



# Access to long-term credit and productivity of small and medium firms: A causal evidence<sup>☆</sup>



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## HIGHLIGHTS

- This paper studies the effects of credit subsidies provided by the Brazilian Development Bank (BNDES) on investment and productivity of manufacturing firms.
- The identification strategy relies on an exogenous variation in access to a targeted loan program to small firms from BNDES.
- The estimated causal effects point to positive shifts in the trend for investment rates and productivity indexes; however, after considering firm and year fixed effects, it remains statistically significant only for the permanent changes on credit conditions.

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## ABSTRACT

This letter assesses the impact of a variation in access to a targeted loan program from Brazil's development bank on investment and productivity. Results suggest that eligible firms increased their relative investment rate and productivity, but results are robust only for permanent rather than temporary improvements in access to credit.

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## 1. Introduction

This paper uses a variation in access to a targeted loan program 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. 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 for the permanent changes 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 distinct to theirs. The similarity is on the use of an exogenous 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

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needs.<sup>1</sup> 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.

## 2. The BNDES credit intervention

BNDES is the main financing agent for development in Brazil. Its lending portfolio is larger than the World Bank and has been used primarily to finance the expansion of industry and infrastructure. The Bank is responsible for more than 70% of long term credit in the country.

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. The Bank offers subsidized interest rate for long-term investments but benefits were defined as a function of firms gross operating revenue. BNDES offers several credit lines and products. Among those targeting small and medium size firms are: *FINAME*, *BNDES automático* and *BNDES card*. The first two are designed to finance physical capital accumulation or investments in intangible capital meant to increase productivity, and together they compose the largest outlay. Nonetheless, credit conditions are size-dependent and classification changed over time, which motivates our identification strategy. *BNDES card* facilitates acquisition of inputs, but credit conditions are the same for all firms.<sup>2</sup>

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 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 above R\$10.5 millions were still treated as medium firms. For instance, under *FINAME* and *BNDES Automático*, small firms paid at least 1.5% point less in interest rate per year than medium firms and the interest rate differential could reach 3% points depending on the sector and location of the firm.<sup>3</sup> Small firms had also favorable 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. The causal effect is estimated considering new-small firms (revenue between R\$6Mi and R\$10Mi) as treated and two different control groups: the always-small firms (revenue below R\$6Mi), unaffected by the reclassification, and always-medium firms (revenue above R\$10Mi), affected only two years later. 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. For this reason, when estimating the causal effect for the temporary change in credit conditions, we

will focus the comparison of new-small firms solely with 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, the always treated group.

## 3. Empirical strategy

### 3.1. Data

Firm level data were obtained from a confidential survey constructed by the Brazilian Institute of Statistics (IBGE),<sup>4</sup> called the Annual Industrial Survey (PIA), which monitors the performance of Brazilian firms in the extractive and manufacturing sectors.<sup>5</sup> They are yearly survey from 1996 to 2010 from all firms with 30 or more employees. The variables used include the number of employees, value added, gross production value, investment and operating revenue.

The summary statistics are shown in Table 1. New small firms, those which were classified as medium before 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 deviation. Fig. 1(b) depicts the distribution of the labor productivity while Fig. 1(c) shows the distribution of Total Factor Productivity (TFP). The distribution of size, as number of employees per firm, is depicted on Fig. 1(a). Firms on the new-small group are more disperse and positive skewed on this regard. Moreover, though not exposed here, the sectorial composition is quite similar for both groups of firms.

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 the states of São Paulo, Rio de Janeiro, Espírito Santo and Minas Gerais. Our sample is restricted to firms operating between 2002 and 2004, preserving their classification at this period, when the shift in classification took place. We end up with 14,003 firms with more than 30 employees and we keep track of them over time.

### 3.2. Productivity measures

Two measures of productivity were constructed: labor productivity and a TFP measure.<sup>6</sup> Besides 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.

<sup>4</sup> The dataset cannot be extracted from the Brazilian statistical office.

<sup>5</sup> We focus on the manufacturing sector as defined by the Brazilian sector classification CNAE 2.0 (sectors 10–33).

<sup>6</sup> The capital stock is constructed through the perpetual inventory method. 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. 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 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  $L_{BC}$  are white-collar labor and blue collar labor, and  $M$  corresponds to raw materials.

<sup>1</sup> Antunes et al. (2015) and Buera et al. (2013) study such a policy in a macro-development quantitative environment.

<sup>2</sup> Despite recent expansion of the *BNDES card*, particularly after 2009, it does not reach 10% of disbursements made by the other two products.

<sup>3</sup> 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 was about 18%, while the government lent to BNDES at about 11%. The final component in BNDES credit lines is an interest rate spread of about 2.5% points in 2002–2004 and a financial intermediaries spread (cf., Ribeiro and DeNegri, 2010; Ottaviano and de Sousa, 2008).

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