated data obtained in the SNA. This compatibility and balancing were done using the Generalized RAS (GRAS) method.[39] It is important to note that the model must be determined in demand values for national production at basic prices,[40] for this purpose, before the application of GRAS, the relationships between total supply and national supply at basic prices were used, by product of the TRU of 2018.

A.4.2. Household wages

With the TRU and CEI, from the SNA, household sources of income are identified in aggregate. But, for the purpose of this work, it is necessary to observe the distribution of these incomes among the different income classes. For this, PNAD 2018 data are used.

The first part of the data processing relates to the identification of people's sources of income. Since the focus of the paper is on the Payroll, the origins of income were divided into labor and non-labor income.

Labor income must be organized in such a way as to identify, for each person, income class and income obtained as remuneration for work in each activity of origin.

A.4.3. Update of the input-output matrix

For the update of the input-product matrix (MIP) for the year 2018, the values of the tables of supply and use of the system of national accounts for 2018 and the GRAS method were used as a basis. The transformation to national intermediate consumption values at basic prices was used following the methodology presented in Alves-Passoni and Freitas (2018).

[39] For more details Junius and Oosterhaven (2003).
[40] The model should exclude supply from imports, trade and transport margins and taxes on products.

As done for household consumption, intermediate consumption should also be used as consumption of domestic production at basic prices.

A.4.4. Initial shock

With the structure ready, it was necessary to define the initial shock in the model. For this purpose, the additional Payroll calculated in this report was used. The first step is to allocate the shock to each income group.

Based on the data used in the models, we obtained the average earnings per group size of the supported companies and the related additional Payroll. With PNAD 2018 data, we relate individual average income and household income. Thus, we estimated the volume of additional wages allocated to each group of total family income.

This vector is then multiplied by the extended MIP described above, returning a vector with the direct, indirect and induced impacts of the initial shock on the production of activities and on the Payroll absorbed by income groups.

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