CENTRE *for* ECONOMIC
PERFORMANCE

CEP Discussion Paper No 1309

October 2014

Relaxing Credit Constraints in Emerging Economies: The Impact of Public Loans on the Performance of Brazilian Manufacturers

Gianmarco I.P. Ottaviano and Filipe Lage de Sousa

THE LONDON SCHOOL
OF ECONOMICS AND
POLITICAL SCIENCE ■

E·S·R·C
ECONOMIC
& SOCIAL
RESEARCH
COUNCIL

Abstract
Especially in developing countries credit constraints are often perceived as one of the most important market frictions constraining firm innovation and growth. Huge amounts of public money are being devoted to the removal of such constraints but their effectiveness is still subject to an intense policy debate. This paper contributes to this debate by analysing the effects of the Brazilian Development Bank (BNDES) loans. It finds that, before receiving BNDES support, granted firms are indeed more credit constrained than comparable non-granted firms. It also finds that BNDES support allows granted firms to achieve the same level of performance as similar non-granted firms that are not credit constrained. However, it does not allow granted firms to outperform similar non-granted ones.

Gianmarco Ottaviano, Director of the Globalisation Programme at the Centre for Economic Performance and Professor of Economics at the London School of Economics and Political Science. Filipe Lage de Sousa, World Bank and Universidade Federal Fluminense.

1. Introduction

Large emerging economies, such as Brazil, China and India, are considered the markets of the future as promising destinations for sales as well as worrying origins of new tough competitors. At the same time, firms from those countries feel they are not able to compete on a level playing field with firms from more advanced economies due to all sorts of market failures. In particular, credit constraints are often perceived one of the most important market frictions constraining innovation, growth and performance as they hamper the entrepreneurial efforts of local firms. While huge amounts of public money are being devoted to the removal of such constraints, their effectiveness is still subject to an intense policy debate.

The aim of this paper is to contribute to this debate by investigating the case of Brazil. The Brazilian government provides long-term loans through the *Banco Nacional de Desenvolvimento Econômico e Social* (henceforth, BNDES), a development bank whose main statutory goal is to improve Brazilian economic competitiveness without neglecting broader social and environmental aspects. BNDES invests in several areas including research and development, infrastructure, export support, regional and urban development. More specifically, in the case of manufacturing, BNDES finances long-term projects aimed at the creation of new plants, the enlargement of existing ones, the restructuring and the modernization of production processes, innovation and technological development, export promotion. Overall, the importance of BNDES in the Brazilian economy is quite sizeable: in 2012 its disbursements reached the value of R$ 156 billion (or US$ 76 billion), representing 20% of aggregate investment.[1] When compared with that of other development banks, the size of BNDES financing becomes even more impressive. For instance, in 2012 the World Bank and the Inter-American Development Bank disbursed 19.8 and 6.9 billion dollars respectively.[2] In comparison, BNDES financing reached nearly three times their combined disbursements.

Even though BNDES project analysis involves several dimensions including social and environmental aspects, this paper focuses on the assessment of the overall impact on the competitiveness of Brazilian firms. Do BNDES loans help relax credit constraints that hamper the innovativeness and productivity of Brazilian firms? We address this question by analysing micro-data drawn from a variety of sources: the Annual Industrial Research (*Pesquisa Industrial Anual* – [PIA]) of the Brazilian Institute of Geography and Statistics (*Instituto Brasileiro de Geografia e Estatística* – [IBGE]); the Annual Social Information Report (*Relação Anual de Informações Sociais*

---

[1] Information accessed on May 29th, 2014 at
http://www.bndes.gov.br/SiteBNDES/bndes/bndes_en/Institucional/The_BNDES_in_Numbers/
[2] According to WB (2013) and IADB (2013).

– [RAIS]) of the Ministry of Labour; the Foreign Trade Secretary (*Secretaria de Comércio Exterior* – [SECEX]) of the Ministry of Industrial Development and Foreign Trade; the Foreign Capital Census and the Central Bank Register of Brazilian Capital Abroad of the Brazilian Central Bank; BNDES itself.

While there is an increasing literature evaluating government policies for business support (Bronzini and Blasio, 2006), there is a relative shortage of papers on the specific impact of government policies on firms' productivity (see, e.g., Griliches, Klette and Moen, 2000; Criscuolo, Martin, Overman and Reenen, 2007). This is not due to a shortage of methods, since other areas have already developed different ways to deal with the issue. An example can be found in the literature of labour economics that evaluates to what extent government polices affect individuals' achievements (Heckman, LaLonde and Smith, 1999). The role of credit constraints for innovation and growth has been stressed mainly in the development literature. Banerjee and Duflo (2005) provide evidence that firms in many developing countries face credit constraints, using a sample of countries which includes Brazil. More specifically, Terra (2003), Aldrighi and Bisinha (2010) and Ambrozio, Faleiros, Sant'Anna and Sousa (2013) provide evidence that Brazilian firms are credit constrained by investigating this issue at the firm level. In the case of Brazil, Coelho and Sousa (2010) present a review of all recent studies using evaluation techniques investigating BNDES support on firm performance. In total, six papers address whether firm productivity is related to BNDES loans. However, the majority of them evaluate only labour productivity. These include De Negri, De Negri and Alves (2008), Coelho and De Negri (2010) and Araújo, Esteves and De Negri (2010), which investigates effects of any BNDES' loans on firm performance, including those loans not aimed at improving productivity. Ribeiro and De Negri (2009) and Coelho and De Negri (2010) look at both labour productivity and Total Factor Productivity (TFP), but the former focus on a specific loan allotted to acquisition of domestic capital goods whereas the latter analyse any BNDES loan.

Closer to the spirit of the present paper, Ottaviano and Sousa (2008) and Sousa (2013) investigate the relationship between firms' performance and BNDES loans allocated to the modernization and enlargement of existing plants or to the creation of new ones. Both those papers look only at labour productivity, while this paper uses not only labour productivity but also TFP. Another feature that distinguishes the present paper from the others is the design of an estimation strategy that not only uses different sets of counterfactual groups but also tests whether granted firms faces tougher credit restriction.

Overall, we find that granted firms were more credit constrained than comparable non-granted firms before receiving BNDES support. In addition, such support allowed granted firms to achieve the same level of performance as similar firms that were not credit constrained, but not to outperform them. These findings have two main policy implications. First, government support such as that provided by BNDES can indeed help relaxing credit constraints that prevent constrained firms to perform as otherwise identical unconstrained ones. Second, for better firm performance, financial

support should come together with initiatives that incentivise firms to implement their projects using frontier technologies.

The paper is structured as follows. Section 2 presents a theoretical framework to inform the subsequent empirical analysis. Financial support offered by BNDES to manufacturers is detailed in Section 3. Section 4 introduces the data together with alternative 'treatment' and 'control' groups that one can use to assess the impact of BNDES support. Credit constraints are investigated in Section 5, while Section 6 looks at the impact of BNDES support on firm performance. Section 7 concludes.

2. Theoretical framework

Consider a firm that has a portfolio of projects and has to decide which projects to implement. Projects differ in terms of efficiency $\varphi > 0$ and their implementation generates imperfectly substitutable outputs.

The firm faces a perceived demand for the output of any of its projects with constant price elasticity equal to $\sigma > 1$ such that

$$q = A\,p^{-\sigma} \tag{1}$$

where q is quantity demanded, p is price, and A is aggregate demand, which the firm takes as given.

A project can be implemented only after incurring a fixed investment cost. Production also faces a constant marginal cost, which depends on the efficiency of the project and the type of technology adopted for production. There are two types of technologies available, 'old' and 'new', and they differ in terms of both fixed and marginal costs. Specifically, the old technology requires a smaller initial investment but is also less effective: its fixed cost is lower but, for a given level of project efficiency, its marginal cost is higher. All this is captured by total cost

$$TC_T = f_T + \frac{c_T}{\varphi}q, \ T = N, S \tag{2}$$

where f_T is the fixed investment cost and c_T/φ is the marginal production cost. All the rest given, higher project efficiency (larger φ) maps into lower marginal cost (higher 'productivity'). T is an index of technology, which equals N and S in the case of new and old technologies respectively. Hence, we have $f_N > f_S$ and $c_N < c_S$.

Profit maximization with constant demand elasticity requires the firm to set its price for the output of a project with efficiency φ as a constant mark-up over marginal cost:

$$p_T(\varphi) = \frac{\sigma}{\sigma - 1}\frac{c_T}{\varphi} \tag{3}$$

This price then determines output, revenue and profit as:

$$q_T(\varphi) = A\,p_T(\varphi)^{-\sigma}, \quad r_T(\varphi) = A\,p_T(\varphi)^{1-\sigma}, \quad \pi_T(\varphi) = A\,p_T(\varphi)^{1-\sigma}/\sigma - f_T \tag{4}$$

As σ is larger than one, results (3) and (4) show that, for a given technology, a more efficient project leads to lower price, larger output, larger revenue and larger profit. As the firm chooses the technology that generates more profit net of fixed cost, higher

project efficiency, therefore, fosters its adoption. Moreover, as the fixed cost is higher for the new technology, higher project efficiency also fosters implementation through the new technology.

Specifically, there are two threshold efficiency levels, φ_S and φ_N (with $\varphi_N > \varphi_S$), that determine whether the project is implement or not and, if implemented, which technology is adopted. For efficiency below φ_S, neither the old technology nor the new technology break even as output from the project is too small to cover the fixed investment cost. For efficiency above φ_N, output is large enough not only to cover the fixed investment cost of the old technology but also to fruitfully exploit the new technology notwithstanding its larger fixed investment cost. For efficiency between φ_S and φ_N, output is still large enough to offset the fixed investment cost of the old technology but not large enough to cover the larger fixed investment cost of the new technology. Hence, projects with $\varphi < \varphi_S$ are not implemented; project with $\varphi > \varphi_N$ are implemented through the new technology; projects with $\varphi_S < \varphi < \varphi_N$ are implemented through the old technology.

Formally, φ_S is such that $\pi_S(\varphi_S) = 0$: for $\varphi = \varphi_S$ the firm is indifferent between implementing and not implementing the project. Using (4), this cutoff for project implementation is

$$\varphi_S = \frac{\sigma}{\sigma - 1} \left(\frac{\sigma}{A} \right)^{\frac{1}{\sigma-1}} f_S^{\frac{1}{\sigma-1}} c_S \qquad (5)$$

Analogously, the cutoff for the adoption of the new technology φ_N is such that $\pi_S(\varphi_N) = \pi_N(\varphi_N)$: for $\varphi = \varphi_N$ the firm is indifferent between the two technologies. Using again (4), we have

$$\varphi_N = \varphi_S \left[\frac{(f_N/f_S) - 1}{(c_S/c_N)^{\sigma-1} - 1} \right]^{\frac{1}{\sigma-1}} \qquad (6)$$

with $\varphi_N > \varphi_S$ if $(f_N/f_S) > (c_S/c_N)^{\sigma-1}$ which is assumed to hold so that the new technology does not always dominate the old technology whenever the firm decides to implement the project.

Credit constraints on the implementation of projects and the adoption of technologies can be introduced in this framework by assuming that they increase the costs of the required initial investments. Vice versa, interventions that relax credit constraints can be thought of as implying smaller fixed investment costs f_S and f_N. Inspecting (5) and (6) reveals that smaller f_S and f_N reduce both φ_S and φ_N, thus increasing the share of projects that are implemented. As for technology adoption, credit constraints may affect the two fixed investment costs asymmetrically. For instance, if they affected disproportionately the adoption of the new technology, their relaxation would decrease f_N more than f_S, increasing the relative number of projects implemented through the more efficient new technology and thus improving firm productivity. On the contrary, if credit constraints affected disproportionately the adoption of the old technology, their relaxation would decrease f_S more than f_N, increasing the relative number of projects implemented through the less efficient old technology and thus reducing firm productivity. Finally, if credit constraints for both technologies were reduced proportionately, some projects would be implemented adopting the new

technology while others would be implemented adopting the old technology with ambiguous effects on firm productivity.

To summarize, our theoretical framework implies that, if BNDES loans relaxed the credit constraints faced by Brazilian firms, this would map into more projects being implemented. However, the implementation of more projects would eventually lead to higher firm productivity only if projects were implemented mainly using new technologies rather than old ones.

3. Overview of BNDES schemes

BNDES provides a wide range of financial tools to support Brazilian manufacturing firms: FINEM, Automatic BNDES, FINAME, Leasing FINAME, International Competition FINAME (BNDES-Exim) and Subscription of Securities.

FINEM ("Financing and Endeavours") is a direct or indirect support scheme for projects with financial needs over R$10 million (equivalent to US$ 5.7 million). Projects with financial needs below this threshold are instead supported solely indirectly through retailing banks under the Automatic BNDES scheme. Both schemes contemplate several categories of expenses covering the creation of new plants, the enlargement of existing ones, the restructuring and the modernization of processes, innovation, and technological development.[3]

Through the FINAME ("Machines and Equipment") and the Leasing FINAME schemes, BNDES supports the acquisition of new domestically produced machines and equipment either buying them (FINAME) or leasing them (Leasing FINAME). Finally, the aim of BNDES-Exim is to provide financial support for exports while the aim of Subscription of Securities is to facilitate changes in firm ownership.

Our focus is on FINEM and Automatic BNDES as they are more focused on supporting the discovery and the implementation of promising projects. Differently, FINAME and Leasing FINAME do not contemplate investments in innovation and technological development.[4] Nonetheless, it is necessary to account for them in order to isolate the role of FINEM and Automatic BNDES. BNDES-Exim and Subscription of Securities have, instead, rather different objectives.[5] FINEM and Automatic BNDES are therefore loans that have stronger potential to directly affect firms' productivity since their expansion may be guided by improvements in production and/or creation of new and/or more sophisticated goods.[6]

In order to receive any of these two loans, either FINEM or Automatic BNDES, firms need to send a supporting application form with some brief information of their projects to a retailing bank or BNDES itself. The banks evaluate whether their projects are in line with the purpose of the mentioned loans. After getting their application approved, firms have to send complete and detailed project plans to be evaluated by the financial institutions. These project plans are evaluated in terms of whether they are economically viable, what collateral can be used to guarantee the loan, and so forth.

If successful, the evaluation process culminates in a formal contract proposal where the terms and conditions of the loan are established, including amount, period, and interest rate. After negotiations have finished, the loan contract is signed. It is

---

[3] A complete list is available at http://www.bndes.gov.br.
[4] Their impact on firms' productivity is investigated by Ribeiro and De Negri (2009)
[5] Although changes of ownership might affect firms' performance, we are interested in how productivity might be affected by the implementation of projects. Additionally, all firms being supported by this scheme are discarded.
[6] Regarding their importance, those two loans are quite representative in BNDES budget as they were on average 46% of the total disbursements from 2000 to 2009.

important to note two crucial points here. First, there is a limit for BNDES participation in any project. This varies over time but is generally around 80%. A project is thus never fully financed by BNDES. Second, firms receive their loan in instalments according to the development of the project and following a schedule decided during negotiation.

In particular, firms receive the first instalment when the loan is approved and the remaining ones only after an evaluation of the project's progress. Before the second instalment, the firm should prove whether the money of the first disbursement was invested as dictated by the project plan. Any violation of the loan terms leads to a further investigation and instalments are interrupted until justifications are given. If no problems emerge, instalments continue until the end of the project. Since these are long-term projects, the period between contract signing and the end of instalments takes on average 5 years. Generally, only after all instalments have been paid, firms start to amortize their loans.

4. Treatment and control groups

Do FINEM and Automatic BNDES loans help relax credit constraints that hamper the competitiveness of Brazilian firms? Answering this question requires, first of all, identifying the group of granted ('treated') firms for which enough information is available. Then, it is crucial to define a 'valid' counterfactual highlighting what would have happened to the granted firms had they not be supported by BNDES. Compared to the counterfactual, one has to establish whether firms granted BNDES loans were indeed credit constrained, and then check whether their performance actually changed after receiving the BNDES loans. Checking that they have implemented their projects is, instead, redundant given that, as already discussed, BNDES funds are transferred to firms in instalments and, except for the first one, these are made conditional on firms having successfully followed the agreed implementation plan.

The analysis relies on micro-data drawn from a variety of sources already used by the papers described by Coelho and Sousa (2010). In particular, our dataset combines information from: the Annual Industrial Research (*Pesquisa Industrial Anual* – [PIA]) of the Brazilian Institute of Geography and Statistics (*Instituto Brasileiro de Geografia e Estatística* – [IBGE])[7]; the Annual Social Information Report (*Relação Anual de Informações Sociais* – [RAIS]) of the Ministry of Labour; the Foreign Trade Secretary (*Secretaria de Comércio Exterior* – [SECEX]) of the Ministry of Industrial Development and Foreign Trade; the Foreign Capital Census and the Central Bank Register of Brazilian Capital Abroad of the Brazilian Central Bank; BNDES itself.[8]

4.1 Treated groups

We select out group of 'treated' firms as follows. First, we use BNDES data to identify granted firms from 1995 to 2007.[9] During this period, 9,828 firms were 'treated' in that they received at least once one of the two targeted BNDES financial schemes (FINEM and/or Automatic BNDES schemes). These firms represent nearly 4% of all manufacturing firms in Brazil.[10] Second, it is unfortunately impossible to use all

---

[7] This is our main data source, since it contains the majority of the variables useful for this analysis, including those needed to measure firm productivity.

[8] The construction of the dataset has followed procedures that guarantee the confidentiality of information so that individual data cannot be related to any specific firm.

[9] Data on 1995 are used only to exclude any firm that received 'financial treatment' in that particular year. Data on 2007 are used for choosing a counterfactual group, as described in a later stage in this paper.

[10] More precisely, there were 274,515 active firms in the Brazilian manufacturing sector in 2007 (source PIA/IBGE).

these manufacturers as some of them are not available from PIA, especially small firms. The reason is that PIA covers only around 30,000 firms with more than 30 employees. These firms represent only 11% of all manufacturers but around 2/3 of overall manufacturing employment.[11] Hence, the fact that we have to focus only on PIA firms reduces the number of firms granted Automatic BNDES in our sample by half. Third, the size of the 'treated' group is further reduced because we want to evaluate only the performance of *manufacturing firms* granted loans to implement projects in the manufacturing sector. BNDES records, however, concern all *manufacturing projects*. They thus report also manufacturing projects by non-manufacturing firms (e.g., those of large food retailers investing in the development of their own brands) and do not cover non-manufacturing projects of manufacturing firms (e.g., those implemented in agriculture). Fourth, some firms appear or disappear from records due to mergers. For example, if Firm A received a loan in 1997 and in 2000 merged with Firm B creating a new Firm C, the initial loan should be registered for firm C. As the past records of Firm C are impossible to reconstruct, we drop all information on loans projects granted to firms like A and B.[12] Finally, there is a time lag of generally two to three years before a firm enters the Census part of PIA.[13] Hence, some granted firms with more than 30 employees are not recorded by PIA at the moment they receive BNDES loans.

Further issues potentially affect the size our 'treated' group. Some firms are exposed to other government interventions apart from BNDES loans. Since BNDES is the largest financial institution in Brazil offering loans for long-term projects, we imply assume that its loans are the main type of policy tools affecting firms' productivity. In addition, there may be a time lag for any impact to be detected, since outcomes do not necessarily appear immediately after the loan has been granted. As some projects last at least five years, we need a period beyond the five-year horizon to assess their impacts. Given the time spanned by our dataset (1996 to 2006), that is clearly not feasible for loans granted from 1999 onwards. On the other hand, as we will discuss later, to construct the 'control' group for firms treated in a certain year, one needs at least two years before treatment. Hence, the impact of BNDES schemes can be scrutinized only for firms granted Automatic BNDES and FINEM loans in 1998. Excluding all firms treated before 1998 leaves us with 227 firms. Among these, 86 firms are not present in PIA dataset for the whole period investigated.[14] In the end, the 'treated' group consists thus of 141 firms.

Lastly, it may be useful to distinguish among three 'treated' groups. Group I comprises all our 141 firms. To see whether there is any differential impacts between FINEM and Automatic BNDES, Group II consists only of firms receiving Automatic BNDES. To investigate the effects of repeated treatment, Group III considers only firms

---

[11] Firms with less than 30 employees are also considered in this survey, but they are selected randomly for the survey each year. Since their sample varies annually, and is thus impossible to follow, we have decided to discard them.

[12] All firms that have received financial support through Subscription of Securities are deleted from our sample.

[13] IBGE receives information of firms' size (number of employees) for a particular year only at the end of the following year.

[14] There are three possible explanations for why a firm leaves the PIA dataset: first, it goes bankrupt; second, its employment level falls short of the threshold of 30 employees; third, the main part of its revenue does not come anymore from manufacturing.

that are awarded BNDES support only in 1998 and not after. This summarized in Table 1.[15]

Table 1 – Treated Groups

Group Name	Description	Number of Firms
Group I	Firms granted for the 1st time in 1998	141
Group II	Firms granted only Automatic BNDES	112
Group III	Firms granted only in1998	75

4.2. Control groups

How can we build a 'valid' counterfactual for the selected groups of 'treated' firms? Short of natural experiments or randomized control trials, the answer is not straightforward and we try various alternatives which we present in increasing order of sophistication.

4.2.1. Unobservable characteristics

As a first alternative we use our judgement to identify 'control' groups that are likely to share similar *unobservable* characteristics with the 'treated' ones. The first 'control' Group A consists of all 21,380 Brazilian firms (above 30 employees) that do not receive any BNDES loans during the period of analysis. Firms, however, are not randomly selected by BNDES. Ideally one would like to compare granted to non-granted, yet eligible, firms. As granted firms are among those interested in making investments, Group B consists of all non-granted firms that during the investigated period have invested and survived. There are 6,344 such firms. Vice versa, as granted firms are assumed to be credit constrained, another control group should include non-granted firms that might have invested if they have had access to credit. Since our treated group comprehends firms granted loans in 1998, control Group C comprises firms that have not invested before 1998, yet they have invested afterwards. There are 1,124 such firms. Lastly, Group D is composed by firms that have received BNDES loans but not during the investigated period as also these firms may be similar to those granted. Given that the information we use to test whether BNDES financial support has any impact begins in 1996 and ends in 2006, we place in Group D all firms granted in 2007 for the first time. It is important to mention that firms from Groups C and D are also contained in Groups A and B, and all firms from Group B also belong to Group A.

Table 2 gives a summary of the main characteristics of treated and non-treated firms before BNDES intervention.[16] First, credit constraints seem indeed to be stricter for 'treated' than 'non-treated' firms: whereas cash flow over capital is lower for the former than the latter, the reverse holds for the investment rate (investment over capital). While this is consistent with 'treated' firms facing stricter constraints, it may also be due to the fact that granted firms are more present in riskier sectors, as evidenced by the OECD technological classification.

---

[15] We have also investigated different treated groups (such as firms financed through Automatic BNDES only in 1998 or all firms financed in 1998 regardless of their survival rate), but results were similar to those presented for the chosen three treated groups.

[16] Table A.2 presents descriptive statistics for all variables in Appendix II. Description and sources are shown at Table A.1 in Appendix I.

Table 2: Average of Some Variables from Financed Firms in 1998 and Non Financed Firms One Year Before Treatment

Variables *	Non Treated Firms				Treated Firms		
	Group A	Group B	Group C	Group D	Group I	Group II	Group III
	All Firms over 30 employees	Survived and Invested	No Investment before 1998	First Treated in 2007	All First Time in 1998	Automatic BNDES	All only in 1998
Labour Productivity	26.6	26.8	12,5	27	35.5	29.7	31.8
Labour Productivity Growth	30.30%	26.00%	22.50%	14.30%	31.70%	27.60%	34.60%
TFP Levinhson-Petrin	100	99.6	94.8	99.1	102.6	101.9	101.7
TFP Growth	-3.20%	-1.10%	-4.20%	-2.90%	0.50%	-1.60%	0.00%
Number of Employees	175	196	89	255	620	332	468
Investment / Capital	3.70%	4.00%	0.00%	4.20%	6.60%	6.90%	5.50%
Cash Flow / Capital	12.30%	16.70%	12.20%	19.00%	10.50%	10.40%	11.20%
Export Status	32.2%	40.0%	23.1%	38.3%	58.9%	54.5%	49.3%
Export Share of Exporters	15.2%	15.3%	11.6%	20.1%	11.0%	10.3%	10.3%
Export Share All	4.90%	6.10%	2.68%	7.70%	6.50%	5.60%	5.10%
OCDE Classification							
High & Medium-High Tech	22%	26%	17%	18%	32%	32%	35%
Low & Medium-Low Tech	78%	74%	83%	82%	68%	68%	65%
Number of Firms	21,380	6,344	1,124	128	141	112	75

* All values from 1997

Turning to performance, on average treated firms are larger and tend to exhibit higher productivity. This is so in terms of both total factor productivity (TFP) and labour productivity (value added per worker), though the difference is more pronounced for the latter.[17] While the labour productivity of firms granted for the first time in 1998 (Group I) is more than 30% higher than that of non-granted firms that survived and invested (Group B), the TFP of the former is only 3% higher than that of the latter. Compared to the period before treatment, both measures of productivity grow faster for treated than non-treated firms.

4.2.2. Observable characteristics

So far we have proposed 'control' groups based on their likely similarity with the 'treated' ones with respect to unobservable characteristics, yet differences persist as shown in the previous section. Alternatively, we can try to minimize the differences between 'treated' and 'control' groups in terms of observable characteristics. In so doing we use one-to-one Propensity Score Matching (PSM).[18] This method creates a counterfactual group by pairing each granted firm with a similar non-granted one. Treated firms that cannot be paired with any non-granted firm are discarded.

In our case matching is based on pre-treatment observable characteristics that can be considered as relevant for firms to be eligible for support. In principle, these characteristics should include both dynamic performance indicators (e.g. revenue growth) and static performance indicators (e.g. size) as well as financial information (e.g. availability of collateral).[19] To pin down the subset of characteristics that are indeed relevant, we use a Probit model in which the outcome is the ex-ante probability of receiving financial support from BNDES. We then pair granted and non-granted firms with similar ex-ante probability of being funded. We start looking for matches at the seventh decimal digit of probability. For unmatched firms we gradually relax the

---

[17] Appendix VI describes the estimation procedures of TFP à la Levinsohn and Petrin (2003).
[18] See Arnold and Javornik (2005) who use PSM to evaluate the impact of foreign investment on firm productivity in Indonesia.
[19] More details of each variable are available in Appendix III.

requirement until the second decimal digit.[20] Granted firms that at that point cannot find a non-granted match are dropped.[21]

Considering only non-granted firms that invest and survive during our period of analysis (6,344 firms), we find three different 'control' groups depending on each 'treated' group. A summary of how many firms are matched is shown in Table 3. More than 80% of treated firms find their non-treated 'twin'.

Table 3: Number of Matched Firms

	Group I	Group II	Group III
Treated Matched	118	99	65
Treated Not Matched	23	13	10
Percentage Matched	84%	88%	87%

Table 4 illustrates the extent to which matched pairs are similar in terms of the observable characteristics. It reports averages for these characteristics as well as the t-statistics and p-values for the test of mean difference between matched pairs.[22]

Table 4: Comparing All Firms Granted in 1998 after Matching with Non Granted

	Non-Treated		Treated		Testing Matched Firms	
	Not Matched	Matched	Matched	Not Matched	t Value	P-value
Capital Stock	19	53	66	179	-0.55	58.0%
Number of Employees	192	420	526	1,103	-1.03	30.2%
Solvency	3.0%	2.5%	2.7%	3.2%	-0.44	66.0%
Profit	6.7%	6.2%	6.4%	2.0%	-0.20	84.3%
Profit Growth	49%	82%	38%	125%	1.78	7.8%
Employment Growth	4%	5%	8%	14%	-0.71	47.6%
Revenue Growth	21%	21%	20%	7%	0.18	85.7%
Market Share	0.10%	0.10%	0.20%	0.90%	-1.91	5.8%
Multinational Status	8%	11%	16%	9%	-1.14	25.6%
Rich	87%	87%	89%	83%	-0.40	68.9%
Labour Productivity	26.8	30.3	35.1	37.6	-1.21	22.7%
TFP Productivity	99.6	100.0	103.0	100.6	-1.67	9.6%
Investment	2.3	5.6	11.9	33.5	-1.41	16.0%
Cash Flow / Capital	16.8%	10.6%	10.4%	11.4%	0.14	88.8%
Investment / Capital	4.0%	4.3%	6.8%	6.0%	-3.23	0.2%
Number of Firms	6226	118	118	23		

Generally, it is possible to observe that treated and non-treated firms are much more alike in Table 4 than in Table 2. At the 5% level of significance, nearly all averages do not exhibit any statistically difference. Most notably, although some observable characteristics are not considered in our Probit model since they are not eligibility criteria for BNDES support, matched firms are similar even with respect to those characteristics. An important example is productivity: matched firms exhibit similar productivity levels before treatment even though productivity is not used to

---

[20] If no matches are found until second decimal digit, the treated firm is considered "not matched".

[21] More information on PSM results are presented in Appendix III.

[22] It is important to notice that for performing the Probit model, all continuous variables are in logs, where averages reported in Table 5 as well as test of means are in levels. Additionally, for parsimony, we are presenting only results related to Group 1. Results using the other three groups are presented in the Appendix III.

match them.[23] For these reasons, we consider the control group derived from PSM the most reliable counterfactual.

Now that we have identified the 'treatment' and 'control' groups we can check first whether granted firms are indeed credit constrained before receiving BNDES support, and then whether their performance improves after receiving BNDES support.

5. Were granted firms credit constrained before 'treatment'?

Credit constraints can be investigated in the wake of Fazzari, Hubbard and Peterson (1988) and recent related works by Carpenter and Guariglia (2008), Guariglia (2008) and Guariglia, Liu and Song (2011). These works measure credit constraints by looking at the correlation between firms' investment and cash flows. The idea we already used to comment on Table 2 is that, when firms are credit constrained, investment has to rely on own liquidity leading to a positive correlation between investment and cash flow.[24] This idea can be implemented through the following regression:

$$Inv_{it}/K_{it-1} = \beta(CashFlow_{it}/K_{it-1}) + \alpha(CashFlow_{it}/K_{it-1})*BNDES_i + \gamma X_{it} + \varepsilon_{it} \qquad (7)$$

where i identifies the firm and t denotes time, Inv_{it} is the level of investment, K_{it-1} is the capital stock, $CashFlow_{it}$ is the amount of cash flow generated, $BNDES_i$ is a dummy for 'treated' firms granted a loan in 1998 (treated Group I), X_{it} is a set of controls and ε_{it} is the error term. As the capital stock is lagged in time, this specification requires two-period information and, as our treated group comprehends 1998 granted firms, we are restricted to use information from 1996 and 1997. We are thus able to estimate this specification only with OLS in the cross section. In order to eliminate as much as possible firms' specific characteristics, we introduce different sets of dummies, including OCDE technological classification, size, region and multinational status, as well as current and lagged sales over capital. For investment opportunities, we have followed the literature by including sectoral value added variation and investment. The parameter of interest is α. A significant positive estimate would mean that, before receiving BNDES support in 1998, granted firms faced indeed stricter credit constraints than non-granted firms.

Table 5 reports the estimation results for equation (7). Columns correspond to the different counterfactuals. Since the coefficient of cash flow interacted with the BNDES dummy is positive and significant in all entries, the table shows that granted firms are indeed more credit constrained than most control groups before being awarded BNDES financial support. These findings are confirmed also in the case of 'treated' Groups II and III, except for the control group created through propensity score matching in which case paired non-granted firms do not seem to present softer credit constraints than granted firms.[25]

---

[23] Not only previous productivity measures (either labour or TFP) are not considered as eligible criteria when BNDES analyses a project, but also previous investment level and cash flow over capital. All those measures are not included in our Probit model used to match treated and non-treated firms.
[24] See also Aldrighi and Bisinha (2010), Ambrozio, Faleiros, Sant'Anna and Sousa (2013), and Terra (2003) for other papers investigating credit restriction using Brazilian firm-level data.
[25] Results for Groups II and III are available in Appendix IV.

Table 5: Credit Restriction

Dependent Variable: Invest / K	All Firms	Invested Firms	No Investment before 1998	Granted 2007	Paired Firms with Group I
	(1)	(2)	(3)	(4)	(5)
Cash Flow / K	0.000816**	0.000436	0.00548*	-0.00704	0.0508
	(0.000410)	(0.00110)	(0.00292)	(0.0159)	(0.0394)
BNDES * Cash Flow / K	0.131***	0.128***	0.268***	0.128***	0.120**
	(0.0302)	(0.0300)	(0.0160)	(0.0419)	(0.0532)
Sales / K	-0.000290***	-0.000413***	-0.00555***	-0.00124	-0.0247***
	(3.45e-05)	(0.000158)	(0.00110)	(0.00355)	(0.00721)
Sales / K lagged in time	0.000352***	0.000290***	0.00683***	0.000518***	0.0168***
	(1.96e-05)	(2.44e-05)	(0.000992)	(0.000188)	(0.00406)
Sector Investment	0.0903***	0.105***	0.0119	0.109***	0.0253
	(0.00397)	(0.00628)	(0.00879)	(0.0391)	(0.0454)
Sector Value Added Var.	-0.0564***	-0.0704***	-0.0292**	-0.0771	0.0103
	(0.00587)	(0.00929)	(0.0127)	(0.0594)	(0.0635)
OCDE Tech. Dummy	Yes	Yes	Yes	Yes	Yes
Region Dummy	Yes	Yes	Yes	Yes	Yes
Multinational Dummy	Yes	Yes	Yes	Yes	Yes
Size Dummy	Yes	Yes	Yes	Yes	Yes
Observations	18,104	6,485	1,246	271	216
R-squared	0.111	0.132	0.339	0.215	0.181

Robust standard errors in parentheses

*** p<0.01, ** p<0.05, *p<0.1

6. Do granted firms improve their performance after 'treatment'?

After checking that, before accessing BNDES funds, granted firms faced more severe credit constraints than non-granted ones, we can now investigate whether BNDES support affected their subsequent performance. We do this through a difference-in-differences (DID) approach that allows us to eliminate any residual time-invariant unobservable characteristic that is different between 'treated' and 'non-treated' firms. In particular, we adopt the specification in Bronzini and Blasio (2006):

$$y_{it} = \beta BNDES_i + \sum_t \alpha_t D_t + \sum_t \delta_t (BNDES_i \cdot POST_t) + X_{it}\gamma + \varepsilon_{it} \tag{8}$$

where y_{it} is a productivity measure, $BNDES_i$ is a dummy variable indicating granted firms in 1998, D_t is a year dummy, $POST_t$ is a set of dummies for each year after the firm receives the loan, and X_{it} is the vector of control variables. The parameter of interest is δ_t, whose estimated value measures the impact of BNDES support on firm productivity over time. Note that the estimation of (8) allows us to assess not only whether BNDES support affects firm productivity but also when its impact eventually materializes.

Table 6 present the estimation results using Group 1. Control groups are presented in increasing order of refinement: all existent firms; firms that invested and survived; firms that did not make any investments before 1998; firms that received their first BNDES support in 2007; pair firms through propensity scored matching.[26] Columns of each counterfactual group are divided into two types of productivity measures: labour productivity and total factor productivity (TFP) estimated following the procedure by Levinhson and Petrin (2003).[27]

---

[26] It is important to mention that all control groups, apart from "All Firms", consider only firms that survived during the whole period investigated. For instance, firms that did not invest until 1997 survived from 1996 to 2006.

[27] Results with all controls as well as for treated groups II and III are available in Appendix V. Taking into consideration only Automatic BNDES schemes or firms financed only once in 1998 gives similar results. In other words, using different 'treated' groups leads to similar conclusions.

Table 6: Results of Difference-in-Differences (More than Once)

Control Group	All Firms		Invested		No Invest. before 98		BNDES 2007		Paired	
Dependent Variable	Labor	TFP	Labor	TFP	Labor	TFP	Labor	TFP	Labor	TFP
Effect in 1998	0.130**	-0.00728	0.0943*	0.0162	0.192***	0.0180	0.180	0.0211	0.103	0.0176
	(0.0577)	(0.0466)	(0.0565)	(0.0451)	(0.0711)	(0.0477)	(0.156)	(0.0649)	(0.102)	(0.0605)
Effect in 1999	0.150***	-0.0589	0.109**	-0.0210	0.183***	-0.0516	0.0303	-0.0227	0.0940	-0.0414
	(0.0549)	(0.0449)	(0.0533)	(0.0431)	(0.0669)	(0.0467)	(0.123)	(0.0609)	(0.0983)	(0.0587)
Effect in 2000	0.181***	-0.0764	0.130**	-0.0185	0.216***	-0.0564	0.0742	-0.0383	0.194	-0.0889
	(0.0562)	(0.0466)	(0.0550)	(0.0442)	(0.0698)	(0.0475)	(0.158)	(0.0613)	(0.118)	(0.0595)
Effect in 2001	0.163***	-0.0839*	0.128**	-0.0276	0.194***	-0.0599	0.281	0.00854	0.195*	-0.0620
	(0.0589)	(0.0433)	(0.0574)	(0.0415)	(0.0687)	(0.0450)	(0.199)	(0.0587)	(0.119)	(0.0599)
Effect in 2002	0.169***	-0.0512	0.153***	0.0224	0.244***	-0.0100	0.182	0.0121	0.0724	0.00629
	(0.0567)	(0.0455)	(0.0550)	(0.0442)	(0.0696)	(0.0471)	(0.130)	(0.0624)	(0.0736)	(0.0609)
Effect in 2003	0.126**	-0.0978**	0.123**	-0.0284	0.185***	-0.0823*	-0.0456	-0.0402	0.104	-0.0610
	(0.0529)	(0.0462)	(0.0511)	(0.0450)	(0.0642)	(0.0484)	(0.106)	(0.0606)	(0.0743)	(0.0622)
Effect in 2004	0.0993*	-0.106**	0.113**	-0.0184	0.115*	-0.0840*	-0.0556	-0.0598	0.0918	-0.0664
	(0.0583)	(0.0442)	(0.0561)	(0.0429)	(0.0668)	(0.0465)	(0.108)	(0.0620)	(0.0760)	(0.0606)
Effect in 2005	0.0573	-0.134***	0.0875	-0.0462	0.0919	-0.111**	-0.0822	-0.0574	0.0717	-0.104*
	(0.0587)	(0.0434)	(0.0563)	(0.0417)	(0.0660)	(0.0456)	(0.108)	(0.0612)	(0.0763)	(0.0628)
Effect in 2006	0.0122	-0.193***	0.0600	-0.0636	0.0719	-0.123***	-0.104	-0.115*	0.0789	-0.0791
	(0.0581)	(0.0457)	(0.0563)	(0.0439)	(0.0655)	(0.0472)	(0.107)	(0.0642)	(0.0744)	(0.0606)
Multiple Treatments	0.00255	0.00167	0.00657	-0.0138*	0.00347	-0.0197***	0.0136	-0.00822	0.0120	-0.0262***
	(0.00802)	(0.00723)	(0.00782)	(0.00712)	(0.00914)	(0.00759)	(0.00915)	(0.00752)	(0.0102)	(0.00816)
Domestic Capital	0.0194***		-0.0147***		-0.0155		-0.144***		-0.0217	
	(0.00450)		(0.00568)		(0.0185)		(0.0394)		(0.0301)	
Imported Capital	0.0181**		0.0143		0.0471**		0.0770**		0.0529**	
	(0.00904)		(0.00900)		(0.0231)		(0.0319)		(0.0225)	
Observations	203.418	192,970	78,137	76,878	12,220	11,811	2.698	2,674	2.336	2,317
R-squared	0.693	0.336	0.707	0.445	0.669	0.405	0.694	0.446	0.779	0.495

Robust standard errors in parentheses

* significant at 5%; ** significant at 1%

As the TFP measure accounts for differences in capital stock among firms, the corresponding regressions do not feature investment in either domestic capital or imported capital as a covariate.[28] These are, instead, included in the case of labour productivity. Interestingly, investment in imported capital and labour productivity are positively correlated while no clear cut correlation appears in the case of domestic capital. This may suggest that imported capital goods are technologically more advanced.

As for our parameter of interest, in the case of labour productivity results are mixed depending on control groups. In our less refined control groups (Groups A, B and C), we find a positive impact of BNDES support on labour productivity until 2004 and no effect afterwards, suggesting that it improves the relative performance of granted firms for seven years. However, this does not happen when we consider the remaining more refined control groups (Groups D and E). Compared to these groups, 'treated' firms do not perform any different. On the other hand, results are not mixed in the case of TFP, in which no effect of BNDES support is detected in the first years after 'treated' firms are granted whatever compassion group is considered. From 2003, BNDES financial support impacts negatively granted firms when compared to those in control Groups A and C. However, this does not happen for the other three control groups

---

[28] We have included them but results remained qualitatively similar.

(Group B, D and E). Overall, we find little ground to conclude that BNDES support has any robust effect on granted firms' productivity in our sample.[29]

7. Concluding remarks

Do FINEM and Automatic BNDES loans help relax credit constraints that hamper the competitiveness of Brazilian firms? We have addressed this question by comparing granted and non-granted firms. It has been crucial to identify a 'valid' counterfactual highlighting what would have happened to the granted firms had they not been supported by BNDES. Compared to the counterfactual, we have checked whether firms granted BNDES loans were indeed credit constrained, and then whether their performance actually changed after receiving BNDES loans.

Overall, granted firms appear to have been more credit constrained than comparable non-granted firms before receiving BNDES support. Moreover, it seems that such support has allowed the selected sample of granted firms to achieve the same level of performance as similar firms that were not credit constrained, but not to outperform them.

While this is already some achievement, a positive differential impact on the performance of granted firms could be achieved through a more pro-active role of BNDES in helping these firms select their projects. We have used a simple theoretical framework to show that, if some projects are implemented through new technologies and others through old ones, the net effect on firm productivity might be null. If BNDES wanted to further improve the competitiveness of Brazilian manufacturers, more emphasis should be given to projects using new technologies. As most of the BNDES loans are selected by the retailing banking system, targeting innovative technologies may require rethinking the instructions given by BNDES to banks.

---

[29] Our findings are not an isolated case in the literature. For example, Criscuolo et al (2007) investigated the effect on industrial policy in the UK. Their results show no significant impact on firms' productivity, even though there are effects on employment and investment. Similar outcomes are also found by Ottaviano and Sousa (2008) and Sousa (2013) who investigating the same BNDES schemes through different empirical strategies.

References

Aldrighi, D. M., & Bisinha, R. (2010) "Restrição financeira em empresas com ações negociadas na Bovespa" Revista Brasileira de Economia, Vol. 64 (no. 1): pages 25-47.

Ambrozio, A. H. P., Faleiros, J. P., Sant'Anna, A. and Sousa, F. L. (2013) "Credit Scarcity in Developing Countries: An Empirical Investigation Using Brazilian Firm-Level Data" mimeo, presented at LACEA 2013.

Araújo, B., Esteves, L.A. e De Negri J.A. (2010) "BNDES, Inovação Tecnológica e Desempenho das Empresas Industriais Brasileiras" mimeo.

Arnold, J.M. and B.S. Javorcik (2005) "Gifted Kids or Pushy Parents? Foreign Acquisitions and Plant Performance in Indonesia" World Bank Working Paper No. 3597.

Banerjee, A. V. and E. Duflo (2005) "Growth Theory Through the Lens of Development Economics" Economics Handbook of Economic Growth, Vol. 1, Part A: pages 473-552.

Bronzini, R. and G. d. Blasio (2006) "Evaluating the impact of investments incentives: The case of the Italian Law 488/1992" Journal of Urban Economics, Vol. 60 (no. 2): pages 327-349.

Carpenter, R. and Guariglia, A. (2008) "Cash flow, investment, and investment opportunities: newtests using UK panel data" Journal of Banking and Finance, Vol. 32 (no. 9): pages 1894-1906.

Coelho, D. and De Negri, J. (2010) "Impacto do Financiamento do BNDES sobre a Produtividade das Empresas: Uma Aplicação do Efeito Quantílico de Tratamento" mimeo.

Coelho, D. and Sousa, F.L. (2010) "Os Efeitos dos Financiamentos do BNDES sobre o Desempenho das Empresas Industriais Brasileiras" in Estrutura Produtiva Avançada e Regionalmente Integrada: Desafios do Desenvolvimento Produtivo Brasileiro, Livro 5, Vol. 1, organized by De Negri, F. and Almeida, M., IPEA, Brasília.

Criscuolo, C., R. Martin, H.G. Overman and J.V. Reenen (2007) "The effect of industrial policy on corporate performance: Evidence from panel data" mimeo, London, UK.

De Negri, J. , De Negri, F. e Alves, P. (2008) "Os Financiamentos do BNDES têm Impacto Positivo sobre a Tecnologia, o Emprego e o Faturamento das firmas?" mimeo.

Fazzari, S., Hubbard, R. and Petersen, B. (1988) "Financing constraints and corporate investments" Brookings Papers on Economic Activity (no. 1): pages 141–206.

Guariglia, A. (2008). "Internal financial constraints, external financial constraints, and investment choice: evidence from a panel of UK firms" Journal of Banking and Finance, Vol. 32: pages 1795-1809.

Guariglia, A., Liu, X. and Song, L. (2011) "Internal finance and growth: microeconometric evidence on Chinese firms" Journal of Development Economics, Vol. 96 (no. 1): pages 79-94.

Grilliches, Z., T. J. Klette and J. Moen, et al. (2000). "Do subsidies to commercial R&D reduce market failures? Microeconometric evaluation studies" Research Policy, Vol. 29 (no. 4&5): pages 471-495.

Heckman, J. J., R. J. LaLonde and J.A. Smith (1999) "The Economics and Econometrics of Active Labour Market Programs." in Handbook of Labour Economics organized by O. Ashenfelter, D. E. Card and D. Card, Elsevier. Vol. 3: pages 1865-2097.

IADB (2013) "Annual Report 2013: The Year in Review" Washington, DC.

Levinsohn, J., and Petrin, A. (2003) "Estimating production functions using inputs to control for unobservables" The Review of Economic Studies, Vol. 70(no. 2): pages 317-341.

Ottaviano, G. e Sousa, F. (2008) "O efeito do BNDES na Produtividade das Empresas" in Políticas de Incentivo à Inovação Tecnológica organized by De Negri, J. and Kubota, L., IPEA, Brasília.

Ribeiro, E. P. e De Negri, J. (2009) "Public Credit Use and Manufacturing Productivity in Brazil" mimeo.

Sousa, F. (2013) "How Can Development Banks Boost Firms' Productivity?" in Development Evaluation in Times of Turbulence: Dealing with Crises that Endanger our Future organized by Ray Rist, Marie-Hélène Boily and Frederic Martin, World Bank, Washington DC, forthcoming.

Terra, M. C. (2003) "Credit constraints in Brazilian firms: evidence from panel data" Revista Brasileira de Economia, Vol. 57 (no. 2): pages: 443-464.

WB (2013) "The World Bank Annual Report 2013" Washington, DC.

Appendix I: List of Variables

Table A.1: Description of Variables

Variables	Variable Description	Source
Multinationals	Number of Multinationals	BACEN
%Multinationals	Share of Multinationals	BACEN
Labour Productivity	Value Added / Number of Employees	PIA
Value Added	Value Added	PIA
Number of Employees	Number of Employees	PIA
Average Wage	Total Wages / Number of Employees	PIA
Investment	Total Investment	PIA
Capital Stock	Capital Stock calculated by Perpetual Inventory (using Energy Consumption)	PIA
Total Revenue	Total Revenue (including Financial Revenue, for example)	PIA
Selling Revenue	Net Selling Revenues (only Goods)	PIA
Market Share	Market Share by Net Selling Revenues	PIA
Total Production Value	Value of Total Production (before taxes)	PIA
Energy Consumption	Expenditure in Electricity and Fuel Expenditure	PIA
Profitability	Net Profits / Total Revenue	PIA
Net Profit	Net Profits	PIA
Cash Flow	Net Profits plus Depreciation & Amortizations	PIA
Financial Status	Financial Expenditure / Total Costs	PIA
Solvency	Financial Expenditure / Net Selling Revenue	PIA
Financial Expenditures	Financial Expenditure	PIA
Total Cost	Total Cost	PIA
Efficiency	Production Cost / Total Production Value	PIA
Tax 1	Production Taxes / Selling Gross Revenue	PIA
Tax 2	All Taxes (Production + Land) / Selling Gross Revenue	PIA
Employees Growth	Annual Growth of Total Number of Employees	PIA
Revenue Growth	Annual Growth of Net Selling Revenue	PIA
Productivity Growth	Annual Growth of Productivity	PIA
Profit Growth	Annual Growth of Profits	PIA
Number Firms Profitable	Number of Firms which have earn Profits	PIA
Share of Profitable	Share of Profitable Firms	PIA
Rich Region	Number of Firms in Rich Regions	PIA
%Rich Region	Share of Firms in Rich Regions	PIA
Small Size	Number of Firms which Number of Employees is less than 100	PIA
Medium Size	Number of Firms which Number of Employees is greater than 100 and less than 500	PIA
Large Size	Number of Firms which Number of Employees is greater than 500	PIA
Share of Small	Share of Small Firms (< 100)	PIA
Share of Medium	Share of Medium Firms (> 100 e < 500)	PIA
Share of Large	Share of Large Firms (> 500)	PIA
OCDE Classification	High, Medium-High, Medium-Low and Low Technology	PIA & OCDE
Export Coefficient	Total Exports / Total Production Value	PIA & SECEX
Import Coefficient	Total Imports / Total Production Value	PIA & SECEX
Input Imports Coef	Intermediates Goods Imports / Manufacturing Operation Cost	PIA & SECEX
Capital Imports Coef	Capital Goods Imports / Investments	PIA & SECEX
Age	Number of Years of Firm's existence	RAIS
Workers' Schooling	Number of Years Spent on Education	RAIS
Skill Worker %	Share of Workers with at least Undergraduate Level Completed	RAIS
Capital Imports	Capital Goods Imports	SECEX
Input Imports	Intermediates Goods Imports	SECEX
Total Exports	Total Volume of Exports FOB	SECEX
Export Status	Percentage of Firms which have exported during 1996 to 2006	SECEX
Total Imports	Total Volume of Imports FOB	SECEX

Appendix II: Descriptive Statistics

Table A.2: Variables' Average from Financed Firms in 1998 and Non Financed Firms One Year Before Treatment (in 1997)

Variables	Non Treated Firms				Treated Firms			Unit
	All Firms over 30 employees	Survived and Invested from 1996 to 2006	No Investment before 1998	First Treated in 2007	All First Time in 1998	Automatic BNDES First Time in 1998	All only in 1998	
Number of Firms	21,380	6,344	1124	128	141	112	75	
Age	20.1	22.6	21	22.1	26.6	25	24.4	Years
Labour Productivity	26.6	26.8	12.5	27	35.5	29.7	31.8	R$ thousand / worker
Labour Productivity Growth	30.3%	26.0%	22.5%	14.3%	31.7%	27.6%	34.6%	%
TFP Levinhson-Petrin	100	99.6	94.8	99.1	102.6	101.9	101.7	TFP All Firms = 100
TFP Growth	-3.2%	-1.1%	-4.2%	-2.9%	0.5%	-1.6%	0.0%	%
Investment / Capital	3.7%	4.0%	0.0%	4.2%	6.6%	6.9%	5.5%	%
Cash Flow / Capital	12.3%	16.7%	12.2%	19.0%	10.5%	10.4%	11.2%	%
Export Status	45%	58%	40%	63%				%
Value Added	6.84	7.4	1.22	12.07	28.9	9.99	24.95	R$ millions
Number of Employees	175	196	89	255	620	332	468	Number
Average Wage	22	23.3	14.4	21.4	31.5	26.9	24.8	R$ thousand / worker
Workers' Schooling	6.7	6.7	6.1	6.5	7.1	7	6.9	Years
Skilled Worker %	5.80%	6.80%	3.62%	5.70%	9.20%	8.10%	9.20%	%
Investment	1.17	0.86	0	1.24	5.45	1.58	4.79	R$ millions
Capital Stock 1	31.58	19.61	3.97	34.86	84.45	29.02	53.87	R$ millions
Capital Stock 2	32.35	18.15	3.29	32.19	113.44	33.22	81.44	R$ millions
Total Revenue	17.01	16.56	3.0	25.21	80.71	22.66	82.02	R$ millions
Selling Revenue	15.71	15.41	2.91	21.65	72.91	21.22	73.5	R$ millions
Market Share	0.09%	0.11%	0.02%	0.12%	0.33%	0.11%	0.31%	%
Total Production Value	14.96	14.9	2.82	21.6	68.49	20.86	64.88	R$ millions
Capital Imports	0.32	0.3	0.02	0.3	3.49	0.28	5.64	R$ billions
Input Imports	1.18	1.2	0.09	1.54	3.97	0.63	4.2	R$ billions
Energy Consumption	1	0.99	0.23	1.23	5.99	0.93	2.54	R$ millions
Profitability	5.85%	6.69%	6.1%	7.92%	5.68%	5.89%	6.38%	%
Net Profit	1	1.11	0.41	2	4.58	1.34	5.23	R$ millions
Financial Status	3.90%	3.60%	2.79%	3.20%	4.70%	4.50%	5.00%	%
Solvency	3.90%	3.00%	2.77%	2.20%	2.80%	2.80%	3.10%	%
Solvency 2	3.60%	2.80%		1.90%	2.50%	2.60%	2.80%	%
Financial Expenditures	0.62	0.46	0.39	0.47	2.05	0.59	2.28	R$ millions
Total Cost	18.2	16.6	4.2	24.4	79.3	22.1	80.2	R$ millions
Efficiency	52%	50%	52%	53%	52%	52%	51%	%
Tax 1	17%	16%	15%	16%	15%	15%	15%	%
Tax 2	17%	16%	16%	17%	15%	15%	15%	%
Total Exports	1.87	1.75	0.17	4.47	9.27	1.13	6.45	R$ millions
Total Imports	1.75	1.78	0.14	2.14	8.67	1.2	11.68	R$ millions
Export Coefficient	4.90%	6.10%	2.68%	7.70%	6.50%	5.60%	5.10%	%
Import Coefficient	4.20%	4.60%	2.22%	5.30%	5.60%	4.60%	4.50%	%
Input Imports Coef	4%	5%	2%	7%	6%	5%	5%	%
Capital Imports Coef	5%	6%	0%	8%	9%	9%	5%	%
Employees Growth	0.10%	4.30%	3.39%	1.80%	8.80%	10.30%	6.20%	%
Revenue Growth	22.10%	20.60%	15.27%	16.90%	17.50%	13.70%	13.80%	%
Profit Growth	45.80%	50.10%	45.80%	15.30%	44.40%	50.30%	65.10%	%
Number Firms Profitable	4,344	1,740	240	36	40	34	24	Number
Share of Profitable	20.30%	27.40%	21.35%	28.10%	28.40%	30.40%	32.00%	%
Multinationals	1,089	509	8	7	21	13	8	Number
%Multinationals	5.09%	8.02%	0.71%	5.47%	14.89%	11.61%	10.67%	%
Rich Region	18,165	5,505	914	119	124	97	61	Number
%Rich Region	85%	87%	81%	93%	88%	87%	81%	%
Small Size	14,416	3,584	882	69	43	42	31	Number
Medium Size	5,686	2,304	231	45	57	48	27	Number
Large Size	1,278	456	11	14	41	22	17	Number
Share of Small	67%	56%	78%	54%	30%	38%	41%	%
Share of Medium	27%	36%	21%	35%	40%	43%	36%	%
Share of Large	6%	7%	1%	11%	29%	20%	23%	%
OCDE Classification								
High & Medium-High Tech	4,732	1,648	193	23	45	36	26	Number
Medium-Low Tech	5,360	1,789	364	36	30	18	13	Number
Low Tech	11,288	2,907	567	69	66	58	36	Number
Share High & Medium-High Tech	22%	26%	17%	18%	32%	32%	35%	%
Share Medium-Low Tech	25%	28%	32%	28%	21%	16%	17%	%
Share Low Tech	53%	46%	50%	54%	47%	52%	48%	%

Appendix III: Propensity score matching

Table A.3: Probit Model Results

Probit Model	Employees	Revenues
Dependent Variable: BNDES Dummy	(i)	(ii)
Capital Stock	0.08	0.06
	(0.04)**	(0.04)
Number Employees	0.17	
	(0.06)***	
Revenue		0.15
		(0.05)***
Solvency	-0.96	-0.86
	(0.85)	(0.84)
Profit	-0.58	-0.71
	(0.54)	(0.55)
Profit Growth	0.07	0.08
	(0.04)*	(0.04)*
Employees Growth	0.28	0.38
	(0.16)*	(0.16)**
Revenue Growth	-0.10	-0.17
	(0.14)	(0.14)
Market Share	190.87	182.76
	(87.14)**	(87.58)*
Multinational Status	-0.10	-0.17
	(0.14)	(0.14)
Rich Region	0.14	0.12
	(0.13)	(0.13)
Sector Dummies	Yes	Yes
Observations	5.55	5.55
Percent Concordant	76%	76.2%
Hosmer and Lemeshow Statistic	0.86	0.74

Table A.3.a: Comparing Granted Firms by Automatic BNDES after Matching with Non Granted

	Non-Treated		Treated		Testing Matched Firms	
	Not Matched	Matched	Matched	Not Matched	t Value	P-value
Capital Stock	18	26	30	20	-0.49	62.8%
Number of Employees	192	312	337	297	-0.36	72.1%
Solvency	3.0%	2.4%	2.6%	4.3%	-0.39	69.8%
Profit	6.7%	6.1%	6.5%	1.00%	-0.40	68.6%
Profit Growth	49%	87%	51%	-23%	1.22	22.5%
Employment Growth	4%	4%	9%	19%	-1.21	22.9%
Revenue Growth	21%	18%	16%	0%	0.51	61.0%
Market Share	0.1%	0.1%	0.1%	0%	-1.43	15.3%
Multinational Status	8%	6%	13%	0%	-1.69	9.2%
Rich	87%	85%	88%	77%	-0.62	53.7%
Labour Productivity	26.7	25.2	31.7	14.1	-1.72	8.7%
TFP Productivity	99.6	100	102.7	93.5	-1.55	12.3%
Investment	0.8	1.4	1.6	1.6	-0.25	80.5%
Cash Flow / Capital	16.8%	10.8%	10.1%	12.4%	0.41	68.2%
Investment / Capital	4.0%	4.4%	7.0%	6.4%	-2.94	0.3%
Number of Firms	6234	99	99	13		

Table A.3.b: Comparing Granted Firms only in 1998 after Matching with Non Granted

	Non-Treated		Treated		Testing Matched Firms	
	Not Matched	Matched	Matched	Not Matched	t Value	P-value
Capital Stock	20	27	35	17.7	-0.65	51.8%
Number of Employees	195	298	302	1.553	-0.05	95.8%
Solvency	3.0%	2.5%	3.1%	2.8%	-0.62	53.7%
Profit	6.7%	6.8%	7.0%	2.4%	-0.10	92.2%
Profit Growth	50%	54%	63%	117%	-0.27	79.1%
Employment Growth	4%	3%	5%	18%	-0.33	74.4%
Revenue Growth	21%	19%	15%	9%	0.81	41.9%
Market Share	0.1%	0.1%	0.1%	1.6%	-1.18	24.1%
Multinational Status	8%	6%	9%	20%	-0.65	51.4%
Rich	87%	85%	83%	70%	0.24	81.3%
Labour Productivity	26.9	25.7	31.5	33.7	-1.12	26.7%
TFP Productivity	99.6	100.2	102.2	99.1	-1.36	17.5%
Investment	0.9	0.6	2.5	18.0	-1.78	7.8%
Cash Flow / Capital	16.7%	10.5%	10.3%	17%	0.08	93.6%
Investment / Capital	4.0%	5.9%	4.1%	14.4%	1.59	11.2%
Number of Firms	6279	65	65	10		

Appendix IV: Credit constraints for alternative treated groups

Table A.4.a: Credit Restriction - Automatic BNDES

Dependent Variable: Invest / K	All Firms	Invested Firms	No Investment before 1998	Granted 2007	Paired Firms with Group II
	(1)	(2)	(3)	(4)	(5)
Cash Flow / K	0.000814**	0.000430	0.00559*	-0.00642	0.0664
	(0.000411)	(0.00110)	(0.00291)	(0.0167)	(0.0426)
BNDES * Cash Flow / K	0.135***	0.126***	0.274***	0.114**	0.0728
	(0.0349)	(0.0346)	(0.0174)	(0.0485)	(0.0646)
Sales / K	-0.000290***	-0.000414***	-0.00541***	-0.00106	-0.0524***
	(3.46e-05)	(0.000159)	(0.00112)	(0.00404)	(0.0113)
Sales / K lagged in time	0.000352***	0.000290***	0.00677***	0.000501**	0.0299***
	(1.96e-05)	(2.44e-05)	(0.000993)	(0.000208)	(0.00587)
Sector Investment	0.0901***	0.104***	0.00889	0.111**	0.0317
	(0.00397)	(0.00630)	(0.00876)	(0.0434)	(0.0514)
Sector Value Added Var.	-0.0562***	-0.0701***	-0.0247*	-0.0799	-0.0101
	(0.00588)	(0.00932)	(0.0127)	(0.0655)	(0.0723)
OCDE Tech. Dummy	Yes	Yes	Yes	Yes	Yes
Region Dummy	Yes	Yes	Yes	Yes	Yes
Multinational Dummy	Yes	Yes	Yes	Yes	Yes
Size Dummy	Yes	Yes	Yes	Yes	Yes
Observations	18,075	6,456	1,217	242	180
R-squared	0.111	0.131	0.300	0.207	0.222

Robust standard errors in parentheses

*** p<0.01, ** p<0.05, *p<0.1

Table A.4.b: Credit Restriction - Only 1998

Dependent Variable: Invest / K	All Firms	Invested Firms	No Investment before 1998	Granted 2007	Paired Firms with Group III
	(1)	(2)	(3)	(4)	(5)
Cash Flow / K	0.000827**	0.000519	0.00158	0.0141	0.0871
	(0.000410)	(0.00109)	(0.00224)	(0.0157)	(0.0656)
BNDES * Cash Flow / K	0.0599	0.0549	0.198***	0.0544	0.0836
	(0.0373)	(0.0370)	(0.0136)	(0.0452)	(0.0686)
Sales / K	-0.000290***	-0.000423***	-0.00186**	-0.0131**	-0.0417***
	(3.45e-05)	(0.000158)	(0.000941)	(0.00558)	(0.00978)
Sales / K lagged in time	0.000352***	0.000290***	0.000856	0.000952***	0.0344***
	(1.95e-05)	(2.43e-05)	(0.00147)	(0.000258)	(0.00673)
Sector Investment	0.0898***	0.104***	0.00555	0.0663	-0.0233
	(0.00397)	(0.00630)	(0.00693)	(0.0442)	(0.0583)
Sector Value Added Var.	-0.0556***	-0.0689***	-0.0159	-0.0238	0.0400
	(0.00588)	(0.00932)	(0.0101)	(0.0669)	(0.0860)
OCDE Tech. Dummy	Yes	Yes	Yes	Yes	Yes
Region Dummy	Yes	Yes	Yes	Yes	Yes
Multinational Dummy	Yes	Yes	Yes	Yes	Yes
Size Dummy	Yes	Yes	Yes	Yes	Yes
Observations	18,038	6,419	1,181	205	128
R-squared	0.110	0.129	0.226	0.246	0.324

Robust standard errors in parentheses

*** p<0.01, ** p<0.05, *p<0.1

Appendix V: Post-treatment performance for alternative treated groups

Table A.5.a: Results of Difference-in-Differences (More than Once)

Control Group	All Firms		Invested		No Invest. before 98		BNDES 2007		Paired	
Dependent Variable	Labor	TFP	Labor	TFP	Labor	TFP	Labor	TFP	Labor	TFP
Effect in 1998	0.130**	-0.00728	0.0943*	0.0162	0.192***	0.0180	0.180	0.0211	0.103	0.0176
	(0.0577)	(0.0466)	(0.0565)	(0.0451)	(0.0711)	(0.0477)	(0.156)	(0.0649)	(0.102)	(0.0605)
Effect in 1999	0.150***	-0.0589	0.109**	-0.0210	0.183***	-0.0516	0.0303	-0.0227	0.0940	-0.0414
	(0.0549)	(0.0449)	(0.0533)	(0.0431)	(0.0669)	(0.0467)	(0.123)	(0.0609)	(0.0983)	(0.0587)
Effect in 2000	0.181***	-0.0764	0.130**	-0.0185	0.216***	-0.0564	0.0742	-0.0383	0.194	-0.0889
	(0.0562)	(0.0466)	(0.0550)	(0.0442)	(0.0698)	(0.0475)	(0.158)	(0.0613)	(0.118)	(0.0595)
Effect in 2001	0.163***	-0.0839*	0.128**	-0.0276	0.194***	-0.0599	0.281	0.00854	0.195*	-0.0620
	(0.0589)	(0.0433)	(0.0574)	(0.0415)	(0.0687)	(0.0450)	(0.199)	(0.0587)	(0.119)	(0.0599)
Effect in 2002	0.169***	-0.0512	0.153***	0.0224	0.244***	-0.0100	0.182	0.0121	0.0724	0.00629
	(0.0567)	(0.0455)	(0.0550)	(0.0442)	(0.0696)	(0.0471)	(0.130)	(0.0624)	(0.0736)	(0.0609)
Effect in 2003	0.126**	-0.0978**	0.123**	-0.0284	0.185***	-0.0823*	-0.0456	-0.0402	0.104	-0.0610
	(0.0529)	(0.0462)	(0.0511)	(0.0450)	(0.0642)	(0.0484)	(0.106)	(0.0606)	(0.0743)	(0.0622)
Effect in 2004	0.0993*	-0.106**	0.113**	-0.0184	0.115*	-0.0840*	-0.0556	-0.0598	0.0918	-0.0664
	(0.0583)	(0.0442)	(0.0561)	(0.0429)	(0.0668)	(0.0465)	(0.108)	(0.0620)	(0.0760)	(0.0606)
Effect in 2005	0.0573	-0.134***	0.0875	-0.0462	0.0919	-0.111**	-0.0822	-0.0574	0.0717	-0.104*
	(0.0587)	(0.0434)	(0.0563)	(0.0417)	(0.0660)	(0.0456)	(0.108)	(0.0612)	(0.0763)	(0.0628)
Effect in 2006	0.0122	-0.193***	0.0600	-0.0636	0.0719	-0.123***	-0.104	-0.115*	0.0789	-0.0791
	(0.0581)	(0.0457)	(0.0563)	(0.0439)	(0.0655)	(0.0472)	(0.107)	(0.0642)	(0.0744)	(0.0606)
Multiple Treatments	0.00255	0.00167	0.00657	-0.0138*	0.00347	-0.0197***	0.0136	-0.00822	0.0120	-0.0262***
	(0.00802)	(0.00723)	(0.00782)	(0.00712)	(0.00914)	(0.00759)	(0.00915)	(0.00752)	(0.0102)	(0.00816)
Invest. Domestic Capital	0.0194***		-0.0147***		-0.0155		-0.144***		-0.0217	
	(0.00450)		(0.00568)		(0.0185)		(0.0394)		(0.0301)	
Invest. Imported Capital	0.0181*		0.0143		0.0471**		0.0770**		0.0529**	
	(0.00904)		(0.00900)		(0.0231)		(0.0319)		(0.0225)	
Imported Inputs	0.436***	0.466***	0.383***	0.445***	0.798***	0.666***	0.931***	0.623***	0.710***	0.755***
	(0.0966)	(0.0369)	(0.136)	(0.0598)	(0.251)	(0.142)	(0.220)	(0.105)	(0.199)	(0.133)
Export Coefficient	0.203***	-0.0908***	0.106***	-0.115***	0.274***	-0.0178	-0.00709	-0.263***	0.118*	0.00769
	(0.0384)	(0.00923)	(0.0363)	(0.0130)	(0.0524)	(0.0334)	(0.0788)	(0.0530)	(0.0662)	(0.0548)
Import Coefficient	-1.211***	-0.614***	-1.238***	-0.582***	-1.558***	-0.988***	-1.568***	-0.859***	-1.156***	-1.174***
	(0.163)	(0.0430)	(0.182)	(0.0704)	(0.458)	(0.153)	(0.510)	(0.157)	(0.331)	(0.180)
Net Sales Revenue	0.496***	0.0606***	0.554***	0.100***	0.455***	0.0891**	0.543***	0.103***	0.584***	0.108***
	(0.00490)	(0.00180)	(0.00726)	(0.00238)	(0.0150)	(0.00640)	(0.0267)	(0.0108)	(0.0275)	(0.0113)
Cost over Revenue	-2.010***	-1.260***	-2.250***	-1.273***	-2.580***	-1.436***	-2.217***	-0.955***	-1.670***	-1.071***
	(0.0750)	(0.0248)	(0.0764)	(0.0276)	(0.162)	(0.0757)	(0.268)	(0.107)	(0.378)	(0.112)
Firms' Age	-0.0175***	-0.171***	0.0312***	-0.0535***	0.0805***	-0.0205**	-0.0496	0.0213	0.0997*	0.00228
	(0.00380)	(0.00216)	(0.00786)	(0.00360)	(0.0213)	(0.00982)	(0.0464)	(0.0212)	(0.0516)	(0.0193)
Years of Schooling	-0.0162*	-0.303***	-0.0122	-0.309***	-0.0558	-0.300***	0.0764	-0.324***	0.266**	-0.202***
	(0.00971)	(0.00542)	(0.0144)	(0.00708)	(0.0368)	(0.0170)	(0.0701)	(0.0443)	(0.115)	(0.0491)
Skilled Labour	0.309***	0.586***	0.127***	0.549***	0.321*	0.495***	0.0693	0.460***	-0.0225	0.522***
	(0.0350)	(0.0209)	(0.0469)	(0.0282)	(0.169)	(0.0762)	(0.180)	(0.112)	(0.195)	(0.109)
Average Salary	0.567***	0.266***	0.520***	0.211***	0.593***	0.232***	0.426***	0.192***	0.435***	0.125***
	(0.00682)	(0.00332)	(0.00956)	(0.00420)	(0.0255)	(0.0114)	(0.0418)	(0.0212)	(0.0351)	(0.0209)
Investments	0.0103***	-0.0121**	0.0112***	-0.00203***	0.00941***	0.000735	0.00338	-0.00199	0.00989**	-0.00133
	(0.000421)	(0.000224)	(0.000611)	(0.000295)	(0.00162)	(0.000784)	(0.00353)	(0.00170)	(0.00389)	(0.00174)
Solvency	1.272***	0.559***	1.323***	0.607***	1.343***	0.819***	1.795***	0.522***	1.323***	0.609***
	(0.0856)	(0.0327)	(0.0976)	(0.0379)	(0.325)	(0.102)	(0.298)	(0.173)	(0.265)	(0.139)
Revenue Growth	-0.461***	0.0422***	-0.444***	0.0304***	-0.443***	0.0291*	-0.388***	0.0693**	-0.373**	0.0437
	(0.0126)	(0.00412)	(0.0241)	(0.00615)	(0.0494)	(0.0143)	(0.119)	(0.0287)	(0.145)	(0.0304)
Employment Growth	0.463***	-0.0161**	0.451***	0.00961	0.400***	0.00381	0.286**	-0.0338	0.478***	-0.00706
	(0.0117)	(0.00433)	(0.0234)	(0.00693)	(0.0545)	(0.0165)	(0.131)	(0.0368)	(0.162)	(0.0337)
Productivity Growth	0.492***	0.0353***	0.475***	0.0325***	0.452***	0.0272***	0.469***	0.0167**	0.483***	0.0265**
	(0.00995)	(0.00117)	(0.0206)	(0.00180)	(0.0421)	(0.00404)	(0.116)	(0.00710)	(0.168)	(0.0134)
Profitable	0.170***	0.0635***	0.0907***	0.0405***	0.137***	0.0503***	0.0960***	0.0287*	0.00363	0.0185
	(0.00772)	(0.00334)	(0.00697)	(0.00339)	(0.0179)	(0.0105)	(0.0292)	(0.0162)	(0.0251)	(0.0156)
Multinational	0.0506***	-0.0340***	0.0414***	-0.0648***	-0.119***	-0.100***	-0.0859**	-0.117***	-0.0659*	-0.0298
	(0.0109)	(0.00507)	(0.0114)	(0.00627)	(0.0383)	(0.0234)	(0.0378)	(0.0249)	(0.0371)	(0.0236)
Year Dummy	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
OCDE Dummy	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Size Dummy	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Sector Dummy	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Region Dummy	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Observations	203.418	192.97	78.137	76.878	12.22	11.811	2.698	2.674	2.336	2.317
R-squared	0.693	0.336	0.707	0.445	0.669	0.405	0.694	0.446	0.779	0.495

Robust standard errors in parentheses

*** p<0.01, ** p<0.05, * p<0.1

Table A.5.b: Results of Difference-in-Differences (Only 1998)

Control Group	All Firms		Invested		No Invest. before 98		BNDES 2007		Paired	
Dependent Variable	Labor	TFP	Labor	TFP	Labor	TFP	Labor	TFP	Labor	TFP
Effect in 1998	0.0261	-0.0195	0.129	0.0173	0.229**	0.0226	0.230	0.0197	0.009	-0.102
	(0.0822)	(0.0329)	(0.0865)	(0.0648)	(0.0946)	(0.0663)	(0.168)	(0.0791)	(0.104)	(0.116)
Effect in 1999	0.0508	-0.0326	0.133*	-0.0159	0.204**	-0.0442	0.0578	-0.0279	-0.0456	-0.104
	(0.0722)	(0.0371)	(0.0802)	(0.0608)	(0.0884)	(0.0635)	(0.137)	(0.0735)	(0.103)	(0.0908)
Effect in 2000	0.0432	-0.0664*	0.106	-0.0333	0.187**	-0.0683	0.0461	-0.0676	-0.0694	-0.0710
	(0.0972)	(0.0394)	(0.0854)	(0.0621)	(0.0947)	(0.0646)	(0.172)	(0.0746)	(0.109)	(0.0853)
Effect in 2001	0.0752	-0.0911**	0.0971	-0.0568	0.163*	-0.0841	0.258	-0.0335	-0.0422	-0.121
	(0.0559)	(0.0377)	(0.0891)	(0.0603)	(0.0954)	(0.0730)	(0.210)	(0.0730)	(0.112)	(0.0865)
Effect in 2002	0.0710	-0.0839**	0.135	0.0168	0.216**	-0.0110	0.175	-0.00557	0.0728	-0.109
	(0.0510)	(0.0377)	(0.0845)	(0.0650)	(0.0952)	(0.0672)	(0.146)	(0.0774)	(0.103)	(0.0917)
Effect in 2003	0.0608	-0.131***	0.141*	-0.0391	0.201**	-0.0859	-0.0240	-0.0647	0.121	-0.105
	(0.0516)	(0.0380)	(0.0779)	(0.0630)	(0.0862)	(0.0660)	(0.122)	(0.0741)	(0.103)	(0.0821)
Effect in 2004	0.0246	-0.136***	0.132*	-0.0256	0.128	-0.0850	-0.0231	-0.0854	0.168	-0.0781
	(0.0589)	(0.0385)	(0.0801)	(0.0611)	(0.0870)	(0.0641)	(0.122)	(0.0752)	(0.117)	(0.0822)
Effect in 2005	0.0122	-0.170***	0.117	-0.0547	0.124	-0.109*	-0.0376	-0.0796	0.117	-0.114
	(0.0498)	(0.0395)	(0.0796)	(0.0595)	(0.0852)	(0.0627)	(0.121)	(0.0735)	(0.112)	(0.0824)
Effect in 2006	-0.0647	-0.248***	0.0608	-0.0815	0.0688	-0.132**	-0.0978	-0.144*	0.0128	-0.155
	(0.0567)	(0.0416)	(0.0868)	(0.0629)	(0.0916)	(0.0658)	(0.125)	(0.0783)	(0.117)	(0.0944)
Invest. Domestic Capital	0.0196***		-0.0138**		-0.00629		-0.119**		-0.0182	
	(0.00450)		(0.00570)		(0.0190)		(0.0478)		(0.0300)	
Invest. Imported Capital	0.0186**		0.0142		0.0509**		0.0949**		0.000187	
	(0.00907)		(0.00902)		(0.0249)		(0.0415)		(0.0319)	
Imported Inputs	0.440***	0.467***	0.381***	0.445***	0.791***	0.676***	0.962***	0.676***	0.673***	0.711***
	(0.0970)	(0.0371)	(0.136)	(0.0600)	(0.262)	(0.147)	(0.257)	(0.108)	(0.184)	(0.118)
Export Coefficient	0.206***	-0.0892***	0.110***	-0.111**	0.355***	0.0295	0.107	-0.240***	-0.373***	-0.316***
	(0.0387)	(0.00925)	(0.0367)	(0.0131)	(0.0567)	(0.0351)	(0.0940)	(0.0622)	(0.0943)	(0.114)
Import Coefficient	-1.218***	-0.616***	-1.239***	-0.578***	-1.568***	-0.953***	-1.661***	-0.802***	-0.671**	-1.011***
	(0.164)	(0.0432)	(0.182)	(0.0706)	(0.480)	(0.155)	(0.633)	(0.160)	(0.278)	(0.195)
Net Sales Revenue	0.495***	0.0606***	0.552***	0.100***	0.442***	0.0865***	0.525***	0.110***	0.625***	0.108***
	(0.00491)	(0.00181)	(0.00731)	(0.00239)	(0.0156)	(0.00670)	(0.0296)	(0.0125)	(0.0242)	(0.0154)
Cost over Revenue	-2.010***	-1.259***	-2.253***	-1.275***	-2.605***	-1.452***	-2.310***	-1.000***	-2.106***	-1.337***
	(0.0750)	(0.0248)	(0.0767)	(0.0278)	(0.166)	(0.0778)	(0.307)	(0.114)	(0.221)	(0.164)
Firms' Age	-0.0175***	-0.170***	0.0311***	-0.0538***	0.0833***	-0.0217**	-0.0629	0.0335	0.0840**	-0.0447
	(0.00380)	(0.00216)	(0.00791)	(0.00362)	(0.0220)	(0.0101)	(0.0588)	(0.0247)	(0.0334)	(0.0293)
Years of Schooling	-0.0171*	-0.303***	-0.0144	-0.310***	-0.0674*	-0.302***	0.0600	-0.306***	-0.122	-0.365***
	(0.00971)	(0.00542)	(0.0145)	(0.00710)	(0.0376)	(0.0173)	(0.0852)	(0.0471)	(0.0796)	(0.0696)
Skilled Labour	0.316***	0.588***	0.135***	0.552***	0.430**	0.523***	0.0299	0.263*	0.678***	0.864***
	(0.0351)	(0.0210)	(0.0475)	(0.0286)	(0.201)	(0.0867)	(0.269)	(0.156)	(0.185)	(0.181)
Average Salary	0.567***	0.265***	0.521***	0.211***	0.608***	0.230***	0.425***	0.161***	0.287***	0.123***
	(0.00683)	(0.00333)	(0.00963)	(0.00422)	(0.0271)	(0.0118)	(0.0542)	(0.0242)	(0.0401)	(0.0236)
Investments	0.0104***	-0.0121***	0.0113***	-0.00201**	0.00959***	0.000920	0.00431	-0.000642	0.0150***	-9.56e-05
	(0.000422)	(0.000224)	(0.000613)	(0.000296)	(0.00165)	(0.000798)	(0.00393)	(0.00188)	(0.00289)	(0.00272)
Solvency	1.272***	0.560***	1.325***	0.609***	1.354***	0.843***	1.917***	0.543***	1.212***	0.775***
	(0.0855)	(0.0327)	(0.0980)	(0.0380)	(0.331)	(0.105)	(0.354)	(0.192)	(0.170)	(0.136)
Revenue Growth	-0.461***	0.0423***	-0.444***	0.0301***	-0.444***	0.0281*	-0.394***	0.0545	-0.343***	0.00183
	(0.0126)	(0.00412)	(0.0241)	(0.00617)	(0.0499)	(0.0146)	(0.130)	(0.0332)	(0.0729)	(0.0414)
Employment Growth	0.463***	-0.0162***	0.452***	0.00881	0.399***	-0.000569	0.257	-0.0884*	0.273***	-0.0425
	(0.0118)	(0.00433)	(0.0236)	(0.00699)	(0.0567)	(0.0172)	(0.169)	(0.0509)	(0.0905)	(0.0485)
Productivity Growth	0.492***	0.0353***	0.475***	0.0324***	0.452***	0.0269***	0.471***	0.0139**	0.411***	0.0518**
	(0.00994)	(0.00117)	(0.0207)	(0.00180)	(0.0423)	(0.00406)	(0.120)	(0.00695)	(0.0678)	(0.0226)
Profitable	0.171***	0.0638***	0.0918***	0.0411***	0.150***	0.0555***	0.129***	0.0408**	0.0451*	0.00104
	(0.00773)	(0.00335)	(0.00702)	(0.00341)	(0.0188)	(0.0110)	(0.0362)	(0.0184)	(0.0241)	(0.0241)
Multinational	0.0504***	-0.0341***	0.0428***	-0.0651***	-0.148***	-0.0951***	-0.109*	-0.141***	0.0334	0.0597
	(0.0110)	(0.00510)	(0.0116)	(0.00638)	(0.0537)	(0.0338)	(0.0632)	(0.0387)	(0.0540)	(0.0503)
Year Dummy	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
OCDE Dummy	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Size Dummy	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Sector Dummy	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Region Dummy	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Observations	203,150	192,703	77,479	76,220	11,562	11,153	2,040	2,016	1,273	1,254
R-squared	0.693	0.336	0.705	0.445	0.645	0.402	0.653	0.457	0.870	0.458

Robust standard errors in parentheses

*** p<0.01, ** p<0.05, * p<0.1

Table A.5.c: Results of Difference-in-Differences (Automatic BNDES)

Control Group	All Firms		Invested		No Invest. before 98		BNDES 2007		Paired	
Dependent Variable	Labor	TFP	Labor	TFP	Labor	TFP	Labor	TFP	Labor	TFP
Effect in 1998	0.137**	-0.00221	0.105	0.0217	0.201***	0.0230	0.189	0.0239	0.0555	0.0430
	(0.0665)	(0.0522)	(0.0778)	(0.0517)	(0.0778)	(0.0684)	(0.158)	(0.0684)	(0.0960)	(0.0739)
Effect in 1999	0.160***	-0.0598	0.121**	-0.0196	0.196***	-0.0527	0.0444	-0.0215	0.0425	0.00260
	(0.0618)	(0.0482)	(0.0594)	(0.0456)	(0.0713)	(0.0486)	(0.126)	(0.0626)	(0.0917)	(0.0691)
Effect in 2000	0.195***	-0.0844*	0.146**	-0.0266	0.228***	-0.0664	0.0845	-0.0457	-0.0159	-0.000504
	(0.0610)	(0.0505)	(0.0595)	(0.0472)	(0.0734)	(0.0499)	(0.160)	(0.0631)	(0.102)	(0.0708)
Effect in 2001	0.161**	-0.0935*	0.127**	-0.0375	0.190***	-0.0717	0.281	0.000887	-0.00923	-0.00799
	(0.0631)	(0.0485)	(0.0614)	(0.0461)	(0.0722)	(0.0487)	(0.201)	(0.0617)	(0.102)	(0.0671)
Effect in 2002	0.158**	-0.0695	0.141**	0.00287	0.228***	-0.0316	0.167	-0.0108	0.000578	0.0156
	(0.0634)	(0.0509)	(0.0612)	(0.0492)	(0.0748)	(0.0515)	(0.132)	(0.0656)	(0.0974)	(0.0708)
Effect in 2003	0.105*	-0.107**	0.102*	-0.0347	0.161**	-0.0903*	-0.0727	-0.0507	0.0414	-0.0292
	(0.0610)	(0.0514)	(0.0701)	(0.0500)	(0.0701)	(0.0527)	(0.110)	(0.0641)	(0.0959)	(0.0717)
Effect in 2004	0.0834	-0.0932*	0.0968	-0.00373	0.0982	-0.0728	-0.0746	-0.0529	0.00902	0.0355
	(0.0680)	(0.0497)	(0.0655)	(0.0475)	(0.0747)	(0.0505)	(0.112)	(0.0653)	(0.0961)	(0.0690)
Effect in 2005	0.0429	-0.123**	0.0763	-0.0321	0.0810	-0.0962*	-0.101	-0.0494	0.0174	-0.0142
	(0.0687)	(0.0493)	(0.0658)	(0.0467)	(0.0740)	(0.0497)	(0.113)	(0.0642)	(0.0943)	(0.0695)
Effect in 2006	0.0196	-0.184***	0.0707	-0.0534	0.0769	-0.112**	-0.102	-0.111*	-0.0211	-0.0172
	(0.0667)	(0.0509)	(0.0649)	(0.0486)	(0.0725)	(0.0512)	(0.111)	(0.0671)	(0.108)	(0.0699)
Multiple Treatments	0.0160	0.00623	0.0144	-0.00783	0.0125	-0.0138	0.0176	-0.0124	0.0378***	-0.0121
	(0.0106)	(0.00914)	(0.0104)	(0.00890)	(0.0114)	(0.00902)	(0.0112)	(0.00881)	(0.0111)	(0.00950)
Invest. Domestic Capital	0.0193***		-0.0148***		-0.0157		-0.154***		0.0364	
	(0.00451)		(0.00569)		(0.0186)		(0.0416)		(0.0266)	
Invest. Imported Capital	0.0183**		0.0144		0.0545**		0.0811**		0.0478	
	(0.00904)		(0.00900)		(0.0235)		(0.0359)		(0.0342)	
Imported Inputs	0.435***	0.466***	0.381***	0.445***	0.775***	0.666***	0.890***	0.659***	0.828***	0.696***
	(0.0964)	(0.0369)	(0.136)	(0.0598)	(0.253)	(0.143)	(0.238)	(0.104)	(0.279)	(0.223)
Export Coefficient	0.205***	-0.0904***	0.109***	-0.114***	0.324***	-0.0108	0.0494	-0.323***	0.263***	-0.123*
	(0.0384)	(0.00924)	(0.0365)	(0.0130)	(0.0539)	(0.0343)	(0.0894)	(0.0572)	(0.0725)	(0.0684)
Import Coefficient	-1.211***	-0.614***	-1.237***	-0.579***	-1.533***	-0.969***	-1.514***	-0.826***	-0.759*	-1.008***
	(0.163)	(0.0431)	(0.181)	(0.0705)	(0.471)	(0.153)	(0.580)	(0.155)	(0.452)	(0.337)
Net Sales Revenue	0.496***	0.0606***	0.554***	0.101***	0.451***	0.0922***	0.542***	0.117***	0.593***	0.122***
	(0.00490)	(0.00181)	(0.00727)	(0.00239)	(0.0152)	(0.00659)	(0.0279)	(0.0120)	(0.0203)	(0.0141)
Cost over Revenue	-2.011***	-1.260***	-2.252***	-1.274***	-2.600***	-1.442***	-2.347***	-0.978***	-1.822***	-1.206***
	(0.0751)	(0.0249)	(0.0766)	(0.0277)	(0.164)	(0.0773)	(0.291)	(0.114)	(0.187)	(0.146)
Firms' Age	-0.0175***	-0.170***	0.0310***	-0.0529***	0.0796***	-0.0164*	-0.0560	0.0369*	-0.0217	-0.0362
	(0.00380)	(0.00216)	(0.00787)	(0.00360)	(0.0214)	(0.00985)	(0.0497)	(0.0215)	(0.0246)	(0.0224)
Years of Schooling	-0.0164*	-0.303***	-0.0127	-0.308***	-0.0595	-0.290***	0.0667	-0.254***	0.187***	-0.248***
	(0.00972)	(0.00543)	(0.0145)	(0.00709)	(0.0379)	(0.0172)	(0.0856)	(0.0494)	(0.0696)	(0.0525)
Skilled Labour	0.311***	0.585***	0.130***	0.548***	0.371**	0.499***	0.0946	0.317**	0.365**	0.405***
	(0.0351)	(0.0210)	(0.0474)	(0.0285)	(0.186)	(0.0829)	(0.227)	(0.138)	(0.182)	(0.132)
Average Salary	0.567***	0.266***	0.519***	0.210***	0.592***	0.225***	0.402***	0.156***	0.373***	0.175***
	(0.00683)	(0.00332)	(0.00957)	(0.00420)	(0.0260)	(0.0114)	(0.0443)	(0.0212)	(0.0285)	(0.0216)
Investments	0.0103***	-0.0121***	0.0112***	-0.00202**	0.00938***	0.000883	0.00319	-0.00116	0.00329	-0.000822
	(0.000421)	(0.000224)	(0.000612)	(0.000295)	(0.00163)	(0.000790)	(0.00376)	(0.00176)	(0.00238)	(0.00189)
Solvency	1.271***	0.559***	1.323***	0.605***	1.339***	0.818***	1.819***	0.379**	1.505***	0.746***
	(0.0857)	(0.0327)	(0.0980)	(0.0380)	(0.332)	(0.105)	(0.351)	(0.187)	(0.282)	(0.222)
Revenue Growth	-0.462***	0.0423***	-0.445***	0.0306***	-0.446***	0.0293**	-0.412***	0.0791**	-0.373***	0.0104
	(0.0126)	(0.00412)	(0.0241)	(0.00616)	(0.0498)	(0.0145)	(0.126)	(0.0310)	(0.0911)	(0.0422)
Employment Growth	0.463***	-0.0164***	0.450***	0.00879	0.392***	-0.00189	0.246*	-0.0737*	0.397***	0.0191
	(0.0118)	(0.00433)	(0.0235)	(0.00697)	(0.0556)	(0.0168)	(0.145)	(0.0438)	(0.0931)	(0.0432)
Productivity Growth	0.492***	0.0353***	0.475***	0.0325***	0.452***	0.0272***	0.470***	0.0164**	0.428***	0.0398**
	(0.00995)	(0.00117)	(0.0207)	(0.00180)	(0.0422)	(0.00406)	(0.118)	(0.00711)	(0.0677)	(0.0193)
Profitable	0.171***	0.0635***	0.0909***	0.0404***	0.141***	0.0505***	0.103***	0.0216	0.00879	0.0155
	(0.00773)	(0.00335)	(0.00699)	(0.00340)	(0.0183)	(0.0107)	(0.0318)	(0.0167)	(0.0241)	(0.0190)
Multinational	0.0516***	-0.0344***	0.0429***	-0.0659***	-0.0906**	-0.122***	-0.0614	-0.167***	-0.124**	-0.0870***
	(0.0110)	(0.00509)	(0.0114)	(0.00632)	(0.0441)	(0.0275)	(0.0481)	(0.0310)	(0.0526)	(0.0276)
Year Dummy	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
OCDE Dummy	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Size Dummy	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Sector Dummy	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Region Dummy	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Observations	203.128	192,684	77,847	76,592	11,930	11,525	2.408	2,388	1.747	1.783
R-squared	0.693	0.336	0.705	0.445	0.653	0.402	0.664	0.439	0.812	0.509

Robust standard errors in parentheses

*** p<0.01, ** p<0.05, * p<0.1

Appendix VI: Measuring TFP à la Levinsohn and Petrin (2003)

We have used the following variables:

a) Labour – We use the total number of employees for each firm multiplied by their average number of years spent on schooling as measure of human capital.
b) Capital – Sector investment from 1985 to 1995 is used to create a sector capital stock by perpetual inventory. Sector capital stock in 1995 is allocated across firms in 1996 based on their revenue in 1996. This gives each firm's initial capital stock. The initial capital stock is then added to each firm's investment in 1996. Further accounting for depreciation gives the capital stock of each firm in 1996. From this year on, each firm's capital stock is generated using its initial capital stock, its investments and depreciation.
c) Input – The PIA dataset reports firm input expenditure.
d) Output – We use the total value of production as our measure of production
e) Energy – The PIA dataset reports firm energy expenditure.

The results of the TFP estimation are the following:

<div align="center">

Table A.6: TFP Estimation Results

Dependent Variable: Total Value of Production	
Human Capital	0.30
	(0.006)***
Input Consumption	0.43
	(0.005)***
Capital Stock	0.34
	(0.035)***
Wald Test for Constant Returns	4.54
P-value	3.3%
Robust standard errors in parentheses	
*** p<0.01, ** p<0.05, * p<0.1	

</div>

1298	Iain Cockburn Jean O. Lanjouw Mark Schankerman	Patents and the Global Diffusion of New Drugs
1297	David W. Johnston Grace Lordan Michael A. Shields Agne Suziedelyte	Education and Health Knowledge: Evidence from UK Compulsory Schooling Reforms
1296	Fabio Pinna Stephan Seiler	Consumer Search: Evidence from Path-tracking Data
1295	Matt Dickson Paul Gregg Harriet Robinson	Early, Late or Never? When Does Parental Education Impact Child Outcomes?
1294	Colin Hottman Stephen J. Redding David E. Weinstein	What is 'Firm Heterogeneity' in Trade Models? The Role of Quality, Scope, Markups and Cost
1293	Warn N. Lekfuangfu Francesca Cornaglia Nattavudh Powdthavee Nele Warrinnier	Locus of Control and Its Intergenerational Implications for Early Childhood Skill Formation
1292	Gianmarco Ottaviano	Immigration, Diversity and the Labour Market Outcomes of Native Workers: Some Recent Developments
1291	John Morrow	Benford's Law, Families of Distributions and a Test Basis
1290	Andreas Georgiadis Alan Manning	The Volatility of Earnings: Evidence from High-Frequency Firm-Level Data
1289	Francesco Caselli	The Latin American Efficiency Gap
1288	Thomas Sampson	Dynamic Selection: An Idea Flows Theory of Entry, Trade and Growth