

Can Work Sharing Sustain Employment During Economic Downturn?
Evidence from Brazil

Tulio Cravo¹
African Development Bank
Ph.D. in Economics, Loughborough University
t.cravo@afdb.org

Paulo de Andrade Jacinto²
Federal University of Paraná (UFPR)
Ph.D. in Economics, UFRGS

Rodrigo Quintana
Ministry of Interior of Chile
MSc in Public Administration and International Development
Harvard University
quin.rod@gmail.com

Área 8 – Econometria

¹ Tulio A. Cravo (t.cravo@afdb.org). Part of this research was performed while affiliated to the Inter-American Development Bank as Senior Labor Market Specialist. This is a background paper for the Inter-American Bank project “Employment dynamics and labor market policies in Brazil”. We are thankful for comments from Caio Piza and Chris O’Leary. Leandro Justino and Ana Cristina Sierra provided excellent research assistance.

² Corresponding Author. Paulo de Andrade Jacinto (pajjap@hotmail.com ou paulo.jacinto@ufpr.br) Endereço: Rua Tabajaras, 53 apto 51. Vila Izabel, Curitiba – PR.

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Resumo

O presente artigo faz uma avaliação do impacto do Programa de Proteção ao Emprego (PPE) sobre o nível de emprego no período de 2015 a 2018. Esse programa foi criado com o objetivo de preservar os empregos durante a recessão que teve início em 2014 por meio da redução da jornada de trabalho. Fazendo uso de dados administrativos do PPE os resultados mostram impacto positivo sobre o estoque de trabalhadores durante e após o período de validade do programa. Além disso, o efeito do PPE sobre o emprego aumenta com o passar do tempo. Esses resultados sugerem que o PPE adotado no Brasil foi uma política efetiva para combater o desemprego durante uma recessão.

Abstract

This paper assesses the impact of the short-lived Employment Protection Program (EPP) on employment outcomes for the period between 2015 and 2018 in Brazil. The EPP was a work sharing program that featured wage subsidies with a reduced work schedule and was created to preserve jobs during a recession that started in 2014. Using administrative data of the program, the results show that establishments that participate in the program present higher employment levels than non-participant establishments during and after the program. Furthermore, the effect of EPP on employment increases overtime. Therefore, the analysis suggests that the EPP was an effective tool to fight unemployment during a recession.

Área 8 – Econometria.

Palavras-chave: Emprego, redução da jornada de trabalho, subsídio ao salário.

JEL: J23, J38, L20.

Keywords: Employment, work sharing policies, short-time work, wage subsidies.

JEL Classifications : J23, J38, L20.

Introduction

Work sharing policies often reduce wages and the work schedule of workers as a means to distribute them among a greater number of workers during economic crises (McCarthy and Rosenberg, 1981).³ Temporary work-sharing measures allow businesses to minimize firing and rehiring costs in order to retain employees while keeping their morale afloat in tough times (Messenger and Ghosheh, 2013). Work sharing enables businesses to keep plants open while adapting their business to economic downturns. It also shares the burden of an economic downturn between employers, workers and government.

Work-sharing schemes first emerged in Europe and North America during the Great Depression in the 1930s, reviving again in the Great Recession of 2008–09 when they were adopted in large scale with different designs in OECD.⁴ Some studies argue that the use of WSPs was an important public policy to sustain employment levels in OECD countries by reducing the work schedule and wages but providing government subsidies to wages. Evidence suggests that Germany saved 400,000 jobs, Japan retained 370,000 while Turkey saved 100,000 posts and the United States retained 165,000 jobs due to work sharing schemes (Messenger and Ghosheh, 2013). During the Great Recession, 25 OECD countries implemented work-sharing schemes, yielding positive results in preserving jobs (Hijzen and Martin, 2013).

From the firm's standpoint, the adoption of WSP minimizes firing and rehiring costs in tough times (Messenger and Ghosheh, 2013). The program also allows firms to keep workers with human capital specific to the firm that can contribute to a faster recovery of the economic activity without the need to hire and train new workers at the end of the recession (Bruhn, 2016; Giupponi and Landais, 2018). Although the benefits are temporary, participation in the program provides a reduction in production costs and cash liquidity for firms during the period of sharp sales decline in a recession. For workers, the main benefits when joining the program are the maintenance of the job and most of the income to secure consumption during the recession (Anze et al., 2015). The government also benefits from the program with the reduction of expenses with unemployment insurance and labor intermediation. In addition, the program allows the government to preserve most of payroll tax collection (Pires and Lima, 2015).

Despite the working-sharing policies were used in large scale in countries such as Germany, Italy, France and Belgium in the great recession of 2008-2009, the empirical evidence on the effectiveness of work sharing policies is still scarce, when compared to evidence from other active employment policies such as unemployment insurance (Boeri and Bruecker, 2011; Hijzen and Venn, 2011; Cahuc, Kramarz and Nevoux, 2018). The scarcity of administrative records of firms and workers on WSP is a challenge for researchers looking to carry out an impact assessment for this policy at micro level⁵. Even with the availability of administrative records of firms and workers on the WSP, the

³ Work-sharing policies are also known as short-time work (STW) and short-time compensation (STC) in the US when unemployment insurance benefits are used in work sharing schemes.

⁴ The minimum reduction in hours worked varies from 40% in Norway to 10% in Switzerland, Austria, Germany and the Slovak Republic. Some countries require a minimum number of workers to participate in working-sharing policies such as Canada, Denmark, Hungary, Korea, Switzerland and the United States. Eligibility criteria usually requires that companies present a justification of the economic need for their use. During the program's duration, companies cannot fire workers. It is also common to find programs in which workers are required to attend qualification courses as in Portugal and the Netherlands and other countries. See Hijzen and Venn (2011).

⁵ Hijzen and Venn (2011) and Cahuc and Carcillo (2011) carried out a cross-country analysis for OECD countries and found a positive effect of this policy on the maintenance of employment levels.

challenge has been to find an appropriate identification strategy to isolate the treatment effect of the WSP (Giupponi and Landais, 2018).

Although some studies use instrumental variables to study WSP, the results found do not yet have a consensus in the literature. For instance, the studies by Boeri and Brücker (2011) and Hijzen and Martin (2013) used the firm's previous experience with the program as an instrument to evaluate WSP, however the results found were somewhat conflicting. More recently and using different instruments, Cahuc, Kramarz and Nevoux (2018)⁶ and Giupponi and Landais (2018)⁷, find similar results suggesting positive effects of the WSP in maintaining jobs for France and Italy. Para o Mexico, using a difference-in-difference method Bruhn (2020) examined the intent to treat effect of a work sharing program that provided subsidies to firms in eligible industries which agreed to keep employees on reduced wage and work schedules. While results show no effect on employment during program duration, employment recovers faster after the program ends.

In this paper, we conduct the impact evaluation of the first Brazilian WSP called the Employment Protection Program (EPP). The first Brazilian experience with WSP occurred in 2015 when the Brazilian government launched the EPP to preserve jobs during the recession⁸. The program allowed companies and unions to negotiate a temporary and proportional reduction in working hours and wages, partially compensating workers for lost income. The expectation was that adjustments in the establishment's demand for labor would be carried out through hours worked and not through layoffs (DIEESE, 2016). Thus, employment levels in the establishments would be preserved.

The program allowed companies to reduce working hours and workers' wages by up to 30%, provided that a specific collective labor agreement (ACTE) was signed for this purpose. Reduction in workers' wages were compensated by 50%, being limited to 65% of the maximum amount of the unemployment insurance portion. Establishments could initially apply for a period up to six months but participation in the program could be extended up to 24 months. The program was financed through the Workers' Assistance Fund (FAT).

The implementation of the EPP in 2015 was a major innovation in the Brazil in the context of its complex and rigid framework Labor Law Code - CLT, which regulates labor relations between companies and workers. Inspired by the success of working sharing policies in Germany, particularly after 2008-2009 crisis, the interaction between companies, labor unions and government generated consensus on the rules that would govern the program to deal with the recession that started in the second quarter of 2014 in Brazil, with unemployment rate peaking at 13.7% in the first quarter of 2017.

⁶ Cahuc, Kramarz and Nevoux (2018) employ a causal identification strategy based on instruments: the first is based on the geographical proximity of a company to another that joined the WSP before the recession; the second uses the time needed by the 95 department regions to analyze the application requesting the approval for participating in the WSP in France.

⁷ Giupponi and Landais (2018) use data from the Italian Social Security Administration (INPS), which includes information on the eligibility, requests and authorizations of WSP at firm and workers levels for the period from 2005 to 2015. To instrumentalize the adherence to WSP. They use the probability of using the WSP that is estimated based the size of the company and the INPS code.

⁸ In the second quarter of 2014, the country began to face a new economic recession, in which the Brazilian government decided to implement some flexibilization measures and propose a mechanism to adjust the demand for labor by reducing the work schedule and hours worked.

Following the efforts made in the structuring of the EPP framework and its implementation, a detailed analysis of the impacts on the employment of the firms that joined the program is still pending. Initial efforts to assess the program were made by qualitative studies from Scherer and Oliveira (2017) and DIEESE (2016). The results show support from employers, labor unions and workers and recommend the project to be permanent and more flexible in certain eligibility criteria to ensure broader participation in the program.

Unlike the studies by Boeri and Brücker (2011), Hijzen and Martin (2013), Cahuc, Kramarz and Nevoux (2018) and Giupponi and Landais (2018) that analyzed the impact of WSP on employment using instrumental variables where baselines are not well-defined, the analysis for Brazil in this paper is conducted for a program that has a well-defined baseline with data available before and after its implementation. This allows us to use an identification strategy that uses matching methods in the construction of control and treatment groups to estimate the impact of the program on businesses.

This paper builds on qualitative evidence and contributes to the debate of work share in developing countries. It employs administrative data from the program at establishment level from 2014 to 2018 while using a combination of propensity score matching with difference-in-difference estimator to assess the effect of EPP on employment and worked hours at establishment level during and after participation in the program.

The estimates from difference-in-difference equation show a positive impact of 7.43% on employment level. This evidence indicates that EPP achieved the objective of sustaining employment level during the recession and can thus be an effective countercyclical policy tool to fight unemployment in Brazil. Adoption of the program allowed establishments to retain workers with company-specific capital and also avoided firing and rehiring costs. The effect of EPP on employment continues to be observed even after the participations of business in the program. Establishments that joined EPP had a 21.1% higher employment level than establishments that did not participate. The program provided liquidity that allowed the establishments to keep workers even after the end of the program. The estimates also show an abrupt drop of 6.88 hours in the weekly worked hours in the establishments that participated in the program.

Our results are in line with the studies by Cahuc, Kramarz and Nevoux (2018) for France and Giupponi and Landais (2018) for Italy but our study explored the existence of a well-defined baseline with a period before and after the implementation of the program. Furthermore, our study also indicates that WSP has an impact on employment in the context of Latin America as in Bruhn (2020). Nevertheless, the study by Bruhn (2020) measures the intent to treat as it used data on industries that were eligible for the wage subsidy program in Mexico and found a positive impact of the program on employment only after the duration of the program.

The findings suggest that the WSP implemented in Brazil was successful in the sustaining employment levels during and after the program, even after the return of the number of worked hours to pre-program levels. The evidence found reinforces the use of employment protection policies as an instrument to sustain employment levels and fight unemployment in times of crisis.

The rest of the paper is organized as follows. Section 2 presents a brief description of the EPP program. Section 3 shows the unique dataset used in the paper. Section 4 provides

the empirical strategy. Section 5 that presents the results and Section 6 provides further discussions. The section 7 concludes.

2- The Employment Protection Program (EPP)

The Employment Protection Program (EPP) was created by provisional measure n° 680 in July of 2015 and was regulated by the Decree 8.479 and the Law n° 13.189 from November 2015. The aim of the program was preserved formal employment during the economic recession that began in the second trimester of 2014.⁹ The program would initially run until December 2016. However, the provisional measure No 761 from December 2016 extended enrollment into the program until the end of 2017 under the new name of Employment Insurance Program (EIP).

Inspired by the German experience with work-sharing program, the EPP was regarded as an innovation in Brazil in terms of labor demand adjustment as it was the first program that required employment maintenance during participation in the program. The dialogue between corporate leaders, trade unions and the government generated a consensus on the design and rules of the program.¹⁰ The employment adjustment mechanism would be through hours worked. The establishments would be able to proportionately reduce the number of hours worked and workers' wage up to 30%. The temporary reduction in the number of hours should cover all workers in the department or sector indicated by the establishments (Provisional Measure n° 680 from 2015).

The program reduces the number of hours worked and wages proportionally. The Decree n° 8.479 and the Law 13.189 from 2015 established a reduction of up to 30% in the number of hours worked. The national workers protection fund (FAT in Portuguese) then compensates for 50% of the monthly wage loss due to the reduction in the number of hours worked, up to 65% of the maximum monthly UI payment for up to 6 months, extendable for 6 months with a maximum period of 24 months, limited to the final date of the program.¹¹ The program forbids companies from dismissing their employees while they are in the program plus a further extra one-third of program duration after the last payment (Scherer and Oliveira, 2017).

To be eligible in the program, establishment must meet the following criteria: i) need to be formal entities for at least two years; ii) cannot have any fiscal, social security or severance fund debt; iii) must be undergoing economic strain based on the that would be verified by a net indicator of labor (ILE) with variation equal or below 1%¹² and iv) have

⁹ According to the classification of the Brazilian Business Cycle Dating Committee (CODACE) of the Brazilian Institute of Economics (IBRE), the most recent recession period lasted from the second quarter of 2014 until the fourth quarter of 2016 (CODACE, 2017). Unemployment reached 13.7% in the second quarter of 2017.

¹⁰ The design of EPP included interactions between stakeholders and a study trip to Germany to understand the German experience. See more details on this process on Scherer and Oliveira, 2017 and DIEESE 2016.

¹¹ Please refer to the following link for more details on FAT:

<https://www.bndes.gov.br/wps/portal/site/home/transparencia/fundos-governamentais/fundo-de-amparo-ao-trabalhador-fat>.

¹² The Net Employment Indicator (ILE) is given by the difference between hiring and separation in the last 12 months over the stock of employment. In August 2015, only 17 out of 87 CNAE sectors were not eligible according to this indicator.

a specific collective bargaining agreement (ACTE) celebrated for the purpose of participating in the EPP.¹³

The eligibility conditions were designed so that the program could serve employees of the establishment that are in temporary financial difficulties. This indicator used in EPP is measured by the ratio between the difference in separation and hiring of workers in the last 12 months by the stock of employment in the establishment. The calculation is done monthly based on information from administrative records of CAGED and RAIS. According to DIEESE (2016), in October of 2015, only 17 of 87 sectors CNAE were not eligible according to this indicator. Furthermore, when considering the manufacturing sector, 96% of sub-sectors at 2-digit level had the aggregate indicator below 1%, suggesting that the use of ILE would not be an obstacle to the broad adhesion of the program.

The inclusion of a conditionality criterion in the EPP was an important factor to preserve Jobs and differs from the existing mechanisms for adjusting the demand for work in the context of a recession. When joining the program, establishments were prohibited to layoffs workers under the EPP scheme for the period of time the government contribution was being paid and for a further one-third of period of the benefit payment. By imposing this conditionality, the government expected establishments that joined the EPP to be most likely to recover the level of production during the reversal of the business cycle. This was intended to avoid additional costs from companies that would not be able to get through the economic crisis even with the EPP support. The prohibition of layoff during the participation in a work-sharing programs was also a characteristic of these programs in the Netherlands, Hungary, Austria, France, New Zealand and Poland (Hijzen and Venn, 2011).

The replacement rate of the program, defined by the proportion of the remuneration that the worker preserved when entering the program, was relatively high, it ranged between 100% for the worker who received a minimum wage and a minimum of 70%.¹⁴ Thus, there would be a guarantee of the payment of at least one minimum wage by the employer. This, in turn, made the monetary compensation limit no higher than 65% of the unemployment insurance ceiling.¹⁵ The cost of the hours worked for the company increased, as there would be charges on the monetary compensation. According to DIEESE (2016), for a reduction in wages of up to 30%, the tax collection is reduced by 15%, which increases the hourly cost by 5.53%.¹⁶

The fiscal impact of the program played an important role in its adoption and implementation. Because establishments cannot dismiss workers, tax revenue from payroll contributions would be partially maintained. In addition to payroll contributions, the spending on unemployment insurance and labor intermediation system would be

¹³ For the micro and small companies within the same economic sector would be required a specific multiple collective labor agreement.

¹⁴ The generosity of the subsidy is probably one of the most important aspects that justify the enrolment of the companies into work sharing policies.

¹⁵ In 2016, 65% of the ceiling of the unemployment insurance was equivalent to R\$ 1,002.45 Brazilian Reais. For instance, for a monthly salary of R\$ 6,683.00 with a 30% reduction in hours worked, the worker would receive the maximum possible benefit (R\$ 1,002.45). For wages above that value, the replacement rate is decreasing.

¹⁶ The DIEESE Report (2016) presents an example for a salary of R\$ 4,165.00, which was reduced by 30%. The hourly cost of reduced wages compared to original wages, increased by 8.92%. When the reduced salary plus the supplement was considered, this cost increased to 13.48%.

avoided. This was a decisive aspect for the EPP to be implemented by the government in Brazil.

3- Data and descriptive statistics

Data

Two sources of data were used to build the longitudinal database used in assessing the impact of EPP on job maintenance: the Annual Report of Social Information (in Portuguese RAIS) and administrative data from the Ministry of Labor and Employment with the records of establishments and workers who participated in the program between 2015 and 2018.

RAIS: A RAIS is administrative data collected annually by the Ministry of Labor. Every year, all formal businesses are required to by law to report on their business and employees to the Ministry of Labor. If an establishment fails to provide the annual RAIS declaration, it faces automatic fines proportional to the length of the delay and the number of declarations omitted. Severance payments are based on RAIS records; thus, employers and workers have a strong incentive to submit the annual RAIS declaration. The Ministry of Labor estimates that this coverage represents about 97% of the formal sector.¹⁷

The rich RAIS data provides us with an array of establishment level information, such as sectoral classification (CNAE 2.0), location (municipality), stock of employment, wages, and date of establishment opening. Importantly, RAIS is a linked employer-employee matched dataset that includes a unique establishment identification number (CNPJ) and allows researchers to construct a longitudinal dataset tracking establishment throughout the period of analysis. RAIS also allows to track workers using the PIS or CPF unique identification number. This increases the potential for using this employer-employee microdata for analysis. For the present study, we combine information at establishment level using CNPJ and at employee level using PIS to build a longitudinal data at monthly frequency similar to that created by Cravo et al (2018).

EPP administrative data: We use the EPP administrative data to identify the establishments that participated in the program. The database from the Ministry of Labor contains records of establishments and workers registered in the program between 2015 and 2018. The information includes tax ID (CNPJ), the location of establishments, economic activity and number of workers. This database also reports program information such as registration date, duration of wage reduction, original salary, compensation wage and the salary effectively paid during the program.

The data used in this paper is slightly different from the EPP data used by Scherer and Oliveira (2017). They used files from the employers' application to the program while we used the payment instructions with employers and employee's information sent from the Ministry of Labor to the banking system for transferring the wage subsidies to workers.

¹⁷ According to IBGE (2016), only 50% of workers in Brazil are formally registered; however, this aspect is not as pronounced in the manufacturing sector, which employs around 70% of the workers in the formal sector.

The main advantage of using the information on payment instructions is the correct identification of the companies that met the eligibility criteria to participate in the program and effectively received the benefit. Tables 1, 2 and 3 present information generated from this administrative record generated by the Ministry of Labor and provides an idea about the profile of the establishments in the program.

Table 1: Establishments and Workers Enrolled in the EPP Program (balanced)

Year	Establishments enrolled	Number of employees in the program	Average employees per Establishment	Program payments per month(US\$)*	Program payments per month per employee (US\$)*
2015	34	25,574	752.18	3,030,982.90	118.52
2016	70	17,587	251.24	1,693,264.59	96.28
2017	14	5,140	367.14	722,931.26	140.65
Total	118	48,301	409.33	5,447,178.75	112.78

Source: Authors' calculations based on administrative data.

Note: *Conversion using the nominal exchange rate of December 2017 when US\$ 1 = R\$ 3.31.

The number of establishments and workers enrolled in the EPP during the period between 2015 and 2017 are shown in Table 1. Over the 3 years of EPP existence, 125 establishments were approved to participate in the program with 118 establishments appearing in all years of the data used in this evaluation. The majority of establishments entered the program in 2016 and the volume of resources of the program exceeds US\$ 5 billion, benefiting more than 48,000 registered workers who received an average of US\$ 112.75 (R\$ 373.29) monthly as the government compensation within the program framework.

The geographic distribution of establishments that were enrolled in EPP can be seen in Table 2. Sao Paulo (SP) state encompasses nearly 60% of the establishments registered in the program and 70% of the workers enrolled. Ten out of 27 states had at least one establishment participating though most establishments are from the south and southeast region of the country, the richest and most industrialized areas in the country.

Table 2: Establishments Enrolled by States 2015-2017

State – Region	Establishments registered	Establishments registered (%)	Employees	Employees(%)
SP – South east	69	58.47%	35,101	72.67%
SE – North east	16	13.56%	2,176	4.51%
SC – South	12	10.17%	3,595	7.44%
RS – South	7	5.93%	1,510	3.13%
RJ – South east	5	4.24%	971	2.01%
PR – South	4	3.39%	3,317	6.87%
PE – North east	2	1.69%	574	1.19%
MG – South east	1	0.85%	935	1.94%
GO – Center west	1	0.85%	39	0.08%
AM – North	1	0.85%	83	0.17%
Total	118	100.00%	48,301	100.00%

Source: Based on administrative data of Ministério do Trabalho e Emprego.

Table 3 shows the distribution of establishments and workers enrolled in the EPP by sector. The workers and payments are concentrated in the manufacturing sector, specifically of vehicles and machinery, which accounts for 41% of the establishments in the program. One possible reason for this concentration is the EPP's requirement of a specific collective labor agreement (ACTE) to be signed for the purpose of entering the program. The EPP provisional measure, by including this conditionality, may have benefited those sectors that are known to be more organized and that are located in the southeastern and southern regions of Brazil, which historically have active and more sophisticated labor unions. These sectors are characterized by a well-defined production chain with a large volume of employed workers.

Table 3 – Establishments and Workers Enrolled in the EPP by Sector

CNAE	Workers	Establishments
29 – Manufacture of motor vehicles, trailers and semi-trailers	34277	49
28 – Manufacture of machinery and equipment	7396	19
82 – Office administrative, office support and other business support	1442	2
25 – Manufacture of fabricated metal products, except machinery and	1358	5
30 – Manufacture of other transport equipment	613	2
24 – Manufacture of basic metals	568	6
26 – Manufacture of computer, electronic and optical products	431	2
49 – Land transport	404	1
22 – Manufacture of rubber and plastics products	334	4
13 – Manufacture of textiles	201	2
71 – Architectural and engineering activities; technical testing and	193	3
85 – Education	183	1
33 – Repair and installation of machinery and equipment	119	1
19 – Manufacture of coke and refined petroleum products	109	1
27 – Manufacture of electrical equipment	92	1
78 – Employment activities (selection, management)	79	2
32 – Other manufacturing	65	1
64 – Financial service activities	63	1
20 – Manufacture of chemicals and chemical products	62	1
47 – Retail trade, except of motor vehicles and motorcycles	51	1
41 – Construction of buildings	46	1
45 – Wholesale and retail trade and repair of motor vehicles and	43	2
73 – Advertising and market research	39	1
58 – Publishing activities	38	2
46 – Wholesale trade, except of motor vehicles and motorcycles	26	2
70 – Activities of head offices; management consultancy activities	24	1
94 – Other services, activities of membership organizations	21	1
68 – Real estate activities	11	1
42 – Civil engineering	9	1
17 – Manufacture of paper and paper products	4	1
Total	48301	118

Source: Based on administrative data of Ministério do Trabalho e Emprego.

Sample: The database used in the EPP's impact evaluation on employment and worked hours is the result of the combination of RAIS database from the Ministry of Labor and the records of the companies that joined the program that was also provided by the Ministry of Labor. This was possible because the two databases have the information of an identifier (CNPJ) for each company allowing their merging. Thus, the constructed database includes a balanced panel data with information at the company level for the period from 2013 to 2018.

To capture EPP's impact on employment, the variable denoted by EPP_i will be used. This variable indicates whether the company is part of the treatment group. This variable assumes the value of 1 for the company that joined the program and zero otherwise (control group). The EPP established a conditionality to protect workers in which workers of the companies that joined the program would be prohibited to dismiss workers unfairly during the period in which the companies receive compensation from EPP plus a period equivalent to one third of the program duration after the last payment. Therefore, to capture the effect of this conditionality, the *During* variable was created and assumes a value of 1 during the period in which the company cannot dismiss workers, which includes the period of one third of the program duration after the last payment.

The outcomes variables used in the evaluation will be the stock of workers and worked hours in the companies that participated in the EPP (treatment group) and companies that did not participate in the program (control group). This will be possible by using the methodology proposed in Cravo et al (2018) which used RAIS information to create a monthly employment stocks and worked hours at establishment level.

To create the employee stock variable at establishment level, an interesting feature of RAIS is used, which is the information about the month of separation and hiring of an individual worker. If a worker has a record with two jobs in a given year, that worker appear twice in the RAIS records with the respective month of separation and hiring related to each job. With this information it is possible to create the monthly stock of workers for each company, from January 2013 to December 2018. Thus, the result is a longitudinal panel at monthly frequency built from employer's microdata. This information is useful to the extent that it is possible to correctly evaluate the EPP since its inception.

4- Empirical strategy

We use propensity score matching and difference in differences estimates to evaluate the impact of EPP on the stock of workers and worked hours during and after the program. The combination of these two methods reduces selection bias based on unobservable characteristics and minimize possible bias due to the distribution of observable characteristics.

The identification challenge is to compare establishments that participated in the program with those that did not, as we do not observe the outcome for participants had they not participated in the program. To that end, we use PSM to construct a comparison group for the treated using non-participants who have a similar pre-treatment probability of receiving a treatment.

The PSM is estimated by a probit model where the probability of program participation is a function of the characteristics of the establishments, including establishment age, job tenure of workers, their average age, the logarithm of average salary, proportion of white workers, and share of workers with completed high-school. It also includes dummies for sectors at 2 digit-level, state dummies and quarterly values of labor stock prior to the

program.¹⁸ Analysis is restricted to eligible sectors and states that have at least one establishment in the program. Establishments that use simplified taxation are excluded. We estimate two PSM models, with 1st nearest neighbors providing a better match. The test for differences in mean before and after the matching is used to assess the quality of the matching.

The estimations rely on the assumption that treated and control establishments exhibit the same trends prior to the programs for the outcome. The matching generates a similar control group that exhibits very similar pre-trend pattern, a further indication about the quality of the matching. The estimates difference-in-difference models to formally evaluate the impact of EPP on stock of workers and worked hours as follows:

$$Y_{it} = \varphi_i + \mu_t + \gamma EPP_{it} * During_{it} + \delta EPP_i * Post_t + \varepsilon_{it} \quad (1)$$

where Y_{it} stands for employment or worked hours for establishment i and time t . The term φ captures establishment fixed effects. PPE is a dummy variable indicating EPP enrollment, and $During$ takes the value of one during the treatment, including the period after the last payment of the program in which the workers cannot be dismissed. The term γ , the coefficient of interest, measures the difference in the outcome variable between the treated and control establishments before and after enrollment at EPP limited to the duration of the program. Similarly, the term δ , measures the difference in the outcome variable between the treated and control establishments before and after enrollment at EPP after the duration of the program that is indicated by the dummy $Post$. μ_t are the monthly dummy variables.

Before discussing the results, it is necessary to make a consideration regarding the identification strategy adopted in this study related to the *During* variable. The program started in July 2015 and ended in December 2017, during this period, establishments could join the EPP for a period of up to 6 months, with the possibility of extending it for another six months. As there was not a specific month defined for the establishments to join the program, the *During* variable assumes a value of 1 during the treatment period and zero otherwise. Thus, the establishment is subjected to a treatment that will depend on the date of membership and the length of stay in the program, including the extra period of one third of the length of the program after the last payment of the subsidy. The distribution of memberships during the program shows that, in the second half of 2015, only 34 establishments joined the program. The year 2016 recorded the highest of enrollment in the program with 64 establishments joining the program in that year. Few additional establishments joined the program in 2017 as shown in Table A5 in the annex that summarizes the month and year in which establishments joined the EPP.

5- The impact of EPP on the stock of workers

The PSM was used to balance the control and treatment groups before exploring the effects of EPP on employment and hours worked. Table 4 shows the descriptive statistics pre and post matching considering the criterion of the 10th nearest neighbor with

¹⁸ Table A.1 describes the construction of the other variables that will be used in the analysis. Stock of workers prior to the enrollment in the program in 04/2014, 08/2014, 12/2014, 04/2015 and 08/2015 were used.

replacement and 0.5 caliber and without reposition. Before the matching in 2015, the difference in means between the control variables for the observable characteristics between the treatment and control group is visible. This difference was reduced to close to zero after matching, as shown in the column of the difference in means. Figures A.1 and A.2 in the annex show that the common support hypothesis is observed and the bias in the covariates was significantly reduced by the matching procedure. These results suggest that the participant and non-participant groups are well balanced.

Table 4. - Descriptive Statistics Pre- and Post - Matching - August 2015 (10th nearest neighbor)

Variable	Pré-PSM				Pós-PSM			
	Treated	Control	Diff	T-tes	Treated	Control	Diff	T-tes
Age of establishment	24.56	18.14	6.42	4.19***	24.56	24.22	0.34	0.21
work's age	35.86	36.33	-0.47	-1.29	35.86	35.55	0.30	0.78
Job tenure	78.70	50.26	28.44	7.33***	78.70	73.03	5.67	1.35
Log wage	8.09	7,38	0.71	15.52***	8.09	8.00	0.09	1.93
Semiskilled	0.66	0.73	-0.06	-3.17***	0.66	0.68	-0.01	-0.78
Skilled	0.28	0.17	0.11	5.17***	0.28	0.24	0.04	1.84
Male	0.78	0.57	0.20	12.03***	0.78	0.76	0.02	1.07
White	0.65	0,65	-0.00	-0.26	0.65	0.64	0.00	0.16
Log stock of work 4/31/2015	5.38	2.30	3.07	22.63***	5.38	5.49	-0.11	-0.74
Log stock of work 8/31/2015	5.30	2.28	3.01	22.41***	5.30	5.40	-0.10	-0.71
N	109	292080	-	-	109	873	-	-

Note: The PSM is estimated by a probit model where the dependent variable assumes the value of one if the establishment participated in the EPP and zero otherwise. Control group constructed using the 10th nearest neighbors.

For instance, the variable stock of workers before matching shows an average value lower for the control group when compared to the treatment group. When controlling for the observable characteristics in the PSM, the difference that existed for the pre-matching period fell significantly. Figure 1 shows the evolution of the stock of workers variable for the treatment and control groups for the period from 2013 to 2018. The inspection of this graph shows that the matching generates control groups that exhibit very similar pre-trend pattern required for difference-in-difference estimations and a further indication about the quality of the matching. Figure 1 below show the evolution of the monthly employment stock before and after EPP. Interestingly, the pattern clearly changes after the program from 2017 onwards. Establishments that enrolled to EPP present a higher employment level compared to non-participants, providing a visual indication that EPP helps to sustain employment levels. Estimation of difference-in-difference models will more precisely assess these effects.

Figure 1- Stock of workers for treated and control groups



Note: Control group constructed using the 10th nearest neighbors.

Results for Stock of Workers

We begin by analyzing the relationship between joining the EPP and the stock of workers. Table 5 shows the impact estimates of EPP on employment for equation (1). Column one shows the effect of the program on employment during and after the program. The coefficient that estimates the impact of EPP on the level of employment during the program, *EPP * During*, shows a positive and statistically significant immediate effect of 6.49% on employment level.

This result shows that the program was effective as establishments that joined the program sustained employment levels. As a result, establishments avoided layoffs costs while reducing payroll and production costs, providing more financial liquidity during the fall in sales. This result differs from Bruhn (2020), who used a similar model for companies in eligible sectors in Mexico but found no effect during the program. Our results reinforce the existence of the impact of the WSP on employment as in Giupponi and Landais (2018) and Cahuc, Kramar and Nevoux (2018) but our study uses a well defined baseline to identify the impact of the program.

An interesting result concerns the effectiveness of the program, which can be seen by the statistical significance of the coefficient associated with the *EPP*Post* variable. The result suggests that companies in the treatment group had 14.3% higher employment level than similar establishments after their participation.

Establishments that participated in the EPP were provided with more financial liquidity during the recession between 2014 and 2016. This allowed these establishments to keep their workers even after the end of the EPP and during the weak economic growth period between 2017 and 2018. The establishments that did not participate in the program opted for the deepening the adjustment in the demand for work by laying off workers. Thus, the effect after the end of the program was potentialized, generating an even greater impact.¹⁹

Table 5 – The Effect of EPP on Employment and worked hours – 10th nearest neighbor

Variable	Employment stock (ln)	Worked Hours
EPP*During	0.0649*** (0.0096)	-6.9020*** (0.1050)
EPP*Post	0.143*** (0.0086)	-0.230*** (0.0282)
Constant	5.2520*** (0.0028)	42.6100*** (0.0092)
FE establishment	Yes	Yes
FE month year	Yes	Yes
N	70606	70580

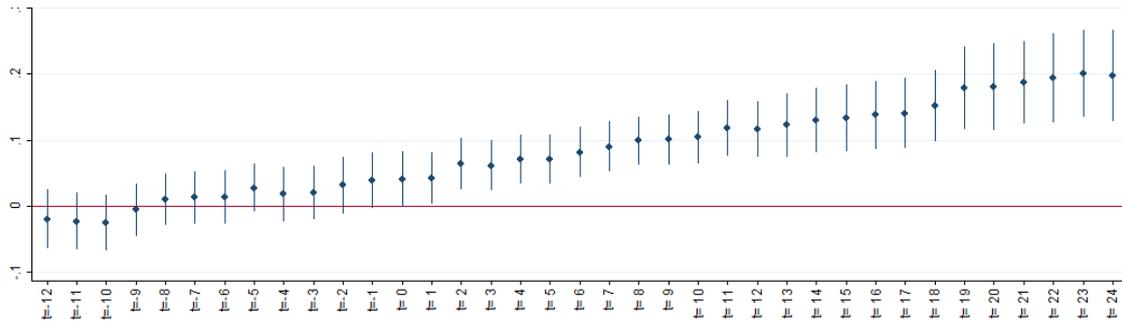
Notes: i) Robust standard errors in parentheses *** p<0.01, ** p<0.05, * p<0.1. Diff-in-diff estimations based on the PSM using the 1st nearest neighbors. ii) Authors' calculations based on administrative data.

This effect on the stock of workers after the end of the program is an advantage for the establishments that participated in the program. By maintaining workers who have specific capital for the company, these establishments could recover the level of economic

¹⁹ Alternative difference-in-difference estimates using the alternative matching using the 1st closest neighbor are provided and present similar results (see Figure A.3 - A.5 and Table A.2 in the annexes).

activity more quickly without the need to hire new workers and training at the end of the economic recession. This is an argument used by Bruhn (2020) and Cahuc, Kramarz and Nevoux (2018) when justifying the impact results for the period after the end of the program. Interestingly, this result was not observed in Giupponi and Landais (2018), who noted that the effect on employment disappeared when a WSP program in Italy ended. Companies that joined the program had workers with low human capital specific to the company, and it is not advantageous to keep them after the salary subsidy ended.

Figure 2 – The effect of EPP on Stock of workers



Note: Event study estimates for the stock of workers based on a specification similar to equation (1) including establishment size and establishment, year and month fixed effects as control variables.

Figure 2 plots the effects of the program in more detail by estimating the monthly effects using an event-study specification for the outcomes that includes establishment size and fixed establishment and month and year dummies as control variables. The estimated coefficients before and after the implementation of the program for monthly data, where $t = 0$ at the time the establishment joined the program. The dots correspond to the estimated coefficients for the interaction between the treatment variable and the month dummy and the vertical bars are the 95% confidence interval. The results show that the EPP had a positive impact on the stock of workers after the month that establishments joined the program and the impact is increases over time, including after the end of the program. Furthermore, there was no statistically significant difference in the trend of the stock of workers before the introduction of EPP. This result is important to the extent that it reinforces the identification strategy used in this study when we assume that the establishments have the same behavior prior to the beginning of the program.

In addition to the event study, a second exercise to verify the robustness of our results takes into account the size of the establishment in the estimation of equation 1. We built three dummy variables based on the classification adopted by IBGE using the number of employees: one for small establishments, one for medium-sized establishments and one for large establishments.²⁰ Our difference-in-difference results are similar to previous results presented in Table 5 in the presence of these variables that control for the establishment size (see Table A2 in the annexes).

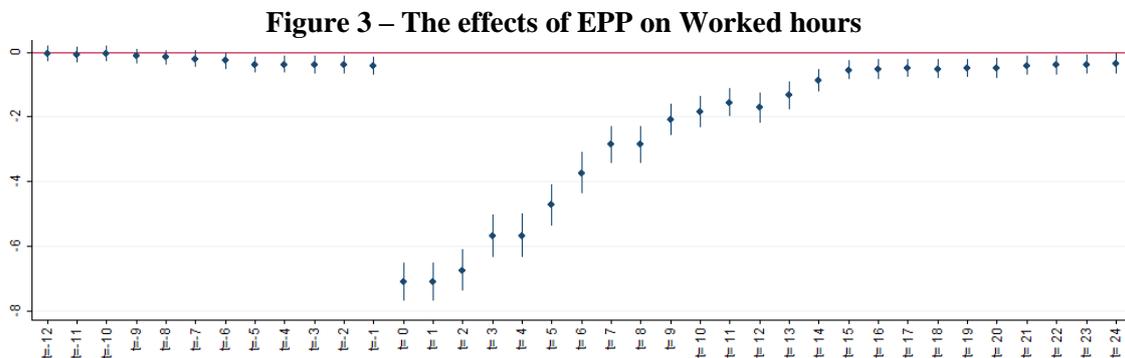
²⁰ According to the IBGE classification, establishments are classified as small when the number of employees is equal or smaller than 49. Medium-sized establishments are those with more than 49 employees and less than 500. Finally, large firms are those with more than 500 employees.

Results for worked hours

Under the EPP, establishments could adjust the demand for work through hours worked and not through layoffs. Provisional Measure 680 of July 2015 established that the temporary reduction of working hours should cover all employees of the company, or at least, employees of a specific sector. On average, 71% of workers within establishments were included in the program. We can extend the analysis carried out for the stock of workers to evaluate the impact of EPP for hours.

Column 2 in Table 5 shows the effect of EPP on hours worked. Estimations suggest a decrease of 6.90 hours in the number of weekly hours worked in the establishments that joined the program. Interestingly, we also found an effect of reducing the work schedule after the end of the program. The result suggests that establishments that participated in the program maintained a reduction of half an hour in the hours worked after the program.

In Figure 3 we analyze the impact of EPP on hours worked. The results show an immediate and abrupt reduction in hours worked when establishments joined the program. However, from the third month onwards, the number of hours worked increasing relative to the control group. This reinforces the temporary nature of the employment protection policy where establishments enrolled in the program for at least three months. In the five months preceding the implementation of the EPP, we noticed that there was a small reduction in the number of hours worked, suggesting that the establishments had already been promoting a strategy to reduce the work schedule of their workers.



Note: Event study estimates for hours worked based on a specification similar to equation (1) including establishment size and establishment, year and month fixed effects as control variables.

The results for hours worked need to be analyzed more carefully for a few reasons. First, it is important to consider the percentage of workers within the establishments that joined the EPP. Table 6 below provides information on the average time that establishments joined the program and the participation rate of workers. On average, establishments joined the program for 7.29 months and 71% of workers were included in the program. Thus, the results described in table 5 and Figure 3 might be also capturing the behavior of the workers within the establishment who did not participate in the program. Some workers were not included in the program possibly because they were affiliated to another labor union or because the establishment chose to enroll in the program only workers from certain occupations or with more specific capital to the company, applying other strategies to keep workers not under EPP, including reducing their number of worked

hours.²¹ Therefore, the result described in column 2 of table 5 and in Figure 4 with the event study is not a surprise.

Table 6: Average time under the program and worker's participation rate

Variable	Avg. time under EPP	Participation Rate (EPP's workers/total workers) (%)
Average	7.29	71.00
Standard deviation	4.24	22.30
P25	4.00	51.40
P50	6.67	68.20
P75	10.67	94.00

Source: RAIS and EPP administrative records.

The results suggest that the employment protection policy led to the maintenance of the stock of workers and there was an abrupt drop in hours worked. These effects suggest that the EPP effectively allowed the establishments to adjust the demand for labor by reducing the work schedule instead of resorting to dismissals.

The evidence described in this study showed that the program had effects on the stock of workers in the establishments and on the hours worked, however, an even better performance could be obtained depending on the design of the EPP. Some improvements in the design of the Brazilian WSP can be made to include a greater number of companies. For instance, the establishments that adopted the program were mostly located in the southeastern region, were concentrated in some sectors of the manufacturing industry and had more organized workers and with strong labor unions. It is possible that the requirement of the specific ACTE contributed to the fact that only companies and sectors that are linked to a more organized labor union took the advantage of the program.²² In this sense, the EPP could be improved by incorporating in its design the possibility of entering into the program without the need of an ACTE. It could also allow firms and workers to access work schedule reductions beyond 30%. These changes can increase participation in a program similar to the EPP and benefit more companies and workers.

Finally, the channels through which EPP impact the labor markets should be further explored. The dismissal restriction or savings in the process of re-hiring and training of new workers are also possible explanations for the effectiveness of the program. Understanding the channels through which the effects of EPP operate is important to design more effective policies that mitigate job losses in recessions. This impact evaluation also presents results for the effect of the program shortly after the program ceased to exist, further evaluations assessing the long-run effects are important to fully understand its impact on establishments and workers.

6. Conclusion

Governments in developed and developing countries alike are designing work sharing programs to prevent job losses during recessions. Nevertheless, most evidence on the

²¹ Establishments that have adopted the EPP are part of an industry recognized for having more organized workers who are affiliated to strong labor unions that are more informed about negative shocks in the economy and seek to mitigate the effects of these shocks on affiliated employees.

²² This point is also made by Scherer and Oliveira, 2017

impact of work sharing schemes continue to be from developed countries. This paper contributes to better inform policy design for work sharing schemes in Brazil and other developing countries as it provides the first impact evaluation of this major labor intervention in Brazil.

The findings suggest that the Brazilian work sharing program achieves the objective of sustaining employment levels during recession and can be an effective countercyclical policy to fight unemployment. The effectiveness of EPP suggests that this was an innovative program in the Brazilian context in which policy makers could consider the extension and further adjustments to allow such program to expand the number of beneficiary establishments. For instance, the conditionality on specific collection labor agreement could be removed allowing more establishments and workers to join the program.

Further research is needed to examine the long run effect of the intervention and whether the channels through which the program affects employment levels are related to costs of re-hiring and training of new workers. In this case, work sharing programs can be more effective if they are designed in coordination with the labor intermediation and vocational training policies.

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Annex

Table A.1 describes the construction of the other variables that will be used in the analysis.

Table A.1: Description of other variables

Variable	Description
EPP	
EPP_i	Binary variable that takes the value one if the establishment is a beneficiary of the program, and zero otherwise.
$During_t$	Binary variable that takes the value of 1 during the period under the program, including the extra one third of that period after the last payment of the program.
$Post_t$	Binary variable that takes the value of 1 after the period under the program that includes the extra one third of that period after the last payment of the program.
Workers characteristics	
Age	Continuous variable that indicates the average age of the worker in the establishment.
Wage	Continuous variable that indicates the average salary of the worker in the establishment.
Male	Continuous variable that indicates the percentage of male workers in the establishment.
White	Continuous variable that indicates the percentage of white workers in the establishment.
Tenure	Continuous variable that indicates the average job tenure of workers in the establishment.
Establishment characteristics	
Age of Establishments	Continuous variable that indicates the age of the establishment.
Stock of workers	Continuous variable that indicates the total number of workers in the establishment.
Semiskilled	Continuous variable that indicates percentage of worker with high school diploma.

Figure A.1 – Kernel Density - Probability distribution before and after matching – 10th nearest neighbor

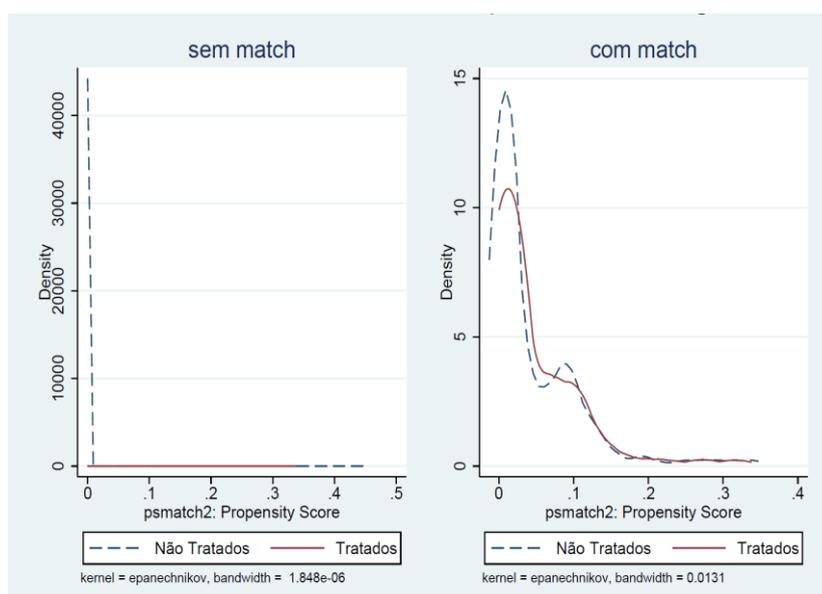


Figure A.2 – Bias across covariates – 10th nearest neighbor

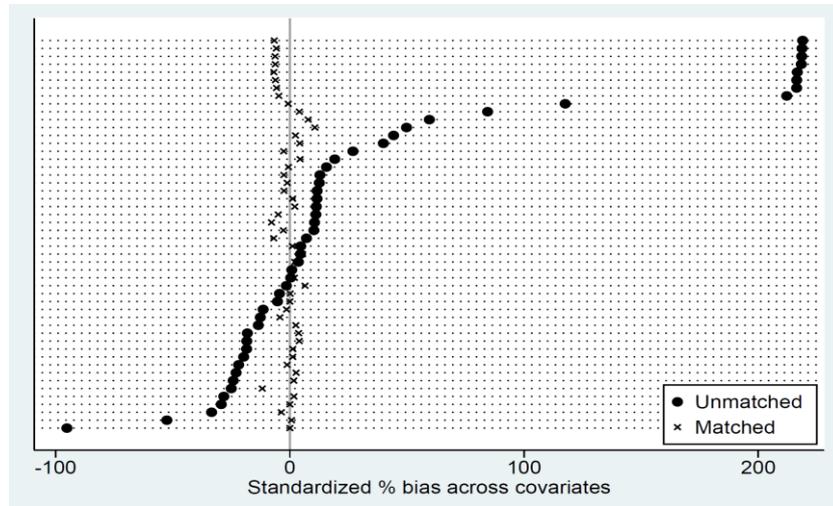


Table A.2 – The Effect of EPP on Employment and worked hours – 1st nearest neighbor

Variables	10 th nearest neighbor	
	Employment stock (ln)	Worked hours
EPP*During	0.0564*** (0.0091)	-6.903*** (0.104)
EPP*Post	0.0977*** (0.0076)	-0.228*** (0.0280)
Mediu-sized	1.259*** (0.0311)	-0.222*** (0.0384)
Large	1.892*** (0.0360)	-0.146*** (-0.0629)
Constant	4.053*** (0.0267)	42.77** (0.0343)
FE establishment	Yes	Yes
FE year month	Yes	Yes
N	70570	70544

Notes: i) Robust standard errors in parentheses *** p<0.01, ** p<0.05, * p<0.1. Diff-in-diff estimations based on the PSM using the 1st nearest neighbors. ii) Authors' calculations based on administrative data.