Access to Long-Term Credit and Productivity of SMEs Firms: A Causal Interpretation*

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Abstract

Limited evidence suggests that access to long term loan for SMEs firms, which are pivotal for economic growth and most likely credit constrained due to financial market failures, may lead to efficiency improvements. Previous literature, however, lack proper identification necessary to endorse a causal interpretation. In this letter, firm-level data are used to assess the impact of a reform in Brazil's major development bank that improved credit conditions for only a subset of firms. Results suggest that eligible firms increased their relative investment rates and productivity, but the results are robust only for permanent rather than temporary improvements.

JEL: O16, O47, O25

1 Introduction

Perfect credit markets equalize the marginal products of capital among firms. In contrast, when credit markets are imperfect due to screening costs, information problems, and enforcement issues, then marginal products generally are not equal and under-investment can occur. High productive firms with low collateral might be credit constrained and therefore these firms might be operating at a marginal productivity of capital which is higher than the market interest rate, resulting in misallocation and lower aggregate productivity. There is a large literature showing that credit constraints might have first-order impact on growth and income per capita of a country [cf., Antunes et al., 2008, Banerjee and Duflo, 2014, **?**, Greenwood and Jovanovic, 1990]. Capital market failure provides a rationale for policies to reduce this

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inefficiency. One common policy intervention in credit markets corresponds to better credit conditions (e.g., lower required collateral) and interest subsidies to small firms. Although preferential credit policies are tools used by many countries, there is not much micro evidence on the causal effects of better credit conditions for long-term investment on firms' productivity and aggregate productivity measure.[1]

This paper uses a policy change from the Brazilian Development Bank (BNDES) to assess the causal effect of better credit conditions on investment and productivity of Brazilian manufacturing firms. BNDES is the main financing institution for productive investment in the country and it offers subsidized interest rate for long-term investments. From 1997 to 2002, the Bank classified firms according to their gross operating revenue levels and offered higher subsidies on interest rate for small firms, as well as better credit conditions in terms of required collateral and grace period. For the period of 2002-04, the Bank reclassified the groups by shifting up the threshold separating small and medium-size firms. The reclassification split the medium size firms into two groups: the new-small firms, which could apply for better credit conditions, and those still classified as medium-size, unaffected by the reform. After 2004, the Bank extended the benefits to all medium-size firms. The causal effect is estimated considering new-small firms as treated and two different control groups, the always-small firms and always-medium firms. Thus, the comparison with the former can be interpreted as estimating the effect of a permanent change in credit conditions, while the comparison with the latter for the effect of two years of better credit conditions. Our identification strategy closely depends upon the fact that the BNDES decision to reclassify firms size was exogenous to firms and that this classification is not adopted by other government policies.

We use firm level data from 1996 to 2010 from a manufacturing survey conducted by the Brazilian Institute of Geography and Statistics (IBGE), which is designed to represent the Brazilian mining and manufacturing sector as a whole.[2] Our sample consists of all firms in mining and manufacturing with labor force of 30 or more employees. The economic variables of interest include the number of employees, value added, gross production value, investment and gross operating revenue. The estimated causal effects point to positive shifts in the trend for investment rates and productivity indexes on average, however, after considering firm and year fixed effects, it remains statistically significant only when comparing to always-small firms, that is, only for the permanent change on credit conditions.

Our empirical strategy resembles that of Banerjee and Duflo [2014] in evaluating whether or not firms are credit constrained in India, but the question studied in this paper is fundamentally distinct to theirs. The similarity is on the use of an exogenous

[1] Antunes et al. [2015] study such a policy in a macro-development quantitative environment. See also Buera et al. [2013].

[2] The dataset used is available for research purposes, but its access is contingent on a set of conditions to ensure confidentiality. In addition, the dataset cannot be extracted from the Brazilian statistical office.

variation in access to a lending program as the identification strategy. Their paper "*estimates the impact of short term capital loans, not that of long term investment credit*" [Banerjee and Duflo, 2014, p. 575], whereas the BNDES credit policies were designed to meet long term investment needs. As a consequence, they focused on the policy effect on firms' short term outcomes (credit limit, interest rate, sales, among other variables) but not on investment and productivity, which constitute the variables of interest of this paper. In fact, BNDES credit policies, such as the size-dependent subsidized interest rates, are explicitly meant to facilitate credit access to projects with long term returns but with high cost of implementation, which include the purchase of machinery and equipment, as well as technology adoption and development of new products/technologies.

The letter is structured as follows. First, we discuss the BNDES intervention; Second, we use a theoretical framework of heterogeneous firms facing financial frictions to examine some predictions for the policy effects. Third, we discuss our empirical strategy, data and models. Finally, we finish with results and concluding remarks.

2 The BNDES Credit Intervention

The Brazilian Development Bank is the main financing agent for development in the country. Its lending portfolio is larger than the World Bank and has been used primarily to finance the expansion of industry and infrastructure. Due to its magnitude, the Bank is responsible for more than 70 percent of long term credit in the country and had become the major source of long-term credit for firms in the manufacturing sector. This feature regarding its importance is key to our identification strategy, which relies on an exogenous change of its financial support mechanisms with considerable impact on the credit market.

Over the last few years, the BNDES has adopted policies targeting firms considered to be more financially constrained, namely low-revenue firms. Interest rates as well as collateral constraints were designed to better support this group. Since 1997, the Bank offers subsidized interest rate for long-term investments but the benefits were defined as a function of firms gross operating revenue. As a consequence of this policiy, the group of micro, small and medium-sized companies have accounted for an increasing share of total disbursements of this Bank, with a positive trend which has been highlighted as a successful policy of the Bank. Although BNDES offers several credit lines and products, for the task undertaken by this research we will focus on the shocks induced by a credit line defined as *FINAME*. This is justified by the following reasons: First, it is the one specifically designed for machinery and equipment acquisition; Second, it is the largest outlay; Third, many projects presented as innovation end up eligible for this credit line. In summary, the majority of the long-term investment capable of enhancing firms' productivity end up being either financed by the BNDES, through *FINAME*, or self-financed. Hence, if firms are credit constrained

then borrowing conditions structured by the program might have a significant impact on long-run investment and productivity.

The level of the subsidy on borrowing rates depends on the firm size in terms of gross operating revenue but firms' classification changed over time. From 1997 to 2002, all firms with revenues between R$6 millions and R$35 millions were classified as medium firms and they faced the same credit conditions offered by the BNDES. In 2002, those with gross operating revenue within R$6 and R$10.5 millions started to be treated as small firms, with the possibility of applying for better credit conditions, while firms with revenues about R$10.5 million were still treated as medium firms. Small firms paid at least 1.5 percentage point less in interest rate per year than medium firms and the interest rate differential could reach 3 percentage points lower depending on the sector and location of the firm.[3] Small firms had also favourable loan conditions in terms of smaller collateral requirements and larger grace periods. A new reform took place in 2004, when the two groups, small and medium-size firms, started facing the same credit conditions. For this reason, when estimating the causal effect for the temporary change in credit conditions, we will focus solely on medium-size firms, according to the first classification, operating within the 2002-04 period and track them back and forth in time. For the permanent shock, the same is done but with the control group composed by always-small firms.

3 Empirical Strategy

In this section we explain the details regarding the data used and our identification strategy.

3.1 Firm-Level Data

Data on firms were obtained from a confidential survey constructed by the Brazilian Institute of Statistics (IBGE), called the Annual Industrial Survey (PIA), which monitors the performance of Brazilian firms in the extractive and manufacturing sectors.[4] They are yearly data from 1996 to 2010 from all firms with 30 or more employees. We construct a panel data in which we investigate outcomes of firms eligible and non-

[3] BNDES resources come mainly from workers' contributions and loans from the Brazilian Treasury at a rate below the Central Bank interest rate. In 2002-2004, for instance, the yearly nominal interest paid by government bonds (Selic) was about 18%, while the government lent to BNDES at about 11%. The final component in BNDES credit lines is an interest rate spread charged by BNDES of about 2.5 percentage points in 2002-2004 and a financial intermediaries spread. BNDES loans have a longer term than other types of credit, but require large collateral. See Ribeiro and DeNegri [2010] and Ottaviano and de Sousa [2008] for more details.

[4] We focus on the manufacturing sector as defined by the Brazilian sector classification CNAE 2.0 (sectors 10 to 33).

eligible for the BNDES intervention between 2002-2004.[5] The variables used include the number of employees, value added, gross production value, investment and operating revenue.

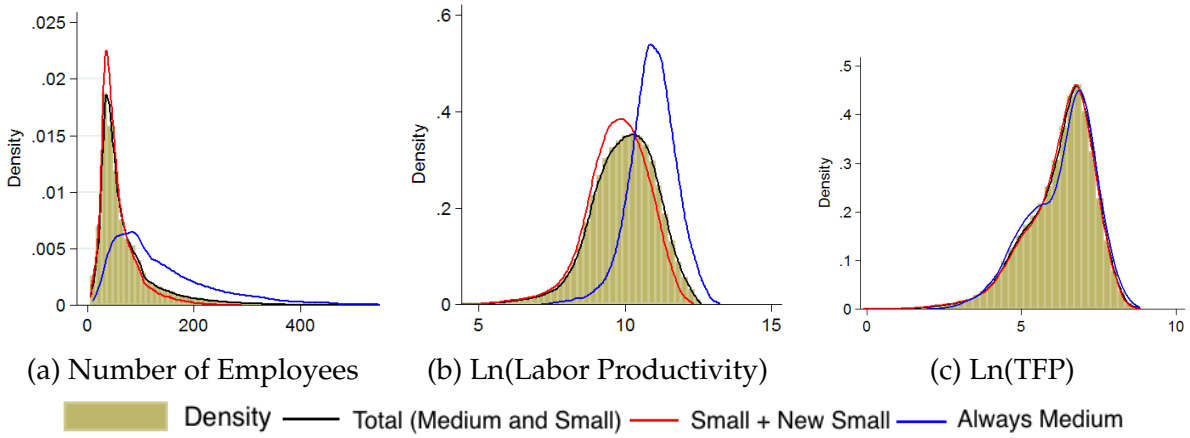
Table 1: **Summary statistics**. *Source:* Annual Industrial Survey (PIA). Brazilian Institute of Statistics (IBGE).

Group	Variable	Mean	se(Mean)	sd	Median	N
Small	ROR (Millions)	2.69	0.01	2.73	1.74	166807
	New	22%	0.00	0.41	-	166807
	Incumbent	70%	0.00	0.46	-	166807
	Exit	12%	0.00	0.32	-	166807
	Investment	4%	0.01	3.51	0.00	150905
	Employees	58	0.11	46	46	166807
	Employees	49	0.10	41	38	166807
	ln(Labor Prodty)	9.68	0.00	1.41	9.80	165377
	Ln(TFP)(OLS)	6.18	0.00	1.49	6.47	113822
	HHI	0.029	0.000	0.057	0.016	166807
New Small	ROR (Millions)	7.81	0.01	1.15	7.72	22249
	New	12%	0.00	0.33	-	22249
	Incumbent	84%	0.00	0.37	-	22249
	Exit	5%	0.00	0.22	-	22249
	Investment	4%	0.00	0.19	0.01	21852
	Employees	92	0.47	70	73	22249
	Employees	73	0.42	63	57	22249
	ln(Labor Prodty)	10.54	0.01	1.23	10.67	22171
	Ln(TFP)(OLS)	6.28	0.01	1.45	6.57	19132
	HHI	0.034	0.001	0.078	0.018	22249
Always Medium	ROR (Millions)	18.70	0.03	6.83	17.00	40069
	New	9%	0.00	0.29	-	40069
	Incumbent	88%	0.00	0.33	-	40069
	Exit	3%	0.00	0.18	-	40069
	Investment	3%	0.00	0.49	0.01	39782
	Employees	149	0.65	130	112	40069
	Employees	115	0.57	113	84	40069
	ln(Labor Prodty)	10.89	0.01	1.13	10.96	39979
	Ln(TFP)(OLS)	6.27	0.01	1.37	6.53	36223
	HHI	0.041	0.001	0.101	0.018	40069

The summary statistics are shown in Table 1. Those medium firms classified as small after 2002, as expected, presented on average a lower number of employees and a higher exit rate relative to the always medium firms group. Not only the average labor productivity of the two groups were very similar, but also the standard

[5]More specifically, the IBGE provides two strata: one with a random sample of firms having between 5 and 29 employees (*estrato amostral*) and another with all firms with 30 or more employees (*estrato certo*). We used only the *estrato certo*. Most medium sized firms according to the BNDES classification are likely to have at least 30 employees.

deviation. Figure 1(b) depicts the distribution of the labor productivity while Figure 1(c) shows the distribution of total factor productivity. The distribution of size, as number of employees per firm, is depicted on Figure 1(a). Firms on the new-small group are more disperse and positive skewed on this regard. Moreover, though not exposed in here, the sectorial composition is quite similar for both groups of firms.



(a) Number of Employees (b) Ln(Labor Productivity) (c) Ln(TFP)

Figure 1: **Distribution of Size, Labor Productivity and TFP** Source: Annual Industrial Survey (PIA). Brazilian Institute of Statistics (IBGE).

There are some sample restrictions for the causal effect estimation. In order to avoid confounding effects of other policies adopted towards manufacturing firms placed on low income regions, we restricted our sample to the most industrialized region, the Southeast, composed by São Paulo, Rio de Janeiro, Espírito Santo and Minas Gerais. Furthermore, since we want to check how the policy affected the treated group relative to a control group, our sample is restricted to firms operating between 2002-2004, when the policy took place. We end up with 14,003 firms with more than 30 employees and we traced them backward and forward.

3.2 Productivity Measures

Two measures of productivity are constructed and used in the analysis:[6] labor productivity and a total factor productivity (TFP) measure, estimated by OLS.[7] Besides

[6]The capital stock is constructed through the perpetual inventory method. We assume that $K_{ti} = (1 - \delta_{ti})K_{t-1} + I_{ti}$ where δ refers to capital stock depreciation. For firms starting before 1996, the initial capital is computed from information on the accounted depreciation, available in the PIA database. The production measure and intermediate consumption are deflated by a sectorial price index, IPA-OG (3-digits), while investment are deflated by an investment price index, IPA-DI. The investment rate is the ratio of investment over capital stock; and investment itself is composed by the sum of acquisition, improvements and reduction on the previous capital stock divided by value added, which might be negative or positive

[7]The TFP measure is a residual term based on an ordinary least square regression. Parameters are sector specific, to account for sectorial heterogeneity on labor and capital shares at two-digit level

the simplicity of our labor productivity measure, it carries important information combining the importance of both tangible and intangible capital on workers' productivity; and, it is not affected by measurement error of firms' capital stock. Labor productivity is simply defined as value added per worker. This is a clear measure.

3.2.1 Aggregate Productivity and Productivity Index

Aggregate productivity measures will be defined as the weighted average of firms productivity and firms' relative market share is determined by their value added share.

At the sectorial level, aggregate productivity is given by:

$$P_{st} = \sum_{i \in s} \theta_{ist} A_{ist}, \tag{1}$$

where $\theta_{ist} = VA_{ist} / \sum_{i \in s} VA_{ist}$ and VA denotes value added.

For the economy as a whole, aggregate productivity measures are defined similarly, as the average of sectors' productivity weighted by value added share. That is:

$$P_t = \sum_{s} \theta_{st} P_{st}, \tag{2}$$

where $\theta_{st} = VA_{st} / \sum_{s} VA_{st}$.

It is convenient, for comparative purposes, to define firm productivity as an index, which is relative to the sector productivity, and then check whether or not the firms eligible to the program between 2002 and 2004 faced any significant change on its productivity index path. Such an index eases cross-section comparison for each year, avoiding differences in sectorial composition to drive further disparities. Over time, the index also facilitate the comparison by accounting for the productivity growth of the sector as a whole, which are not actually related to access to credit.

$$Pindex_{ist} = A_{ist} / P_{st}. \tag{3}$$

3.3 Causal Effect Estimation

As described previously, after the BNDES reclassification in 2002, part of the medium-size firms faced better credit conditions for loans to long-term investment. The policy lasted two years and was extended to include all medium size firms under the same

industries. We consider a production function such as $Y(A, K, L_{WC}, L_{BC}) = AK^{\beta_k} L_{WC}^{\beta_{WC}} L_{BC}^{\beta_{BC}} M^{\beta_M}$ where K denotes capital stock, L_{WC} and L_{WC} are white-collar labor and blue collar labor, and M corresponds to raw materials. We estimate a log-linearized version of this equation. Since all variables except A are observed at the firm level then the TFP measure is obtained as the residual between observed and estimated output.

conditions after 2004. We take advantage of this exogenous policy intervention to investigate the causal effect of interest rate subsidies and lower collateral requirements on firms' relative productivity and investment.

The reduced form estimates for the Difference-in-Difference model can be expressed by:

$$lnY_{it} = \beta_1 Eligible_{it} + \beta_2 Post_t + \beta_3 Post_t \times Eligible_{it} + \mathbf{X}'_{it}\gamma + \alpha_i + \rho_t + \epsilon_{it}, \quad (4)$$

where Y is the explained variable (Productivity Indexes or investment) while *Eligible* and *Post* are the dummy variables representing firms eligibility, those classified as small-size after the reform in 2002, and the period after intervention. Our parameter of interest is β_3, which captures the difference-in-difference between the conditional expected value of productivity before and after the policy for each group of firms. That is, with no controls $\mathbf{X}_{it}$:

$$\begin{aligned} \beta_3 \;=\; & \{E[Y_{it}|Eligible = 1, Post = 1] - E[Y_{it}|Eligible = 1, Post = 0]\} \\ & - \{E[Y_{it}|Eligible = 0, Post = 1] - E[Y_{it}|Eligible = 0, Post = 0]\}. \end{aligned} \quad (5)$$

The time varying controls, represented by the vector $\mathbf{X}_{it}$, are the deflated gross revenue, state and sector dummies, the median of people employed and wage by firms in the same sector, value added by sector and the sector Herfindahl-Hirschman Index (HHI).[8]

The validity of this identification strategy relies on the assumption that the change in the threshold was exogenous to firms which could not precisely anticipate such policy change implemented by the BNDES. Even if one believes that low-revenue firms situation leads the government to adopt this new classification, it is very unlikely that the new cutoff fully reflects differences in firms' current situation. In other words, the cutoff is somewhat arbitrary what makes our estimations above reliable. Banerjee and Duflo [2014] uses similar identification strategy to investigate whether or not firms are credit constrained in India.

The difference-in-difference (DID) strategy adopted in this letter is justified by some potential weakenesses associated with estimations exploiting the discontinuity around the new cut-offs. First, regression discontinuity analysis or DID for a optimal bandwith around the new classification are more sensitive to marginal manipulations around the thresholds. Second, external validity would be compromised even further. To control for size, as firms get away from the cutoff, we explicitly included deflated revenue among the covariates.

[8]Herfindahl-Hirschman Index is measured as $HHI_{st} = \sum_{i \in s} \left(Y_{ist} / \sum_{i \in s} Y_{ist}\right)^2$. We first square the market share of each firm in a sector, and then sum result numbers. It is calculated yearly at the sectorial level (2 digits). A high HHI index indicates market concentration.

4 Results

4.1 The Causal Effect

We start by investigating the impact of this policy change on firms' investment rate, which we defined as the ratio between investment and capital stock. As can be seen Figure 2, the unconditional mean of investment rate for new-small firms seems to be quite sensitive to the program. Before 2002, among medium size firms, both eligible and non-eligible firms presented similar levels and trends for investment rates, and after the change in the threshold the investment rates for the eligible group increased sharply; while there was no significant shift in the investment rate for the non-eligible group. [9]

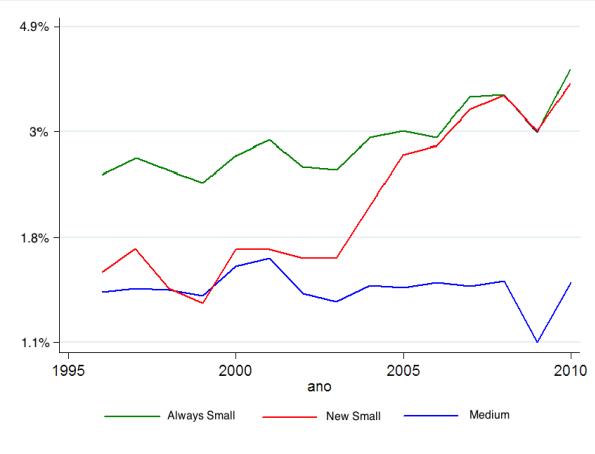


Figure 2: **Log[Investment/(Capital Stock)].** New-small (Red) versus medium firms (Blue) and small firms (Green). *Source:* Source: Annual Industrial Survey (PIA), Brazilian Institute of Statistics (IBGE).

The estimation results of Equation (4), for investment rate, are presented on Table 2. The policy positively change investment rates, when firm and year fixed effects were not considered, and the impact was way stronger for the permanent change, captured by the DID between new-small and always-small groups. Thus, unlike the unconditional average, depicted in figure (2), the conditional investment rate was more sensitive for the comparison to always-small firms. Furthermore, the inclusion of firmand year fixed effect makes the results for the temporary change statistically insignificant. [10] The two years of better credit conditions does not seem enough to change eligible firms investment trend when compared to other medium size firms

[9] It is unclear so far why the average investment rate among firstly unaffected medium size firms remains insensitive to the extension of benefits that took place in 2004. The absence of further controls in this analysis invalidates a deeper interpretation, but it could be said that in general investment decisions in the medium size group as a whole, on average, are dominated by other reasons.

[10] Even if some alternative formulation improve estimation efficiency, its estimated increase would be particularly close to zero.

Table 2: **Policy Effect on Investment**

Investment Rate (Investment / Capital Stock)				
New Small vs Always Medium				
PostXEligible	0.0169***	0.0169***	-0.0007	-0.0009
	-0.01	-0.01	-0.01	-0.01
New Small vs Always Small				
PostXEligible	0.4190***	0.1681***	0.5690***	0.3390***
	-0.04	-0.04	-0.02	-0.03
Controls	No	Yes	No	Yes
Firm and Year Fixed Effects	No	No	Yes	Yes
N Obs.	46491	32394	46491	32551
	55687	42342	55687	42342

Standard errors in parentheses * $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$
Productivity measures are represented in log terms. **Controls:** deflated gross revenue, State dummies, median of people employed and wage by firms in the same sector, value added by sector and the sectorial Herfindahl-Hirschman Index (HHI)

with similar observable characteristics, while the permanent change did. For the permanent policy change, considering firm and year fixed-effects besides time varying controls, the investment rates in the eligible group was raised, on average, by 33% more after the policy.

Table 3: **Policy Effect on Labor Productivity and TFP**

	Labor Productivity				Total Factor Productivity			
New Small vs Always Medium								
Post X	0.057	-0.0191	-0.0332	-0.0353	0.2461***	0.1234***	-0.0287	-0.0404
Eligible	(0.03)	(0.03)	(0.02)	(0.03)	(0.03)	(0.03)	(0.02)	(0.03)
New Small vs Always Small								
Post X	0.2641***	0.6765***	0.2490***	0.0966***	0.2479***	0.3425***	0.2330***	0.1114***
Eligible	(0.03)	(0.03)	(0.01)	(0.02)	(0.03)	(0.03)	(0.01)	(0.02)
Controls	No	Yes	No	Yes	No	Yes	No	Yes
Fixed Effects	No	No	Yes	Yes	No	No	Yes	Yes
N Obs.	115709	88288	115709	88288	87296	67435	87296	67435

Standard errors in parentheses * $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$
The productivity measures are represented in log terms and four models are estimated for each measure.
Controls: deflated gross revenue, State and sector dummies, the median of people employed and wage by firms in the same sector, value added by sector and the sectorial Herfindahl-Hirschman Index (HHI)
Fixed Effects reffers to Firm and Year fixed effect

The estimation results of a difference-in-difference model with productivity measures as explained variable is shown by table (3). Following the trend in the investment variable, both labor productivity and TFP are not affected by the temporary

policy when controlling for firm and year fixed effects, which suggest that the policy did not change the trends between treated and control groups. On the other hand, the effect of a permanent shift of credit conditions is sharper and statistically signigficant. The conditional average of labor productivity and TFP increased 9% and 11% more, respectively, in the group of firms target by the policy.

The estimation using relative measures of productivity are presented by table (4). In this case, the question is whether the policy affected productivity indexes, intended to avoid bias associated to sectorial composition or trend shifts. Results do not change much. The temporary policy effects remains not robust to the inclusion of firm and year fixed effects, while conditional averages of labor productivity and TFP indexes increased 13% and 10% more in the treated group.

Table 4: **Policy Effect on Labor Productivity and TFP Indexes**

	Labor Productivity Index				Total Factor Productivity Index			
New Small vs Always Medium								
Post X	0.079**	0.030*	-0.0282	-0.0474	0.220***	0.112***	-0.0065	-0.0324
Eligible	(0.03)	(0.02)	(0.02)	(0.03)	(0.03)	(0.03)	(0.02)	(0.03)
New Small vs Always Small								
Post X	0.2538***	0.6656***	0.2689***	0.1322***	0.1994***	0.2780***	0.2179***	0.1058***
Eligible	(0.02)	(0.03)	(0.01)	(0.02)	(0.02)	(0.03)	(0.01)	(0.02)
Controls	No	Yes	No	Yes	No	Yes	No	Yes
Fixed Effects	No	No	Yes	Yes	No	No	Yes	Yes
N Obs.	46693	32470	46693	32470	42501	30188	42501	30188

Standard errors in parentheses * $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$
The productivity measures are represented in log terms and four models are estimated for each measure.
Controls: deflated gross revenue, State and sector dummies, the median of people employed and wage by firms in the same sector, value added by sector and the sectorial Herfindahl-Hirschman Index (HHI)
Fixed Effects reffers to Firm and Year fixed effect

5 Concluding remarks

In this paper, we undertook the task of estimating the causal effect of financial frictions reduction on firms productivity and investment decisions. From a panel data set of Brazilian manufacturing firms we used a large-scale reform that altered the credit market conditions only to a subset of firms to pursue our empirical investigation. Results seems to support the hypothesis that financial constraint for long-term investment matters for SMEs firms' productivity and investment decisions, but effects are weak when such reduction of financtial frictions are temporary. When credit market conditions were permanently changed investment rate and productivity measures increased more in the subset of firms affected by the policy. Results are robust

to the inclusion of firm and year fixed effect as well as to the use productivity indexes accounting for sectorial productivity shifts.

References

A. Antunes, T. Cavalcanti, and A. Villamil. The effect of financial repression & enforcement on entrepreneurship and economic development. *Journal of Monetary Economics*, 55(2):278–298, 2008. 1

A. Antunes, T. Cavalcanti, and A. Villamil. The effects of credit subsidies on development. *Economic Theory*, 58(1):1–30, 2015. 2

A. V. Banerjee and E. Duflo. Do firms want to borrow more? testing credit constraints using a directed lending program. *Review of Economic Studies*, 81(2):572–607, 2014. 1, 2, 3, 8

F. J. Buera, B. Moll, and Y. Shin. Well-intended policies. *Review of Economic Dynamics*, 16:216–230, 2013. 2

J. Greenwood and B. Jovanovic. Financial development, growth, and distribution of income. *Journal of Political Economy*, 98(5):1076–1107, October 1990. 1

J. Levinsohn and A. Petrin. Estimating production functions using inputs to control for unobservables. *Review of Economic Studies*, 70(2):317–341, 2003.

G. I. P. Ottaviano and F. L. de Sousa. O efeito do BNDES na produtividade das empresas. In J. A. DeNegri, editor, *Inovação e Crescimento das Empresas*. BNDES, 2008. 4

R. G. Rajan and L. Zingales. Financial dependence and growth. *American Economic Review*, 88(3):559–586, 1998.

E. P. Ribeiro and J. A. DeNegri. Estimating the causal effect of access to public credit on productivity: The case of Brazil. *Mimeo, Universidade Federal do Rio de Janeiro*, 2010. 4