

# EFFECTIVENESS OF INNOVATION POLICIES: EVIDENCE FROM BRAZILIAN FIRMS

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## 1. Background and justification

Throughout the last decade, Brazil has implemented a series of policies and measures meant to reinforce the country's innovation capacity. These measures range from direct financial support, credit and tax incentives to regulatory ones. All of this effort in the design of new policies built a relatively comprehensive framework of innovation policies with regards to the diversity of instruments. Currently, the country can utilize many of the same instruments used by most of the developed world to foster innovation, such as: i) subsidized credit; ii) tax incentives; iii) grants for companies; iv) grants for research projects in universities and research centers, among others.

The table below shows the primary policies and instruments used to support innovation in Brazil, several of them created in the last decade. These are the main sources of financial resources to support innovation and R&D in the country. Some of the resources shown below are not strictly public and some are not budget resources<sup>1</sup>.

**Table 1 – Main innovation and S&T policies and instruments in Brazil (main sources of funding to S&T) – 2012 (last available year)**

Policies and Instruments*		Value in 2012 (Current Reais)
<b>Tax breaks</b>	Tax incentives for R&D	1,476.8
	Tax incentives for the ICT sector (informatics law)	4,482.2
	Other tax incentives for innovation	464.0
	<b>TOTAL (Tax Incentives)</b>	<b>6,423.0</b>
<b>Public credit for innovation (total disbursements)</b>	Brazilian Agency for Innovation (FINEP)	1,800.0
	Brazilian Development Bank (BNDES)**	2,200.0
	<b>TOTAL (public credit)</b>	<b>4,000.0</b>
<b>Public investments in S&amp;T</b>	States (excluding post-graduation)	7,033.7
	Federal Government (excluding post-graduation)	18,387.9
	<b>TOTAL (excluding post-graduation)</b>	<b>25,421.6</b>
<b>Mandatory investments in R&amp;D for regulated companies</b>		<b>1,526.7</b>

Sources: Ministry of Science, Technology and Innovation (MCTI) – [www.mcti.gov.br/indicadores](http://www.mcti.gov.br/indicadores); National Bank for Social and Economic Development (BNDES) – Annual Report/2013; Brazilian Innovation Agency (FINEP); [Electricity Regulatory Agency](http://www.aneel.gov.br) (ANEEL); The National Petroleum Agency (ANP) – Statistical Yearbook/2013. \* Venture capital funds operated by FINEP are not included on this table because of the small amount of resources allocated to those funds. \*\* The total disbursement of the Bank in 2012 was around R\$ 156 bi, which means that disbursements for innovation represents only 1,4% of the Bank's total disbursements.

The volume of resources available in several of these instruments has also increased. The volume of tax breaks, for example, grew from less than R\$ 1 bi (or 0,07% of GDP) in 2003 to R\$ 6,9 bi (or 0,14% of GDP) in 2014. The same happened to subsidized credit for innovation, which was multiplied by 6 – considering both BNDES and FINEP – between 2007 and 2013.

<sup>1</sup> The figures shown in the credit policies, for example, express the total availability of credit for innovation at BNDES (Brazilian Development Bank) and at FINEP (Brazilian Agency for Innovation), and not the fiscal cost associated with the equalization of interest rates in these programs. In the same way, the resources associated with the mandatory investments in R&D express the total amount of R&D investment obligations assumed by the regulated companies and are, therefore, private resources.

As a result, the number of innovative companies that declared having received some kind of public support to innovate increased from 19%, in 2003 to 34% in 2011. If we only consider the companies that declared having received support from public policies oriented specifically to innovation, the number of companies supported also increased from 4.6% to 8.6% in the same period.

Despite the expansion of public policies, the results obtained in terms of innovation, measured by private investments in R&D, by deposits of patents, or by high-intensity technological exports, are much smaller. Business R&D investments in Brazil, for example, increased between 2005 and 2008, from 0.49% to 0.56% of GDP, but decreased in 2011 to 0.54% of GDP. They likely may also have decreased in the 2014 innovation survey (to be released next year).

Part of this result can be explained by the decrease in the participation of the industry (responsible for 78% of all investments in R&D in the country) in the GDP. However, R&D investments are not the only variable that show a weak performance in the Brazilian Economy. The productivity indicators also did not increase over the last years. Manufacturing in Brazil, for example, has lost productivity at a rate of almost 1 % a year in the last decade (DE NEGRI and CAVALCANTE, 2014).

This paradox of increasing the comprehensiveness of the policies without reaching significant results regarding innovation suggests that there is a need to rethink existing policies in order to ensure that they could be more effective in leveraging the country's development.

## 2. Objectives

In this context, the objective of this proposal is to assess the effectiveness of some of the main innovation policies in Brazil: i) tax incentives for R&D; ii) grants to firms; and iii) subsidized credit for innovation.

There are recent empirical studies that show positive results of some of these policies on the R&D spending of firms and, thus, refute the crowding out hypothesis.<sup>2</sup> However, the aggregate achievements of the Brazilian economy in terms of innovation and productivity raise doubts about these micro econometric findings. Therefore, it is necessary to improve our understanding of the results of these policies and to identify which of them are most efficient in fostering R&D increases and productivity gains.

Besides that, it is also necessary to take into account some factors that could be reducing the potential effects of the innovation policies. The main hypothesis of this project is that lack of competition is the most important one. In that sense, one possible explanation for the weak aggregate results in terms of R&D and productivity increases in Brazil is the low dynamism of the economy and the low level of competition that Brazilian firms face<sup>3</sup>.

Therefore, this research project investigates the below questions:

1. What are the effects of different policy instruments in increasing firms' R&D investments and productivity?
2. Which policy instruments are the most efficient from a cost-benefit analysis perspective?
3. Could the level of competition in the market affect the effectiveness of the innovation policies?

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<sup>2</sup> Several of them are mentioned in Hall and Maffioli (2008).

<sup>3</sup> A recent study from OECD (Arnold et al, 2008), for example, has shown that, in Brazil, firms with low productivity have faster employment growth than others, suggesting market selection problems in the Brazilian economy.

### 3. Data and Methodology

This project will use firm-level data from several different sources. The different databases will be merged by the CNPJ of the firm (a unique code that identifies each firm in the Brazilian economy).

Box 1. List of databases and variables to be used by the project

Database / Source	Variables available	Time coverage
Brazilian Innovation Survey / Brazilian Statistical Office (IBGE)	Information about innovation, R&D spending, turnover, number of employees, sector of activity among others economic and technological variables	2000, 2003, 2005, 2008, 2011, 2014 (forthcoming)
Grants / Brazilian Agency for Innovation (FINEP)	Firms that received grants and the amount received by year	2005-2013
Tax incentives for innovation / Ministry of Science, Technology and Innovation (MCTI)	Firms benefiting from tax incentives to R&D and the amount of tax breaks by firm and year	2005-2013
Subsidized credit / Brazilian Agency for Innovation (FINEP)	Firms benefiting from subsidized credit for innovation, the amount of disbursements by year and the interest rate of the operation.	2005-2013

To perform the evaluation of the programs, the project will use quasi-experimental techniques in order to identify the more adequate control group to the benefited firms. Techniques such as propensity score matching with diff-in-diff or heckman selection models could be helpful even to find the best counterfactual or to avoid selection bias problems. Firms not benefiting from any other innovation policy should preferably constitute the control group.

Besides using typical micro econometric techniques, it is important to take into account, in the evaluation, the amount of subsidies received by each firm. In the case of tax incentives or grants, despite the differences in the policy design, this amount is obtained directly. In the case of subsidized credit, it will be necessary to calculate an implicit subsidy of the loan, which can be done by the difference of the interest rate charged by FINEP and the market interest rate.

Finally, this project will take into account that competition requires calculating some sectorial indicator of competition. There are several different indicators and one that could be used is the Lerner Index (as in Aghion et al, 2012).

### 4. References

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