Discourse and Practice of Brazilian Industrial Policy in 2005-2014: an evaluation of the sectorial distribution of resources from BNDES and FINEP

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Abstract:

The article evaluates the alignment between the discourse and the practice of the Brazilian Industrial Policy in the period from 2005 to 2014. For this, it analyzes refundable resources for innovative projects granted by the Funding Authority for Studies and Projects (FINEP) and the Brazilian Development Bank (BNDES), which are the most important federal institutions in charge of the implementation of industrial and innovation policy in Brazil. The priority sectors from Industrial, Technological and Foreign Trade Policy (PITCE), Productive Development Policy (PDP), and Greater Brazil Plan (PBM) are compared with the sectorial distribution of the refundable resources released by these institutions. In general lines, it is possible to observe that there was a real increase in refundable resources from FINEP and BNDES over the period. A convergence between discourse and practice was observed for the pharmaceutical and information and communications technology sectors that were prioritized in the policies and received a significant amount of refundable resources by the institutions. In turn, the automobile sector received a considerable amount of resources and was prioritized only in PDP policy.

Key-Words: industrial policy, funds, innovation, BNDES, FINEP.

JEL: O38

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1. Introduction

The analysis of the evolution of the Brazilian industrial and innovation policies of the last decade shows that there has been an important expansion of all innovation support instruments in its various forms (refundable and nonrefundable funds, equity participation and tax incentives). In fact, since the implementation of the Industrial, Technological and Foreign Trade Policy (PITCE, in Portuguese) in 2004, innovation has become one of the main objectives of the federal government. There was a substantial increase in the amount of resources to support innovation as part of the transformation in the federal government's strategy. To accomplish with this objective, important changes were made in the legal framework to support innovation. These changes enabled public resources to be used in the form of nonrefundable instruments to support private firms' innovation.

In fact, in recent years there has been a growth in the percentage of innovative companies that have received government support, from 19% in the period 2001-2003 to approximately 40% in the period 2012-2014. However, this indicator was accompanied by an increase in the percentage of innovative firms that considered the lack of appropriate sources of funding as a major barrier to innovation, rising from 57% in 2001-2003 to 69% in 2012-2014. From the point of view of the general results of the industrial and innovation policies implemented in the period, it can be observed that the innovation rate increased from 33.3% in the period 2001-2003 to 36.4% in the period 2012-2014 (IBGE, 2005, 2016), as will be shown in section 3. In this sense, the analysis of the main policies and instruments to support innovation and its impacts has become an extremely relevant research topic.

Public funding for innovation is a key factor in leveraging and enabling more radical innovations with greater impacts on technological and economic development. The innovative process is characterized by the need of large amount of resources, long-term return and fundamental uncertainty (CORDER; SALLES-FILHO, 2006; O'SULLIVAN, 2005). These characteristics mean that private funding sources do not address properly the initial stages of this process, as well as the most radical innovations with general application to the economy. In this case, public funding becomes essential, especially in the case of more radical innovations (MAZZUCATO, 2011).

In Brazil, the public funding for innovation has been carried out in by FINEP usually. More recently, BNDES started to provide refundable and non-refundable resources for this area. The two institutions were created in the 1950s (BNDES) and 1970s (FINEP) but with different institutional relationships. FINEP is a public institution linked to the Ministry of Science, Technology, Innovation and Communications. The BNDES is a public bank linked to the Ministry of Development, Industry and Commerce. Both institutions should, in principle, follow the general guidelines of industrial policy. Since 2009 these institutions increased their interaction, homogenizing the understanding of innovation and, later, in 2010, with BNDES acting as a funding source to FINEP (TAVARES, 2013), especially through

the Investment Sustainability Program (PSI in Portuguese), increasing the amount of resources available to FINEP (COSTA, 2013).

Therefore, in the context of expansion of the resources and instruments to support innovation and the importance of FINEP and BNDES in the Brazilian Innovation System, the objective of this paper is to analyze the sectorial distribution of the refundable resources granted by these institutions during the period 2005-2014. This paper compares such distribution for each institution with the sectorial priorities of three policies: Industrial, Technological and Foreign Trade Policy (PITCE in Portuguese); Productive Development Policy (PDP); and Greater Brazil Plan (PBM, in Portuguese). The central hypothesis is that there is a divergence between the objectives of the industrial and innovation policy documents and the effective practice of these policies in terms of the distribution of the larger part of the refundable resources of BNDES and FINEP.

The paper is divided into 4 more sections besides this introduction. The second section presents a brief theoretical review on the role of the State in funding innovation. The third section briefly outlines the three major industrial policies of the period 2005-2014 (PITCE, PDP, PBM), highlighting the priority sectors in each of these policies. In the fourth section, data obtained through the Access to Information Law (*Lei de Acesso a Informação,* in Portuguese) about the refundable resources released by FINEP and BNDES in the period 2005-2014 was analyzed and organized in terms of their sectorial distribution. The objective was to make it possible to compare this distribution with the priority sectors in each policy. Finally, section five presents the concluding remarks, highlighting the limitations and possible advances of the paper.

2. The role of the state in funding innovation

The innovation process is characterized by peculiar characteristics that make the investment in such activities different from other investments. As highlighted by Corder and Salles-Filho (2006), investment in innovation is marked by high cost and asymmetry of information among agents, high relevance of intangible assets, long-term return and, mainly, by fundamental uncertainty. So, the agents do not know the possible results from their efforts and make subjective decisions (O'SULLIVAN, 2005).

These characteristics imply that the private financial sector act mainly when the level of uncertainty is already lower and it prefers projects with short-term returns. Thus, public funding is essential for the initial stages of the innovative process (CORDER; SALLES-FILHO, 2006), where uncertainty is highest, as well as to encourage radical innovations or technologies with general "uses/purposes" (MAZZUCATO, 2011). As Mazzucato (2011) shows, government is essential to make these general-purpose technologies (that affect different sectors) feasible, both in terms of securing the market (by public procurement) and in financial and technological aspects.

In contrast to the neoclassical view that characterizes technological development as a market failure, Mazzucato (2011) states that this vision ignores a fundamental fact

about the history of innovation: it was the government that financed basic and applied research with a higher degree of risk, as well as it has been the source of the most radical innovations.

In fact, the historical analysis of the innovations development shows that the role of the state in the most successful economies is not limited to the building infrastructure and setting competition rules. This history shows that the State has never ceased to play a decisive role in the development process of the most important and radical innovations in the world that have allowed companies and economies to grow.

In the case of the main innovations already developed, what is perceived is that the State acted actively in the creation of a new area or a high growth sector – even before such potential was perceived by the private sector – through the participation in development stages that incorporate a greater degree of uncertainty (MAZZUCATO, 2011). Due to the high degree of risk and uncertainty that characterizes the development stages of innovations, the private sector generally shows no interest in this type of investment.

Several examples illustrate the importance of the role of the State in the development of innovations that were fundamental to the competitiveness of private companies and countries (MAZZUCATO, 2011). One of these examples is related to the pharmaceutical industry. Mazzucato (2011) points out that the laboratories of the US government, as well as the universities supported by it, are mainly responsible for the production of drugs that are effectively innovative in the country. Another example is the Silicon Valley, which success is often associated with the free market. In fact, the Defense Advanced Research Projects Agency (DARPA), an agency linked to the US Department of Defense established in 1958, was involved in the development of technologies and was fundamental to the success of the companies located in the region. In the 1960s, DARPA funded the establishment of computer science departments at various US universities, and in the 1970s it funded a laboratory linked to the University of South Carolina, which is a key to chips manufacturing. In this case, it is relevant to mention the importance of public procurement from the Department of Defense to the success and growth of Silicon Valley.

In this case, especially for innovative development, the role of the state stands out as fundamental to the success of national strategies. Although this issue is controversial, some articles and research reports that analyze the process of innovation development have highlighted the role of the State, through industrial and innovation policies, as the coordinator and articulator of the efforts directed to this end.

A recent research on the innovation strategy of seven countries (the United States, Canada, Ireland, United Kingdom, France, Finland and Japan) highlighted among its conclusions that the state is fundamental to stimulate, articulate, regulate and facilitate innovations. According to this research, the State plays a fundamental role in the

implementation of industrial and innovation policies, either through public agencies or through bodies or councils focused on dialogue with the private sector (ARBIX et al, 2010).

The analysis of the role of the State in innovative development must take into account the explicit – as instruments directed for innovation – and implicit policies. According to Herrera (1995), a policy aimed at the development of a nation must seek coherence between the two types of policies: explicit and implicit. The explicit policies are those official, corresponding to the laws and dispositions disclosed as the "industrial and innovation policy" of the country. The second refers to the social, political and, especially, the current "national project", understood as the set of objectives that the dominant sectors of society have for the country and that drive the effects of explicit policies. For Coutinho (2005), macroeconomic policy is one of these implicit policies, as it has an important effect on agents' decision-making on investments, especially on innovation.

Cassiolato and Lastres (2005) emphasize that innovation policies should consider the systemic and interactive nature of innovation, since the innovative performance of a firm is not only conditioned by intra-company factors or science and technology institutions, but it also depends on the interactions between these elements and other actors, such as political and financial institutions. Thus, a systemic innovation policy must consider not only the aspects directly related to the generation of new scientific and technological knowledge, but it must also address other factors, such as the financial system and its adaptation to the different phases of the innovation process and sectorial specificities. The systemic innovation policy, by combining and articulating policy instruments of different natures, has a greater potential to impact different economic areas.

A systemic policy requires a coordinated action of the State and its institutions to support economic development objectives. The present article will analyze one of the dimensions of State intervention in fostering innovation, which is through the funding to innovative projects from public banks and development agencies. It is expected that these institutions will be aligned with the national project and policy, allowing articulation and coordination of efforts.

3. Industrial and Innovation Policy in Brazil in the period 2005-2014

3.1. Main industrial and innovation policies between 2005 and 2014

Over the last decade, the issue of innovation has gained increasing importance in the Brazilian government policy agenda. In fact, since 1999 when a new funding scheme (the sectorial funds) was introduced, the government budget for science, technology and innovation has significantly improved.

Since 2004, when the Brazilian federal government started again to implement industrial plans and policies, the support to innovation has become a major focus of the federal government actions. Each of the industrial policy documents launched since then – the 2004 Industrial, Technological and Foreign Trade Policy (PITCE), the 2008 Productive

Development Policy (PDP) and finally the 2011 Greater Brazil Plan (PBM) – not only put innovation in the central role but was accompanied by science, technology and innovation (S,T&I) policy plans, namely: the 2006 Science, Technology and Innovation Plan of Action for National Development (PACTI); the 2011 National Strategy for Science, Technology and Innovation (ENCTI) and the 2013 *Inova Empresa*. This paper will only analyses the sectorial priorities of the three industrial policies implemented between 2005 and 2014, as it express the main lines and strategies to be followed by the public institutions in terms of resources concession during the analyzed period (2005-2014).

The analysis of the evolution of industrial and technological policies over the last decade reveals an expansion of mechanisms aimed at encouraging the various types of innovation (e.g.: refundable and non-refundable financing, equity participation, and tax incentives). It is true that some of the policy tools for supporting innovation that were available in the last decade had been created in previous periods. However, in the context of change of federal government's policy strategy during 2000's, a substantial increase was observed in the volume of resources earmarked to support innovation. To this end, crucial changes were introduced in the legal framework that supports innovation, which, among other things, allowed a direct access of the resources by the productive sector to promote innovation.

In what regards to the industrial policy during 2000's, the government enacted a new important policy in 2004: the Industrial, Technological and Foreign Trade Policy (PITCE). This policy provided the implementation of incentives to foster innovation in the enterprises and sought to identify strategic areas in which the federal government should invest (BRASIL, 2003). It is worth pointing out that, despite having selected some priority sectors – semiconductors, software, capital goods, drugs and medicines – and activities seen as bearer of future economic benefits, such as biotechnology, nanotechnology and renewable energy, the PITCE favored the sectors horizontality (BASTOS, 2012).

In 2008, the government reviewed the industrial policy with the launch of the Productive Development Policy (PDP). This policy's main objective was to give sustainability to the expansion cycle of Brazilian economy, based on four action lines: expanding the capacity of supply (expanding investment from 17% of GDP to 21% of GDP), maintaining the robustness of the trade balance (through the expansion of exports), increasing the ability to innovate and strengthening micro and small enterprises. Besides the goal of increasing the investment share in GDP, the PDP also proposed ambitious goals to be achieved at the end of its term (2010). These goals were related to the expansion of private spending on R&D from 0.51% of GDP to 0.65% of GDP, and to an increasing participation of Brazilian exports in world exports from 1.18% to 1.25% (BRASIL, 2008).

The PDP was organized around three distinct programs of action: (1) Systemic Actions; (2) Structuring Programs for Production Systems; (3) Strategic Highlights. Thus, this policy proposed the combination of systemic actions with actions aimed at particular production systems (or to a set of industries).

The Systemic Actions aimed at the integration of PDP with other government programs and involved new initiatives, such as: tax cuts on investment; expansion of resources and reduction the financial costs for fixed investment; expansion of financial aid for innovation; improvement of the legal framework; improvement of international trade law; among others (COSTA, 2013).

The Structuring Programs for Production Systems gathered the sectors considered strategic in Brazil within three main groups, and set objectives and goals for such groups according to their specificities and considering their development stages. Three programs were defined for each set of productive systems, namely: (1) “mobilizers in strategic areas”; (2) “to strengthen competitiveness”; (3) "consolidating and expanding business leadership". The first focused on sectors where competitiveness was based on innovation. In this case, in addition to providing resources for all stages of the innovation process, the PDP aimed the interaction with science, technology and innovation institutions and the private sector. The targeted productive systems were: Health Industrial Complex, Information and Technology Technologies, Nuclear Energy, Defense Industrial Complex, Nanotechnology and Biotechnology.

The second set of PDP’s programs aimed at productive systems with export potential and with high chaining effects in the industrial structure. The PDP proposed articulations with fiscal-financial incentives, regulation, state procurement power and technical support. The targeted productive systems were: Aircraft Industrial Complex; Oil, Gas and Petrochemical Complex; Bioethanol; Mining; Metallurgy; Cellulose and Paper; and Meat.

Finally, the third set of productive systems refers to sectors and firms that already have international projection and competitive capability, including productive systems with long-term investments and of great impact on the economy. In this case, the objective was to strengthen the country's competitiveness in these sectors, promoting innovations and the internationalization of firms (BRASIL, 2008). The targeted productive systems were: Automobile Complex; Capital Goods; Textile and Clothing; Wood and Furniture; Hygiene, perfumery and cosmetics; Civil Construction; Services Complex; Naval Industry; Leather and Footwear; Agroindustry; Biodiesel; Plastics; and Others.

Strategic Highlights (third and last program of PDP) dealt with specific public policy issues, which were selected according to their importance for the productive development of the country in the long run. The topics chosen in this action program were the following: (i) support to exports; (ii) support to micro and small enterprises; (iii) integration of Latin America and the Caribbean production systems, focusing on Mercosur; (iv) regionalization, focusing on taking advantage of the capacities and regional potentials, and also on the promotion of productive activities in the vicinity of industrial and infrastructure projects as well as in marginalized areas; (v) sustainable production; and (vi) integration with Africa.

The government of Dilma Rousseff, initiated in 2011, launched the Greater Brazil Plan (PBM, in Portuguese) that replaced the PDP and was set to be in force until 2014. Greater Brazil Plan includes policy measures for industrial, technological, services and foreign trade sectors and it is divided into two dimensions: sectorial and systemic.

The sectorial dimension of PBM aims at: (i) strengthening of production chains; (ii) enhancement and creation of new technological and business skills by encouraging potential enterprises to enter the dynamic markets with high technological opportunities; (iii) development of production and supply chains which comprise different forms of synergy; (iv) diversification of exports, rooting of foreign companies and incentive to the creation of R&D centers in the country; (v) incentive to the knowledge economy in sectors that are intensive in natural resources (ABDI, 2013).

The systemic dimension, in turn, which has a horizontal and transversal character, involves actions to: reduce costs; enhance productivity; promote basic conditions for Brazilian companies to face their international competitors; and to consolidate the national innovation system through the expansion of scientific and technological skills and their integration in enterprises (COSTA, 2013). The strategic sectors (or complexes) in terms of innovation potential focused by the PBM were: Information and Communications Technologies; Health Industrial Complex; Oil and Gas; Aerospacial; agroindustry and Renewable Energy (ABDI, 2014). Box 1 summarizes the strategic sectors for each recent industrial policy.

Box 1: Strategic Sectors in terms of innovation for Industrial Policy

PITCE	PDP	Greater Brazil Plan (PBM)
Semiconductors Software Capital goods Drugs and medicines Biotechnology Nanotechnology Renewable energy	Aircraft Industrial Complex; Oil, Bioethanol, Biodiesel, Gas and Petrochemical Complex; Cellulose and Paper; Mining, Metallurgy, Meat; Health Industrial Complex; Information and Communications Technologies; Nuclear Energy; Defense Industrial Complex Biotechnology, Nanotechnology; Automobile Complex; Capital Goods; Textile and Clothing; Wood and Furniture; Hygiene, perfumery and cosmetics; Civil Construction; Services Complex; Naval Industry; Leather and Footwear; Agroindustry; Plastics.	Information and Communications Technology Health Industrial Complex Oil and Gas Renewable Energy Aerospace and defense Agroindustry Environmental Sustainability

Source: Own elaboration

The number of strategic sector growth exponentially during the industrial policies, losing the initial sectorial focus observed in the PITCE, being considered a limiting factor of the industrial policies (SZAPIRO; VARGAS; CASSIOLATO, 2016). However, the absence of a sectorial focus did not mean a sectorial decentralization of resources, as will be shown in the next section.

3.2. General picture on the evolution of the resources for innovation during 2000's

First of all, table 1 shows the evolution of the resources from the federal government for diverse instruments to support innovation activities. As can be seen, there is a significant increase in the amount of resources for innovation in Brazil in the period 2007-2014.

Table 1: Total Resources allocated to innovation activities (Constant price December/2015*)

Year	Total (R$)	Total (US$)
2007	7,030,785,596	2,423,996,511
2008	7,606,606,895	2,120,369,761
2009	8,263,259,173	3,293,074,195
2010	9,262,610,580	4,132,041,871
2011	13,109,603,655	5,512,425,696
2012	13,437,662,742	5,496,954,026
2013	23,438,695,808	8,848,325,301
2014	20,006,794,386	7,057,155,106

* It was used the Gross Domestic Product Implicit Deflator from World Bank for Brazil and United States respectively.
Source: Adapted from Gordon (2017).

Also important is to note that the share of refundable resources in the total resources directed to innovation activities has increase substantially in the last years. As can be seen in table 2, in 2014 the refundable resources from BNDES and FINEP accounted for almost 80% of the total resources (GORDON, 2017)[3].

[3] Refundable resources and credits is only one kind of policy instrument to incentive innovations in a firm, as indicated in the table 2. They are credits with subsided tax rate offered by BNDES and FINEP in general and used mainly in the production and commercialization phase of innovation. Fiscal Incentives is another type, used mainly by big firms and as a way to incentive the R&D phase of the innovation. They have two forms: income tax deduction and fiscal credit. In the end, subvention is a non-refundable resource that supports the R&D phase of innovation and offered by public notices and FINEP mainly (AVELLAR; BITTENCOURT, 2017).

Table 2: Share of each policy instrument in the federal support to innovation (%)

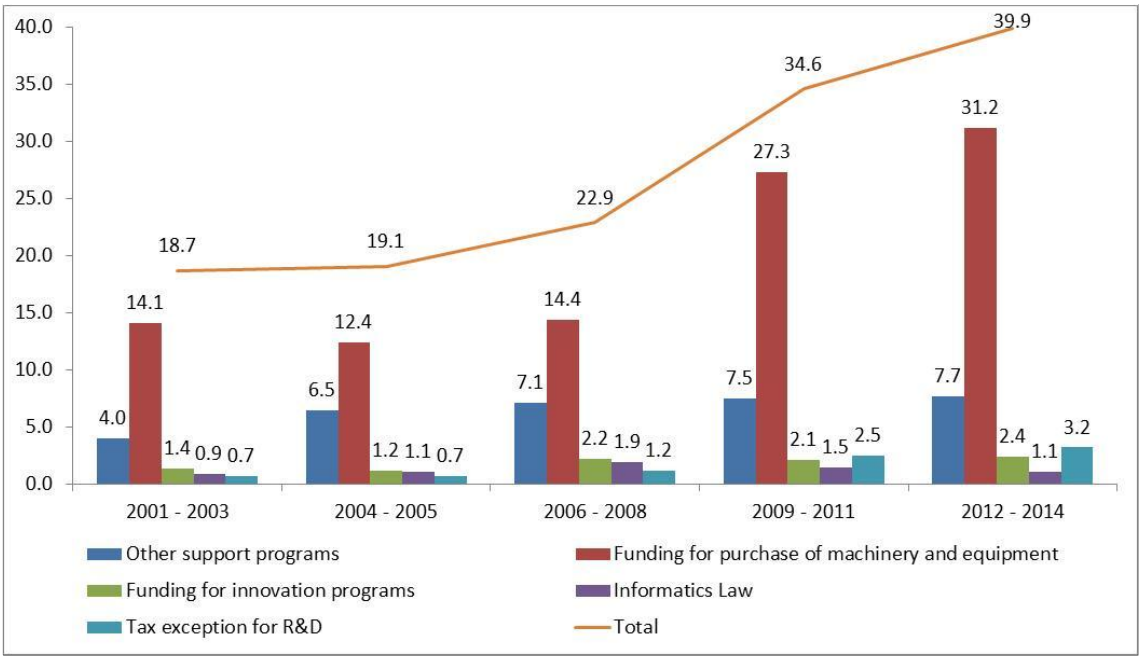
Year	Credit FINEP	Credit BNDES	Total Credit	Subvention	Nonrefundable fund from BNDES (FUNTEC)	Fiscal Incentives	Nonrefundable form FINEP (FNDCT)
2007	14.9	30.0	44.9	13.6	1.4	38.3	1.8
2008	18.3	18.2	36.5	8.7	2.0	50.9	1.8
2009	31.8	18.8	50.6	8.2	0.8	38.7	1.7
2010	23.0	24.9	48.0	8.2	1.4	40.6	1.9
2011	20.3	53.3	73.6	2.0	1.0	23.1	0.3
2012	25.4	48.9	74.3	0.6	0.8	23.2	1.0
2013	31.8	52.6	84.5	0.6	0.6	14.1	0.3
2014	46.4	33.1	79.5	1.4	1.4	17.4	0.3

Source: Gordon (2017).

In general lines, the analysis of PINTEC data[4] reveals a growing percentage of innovative enterprises from the manufacturing industry that used governmental support, either in the form of financing or of tax exception, subsidies and others. Figure 1 shows that, in the period 2000-2003, only 18.7% of the innovative manufacturing firms had used some kind of governmental support. In comparison to the percentage of innovative manufacturing firms that used at least one mechanism of governmental support in the period 2006-2008, a growth trend can be observed: from 22.9% in the period 2006-2008 to almost 40% in the period 2012-2014. This last percentage means a figure of about 16.7 thousand manufacturing firms that accessed some governmental incentive to develop innovations either in products or in processes between 2012 and 2014.

[4] PINTEC is the Brazilian Innovation Survey and it departures from Oslo Manual. It embraces questions regarding: (a) expenditures on innovative activities; (B) sources of financing of expenditures; (C) the impact of innovations on firms' performance; (D) sources of information; (E) cooperative arrangements; (F) government incentives; (G) obstacles to innovation activities. To date, the IBGE has already carried out six surveys, covering the periods 1998-2000 (PINTEC 2000); 2001-2003 (PINTEC 2003), 2003-2005 (PINTEC 2005), 2006-2008 (PINTEC 2008); 2009-2011; 2012-2014 (PINTEC 2014). In 2005, PINTEC included some services sectors. The six surveys allow, therefore, a characterization of the innovative dynamics in Brazil in a decade.

Figure 1: Percentage of innovative companies that used government programs, Total and according to the type of support

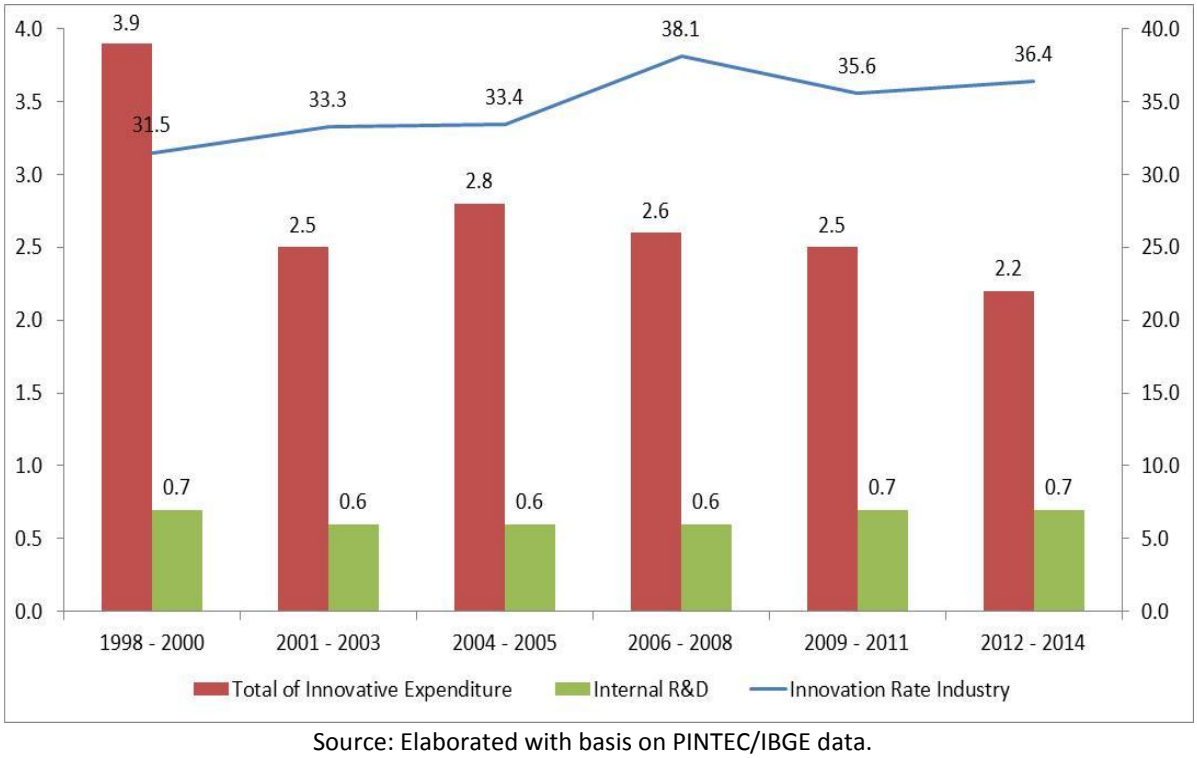


Source: Elaborated with basis on PINTEC/IBGE data.

As can be seen in figure 2, overall, it is observed a small increase in the innovation rate of the manufacturing industry between 2000 and 2008, when it reaches 38.1%, with a subsequent fall in the next 2009-2011 period (to 35.6%). In the period 2012-2014 the innovation rate shows a small increase to 36.4%. At the same time, innovation activities efforts as a share of net sales of the manufacturing industry have dropped every period (except for a small increase in the period 2003-2005), and in the last period (2012-2014) this indicator reaches lowest level of the entire series: 2.2%.

However, it is worth noting that the share of R&D activities in the net sales of the manufacturing industry grew from the period 2000-2003 onwards, reaching the highest level in 2009-2011: 0.7%, which is observed also in the period 2012-2014. That is, while the expenditure on R&D activities in the manufacturing industry grew in the considered period – and the percent of innovative companies that used government programs too –, the total expenditures in innovation activities fell in the last four periods.

Figure 2: Evolution of R & D and innovation expenditures as a share of net sales and the innovation rate in the Brazilian manufacturing industry: 2000-2014.



Source: Elaborated with basis on PINTEC/IBGE data.

4. Methodology, Database and Analysis

4.1. Methodology

The paper uses two databases obtained through the Law of Access to Information about innovative projects contracted by firms with BNDES and FINEP during the period from 2005 to 2014. In the case of FINEP, the analysis focuses on credit operations. In the case of BNDES, the focus is non-automatic refundable resources. The BNDES database also had non-automatic non-refundable operations, but was not chosen for two reasons: (1) to maintain only refundable instruments; (2) during the whole period, there were 95 contracts of a non-refundable type, of which only 10 were from manufacturing industry and one from extractive industry, being in general, to support foundations or research institutes such as Butantan, Funarbe, Brazilian Union of Technical Assistance. All values were deflated according to Extended National Consumer Price Index (IPCA, in Portuguese) with 2005 as year-base[5]. In the next tables (3 and 4), the sector that is one of the twenty sectors for both institutions' case (BNDES and FINEP) is highlighted in bold.

The focus of this paper is limited to the analysis of the "direct" support to the innovative projects of a given sector granted by BNDES and FINEP. This analysis is related

[5]Details about this price index can be found in the official website of the Brazilian Institute of Geography and Statistics (http://www.ibge.gov.br/english/estatistica/indicadores/precos/inpc_ipca/defaultinpc.shtm).

to cases where the company proposes an innovative project and this is evaluated by the institution.

4.2. Credit to innovative projects from BNDES (2005-2014)

Table 3 shows the sectorial distribution (top 20 sectors) of refundable resources contracted from BNDES during the period 2005-2014. The database shows a concentration in the automobile sector, embracing 25.2% of total resources in the period. Some of the projects from automobile sector were from BNDES *ProEngenharia* Program that aims to finance engineering projects in order to stimulate the technical skills of the country. This Program finances: the costs and expenses associated with the engineering and product and process improvement activities of the national machinery and equipment sectors; labor and materials; testing and essays; patent registration; civil works, assemblies and installations; software's developed in the country and related services; imports of new equipment without national similar (BNDES, 2009). Although this program considers other important sectors, such as aeronautics, oil and capital goods, 87% of total resources during the PDP (2009-2011) went to the automobile sector. The automobile sector is dominated by multinational firms, what may limit the results of this kind support on the generation of innovations in the country. The multinational firms usually develop the main innovative activities in their home country (CASSIOLATO et al, 2013).

The information and communication (I&C) sector is the second sector in terms of received resources, representing 13.3% of total resources. The majority of the resources from I&C sector has been linked to the *ProSoft program*, which focuses on developing the national software industry and information technology services, financing investments and business plans for both national and multinational companies in Brazil (BNDES, 2016b).

In the third position is real estate, professional and administrative activities, with 10.6% of total resources from BNDES. This sector encompasses several research and development centers of companies from other sectors (such as *Vale do Rio Doce's* R&D center) or companies where R&D is the end-activity. The fourth sector in terms of received refundable resources is "other transport equipment" that represents, mostly, resources to Embraer.

The pharmaceutical sector appears in the fifth position and the resources are from BNDES *Profarma* Program, which aims at: stimulating the development of productive capacity, training and innovation in biotechnological products and processes, the modernization of facilities, as well as the dissemination of innovative activity and the strengthening of the Research and Development activities (BNDES, 2016c).

The Educational sector are in ninth position, and 89% of total resources are to National Service of Industrial Training (SENAI, in Portuguese)[6], specially through the

[6] SENAI is a set of workforce-training centers that promotes professional education and provides technological services to industries in Brazil.

BNDES Qualification Program. The main objective of this program was to expand vacancies in vocational courses or in technological education courses, as well as to encourage the development of R&D&I infrastructures in these institutions (BNDES, 2016a). Machine and Equipment receive 1.2% of total resources in the period occupying the 11th position, but was a strategic sector in PICTE and PDP (capital goods).

Table 3: BNDES – Twenty Principal Sectors in terms of resources in 2005-2014

Sector	R$	% of resources	Rank
Motor vehicles and trailer	3,375,400.57	25.2	1
Information and communication	1,787,315.46	13.3	2
Real estate. professional and administrative activities	1,416,723.98	10.6	3
Other transport equipment	1,337,842.50	9.9	4
Pharmaceutical products	1,254,088.22	9.3	5
Coke. petroleum and fuel	1,221,259.27	9.1	6
Computer. electronic and optical products	769,611.42	5.7	7
Chemical products	698,989.89	5.2	8
Education	350,401.44	2.6	9
Trade	157,783.38	1.2	10
Machine and equipment	157,297.22	1.2	11
Textile	116,481.01	0.8	12
Confection.clothing and artefacts	102,496.79	0.7	13
Air Transport	72,310.90	0.5	14
Rubber and plastic	68,542.25	0.5	15
Cellulose and paper	68,067.36	0.5	16
Footwear and leather articles	67,234.06	0.5	17
Metal products	59,720.06	0.4	18
Metallurgy	52,658.59	0.4	19
Food products	47,742.82	0.3	20

Source: Elaborated with BNDES database. Deflated data according to IPCA (base 2005).

4.3. Credit to innovative projects from FINEP (2005-2014)

Table 4 shows the contracted values from FINEP in the period. The data from FINEP and BNDES was made available using different levels of sector classification. An effort was made to approximate the classification in order to compare the information from both institutions.

In FINEP, the financial insurance activities leaders, receiving 12.2% of total refundable resources during the period. This sector is composed mainly by holdings of non-financial institutions (48.9% of funds contracted), other holding companies except holdings (20%) and development agencies (17.11%). Thus, one of the future developments of this study is to reallocate these holdings to the related industrial sectors to better understand the distribution of resources.

In the second position and receiving similar amount of resources there are: Electricity and gas (6.3%); pharmaceuticals (6.3%); automobile sector (6.1%) and chemical

products (6.1%). The resources in Electricity and gas were mainly directed to companies focused on the generation of electric energy and not on nuclear energy projects, one of the sectors considered as "mobilizers in strategic areas" in PDP.

Food products appear in 6th position, receiving 5.4% of total resources from FINEP. A closer look at project titles reveals that there are projects that run through different priority production systems, such as: biodiesel and agribusiness; biotechnology; meat. Professional and S&T activities are in the 7th position, with 5.3% of total resources; Machine and equipment are in 8th position with 4.7% of total resource even though it was a prioritized sector in PICTE and PDP (Capital Goods). In 9th and 10th positions are respectively Computer, electronic and optical products and Information and Communication sectors receiving around 4.5% of total resources.

Table 4: FINEP – Twenty Principal Sectors in terms of resources in 2005-2014.

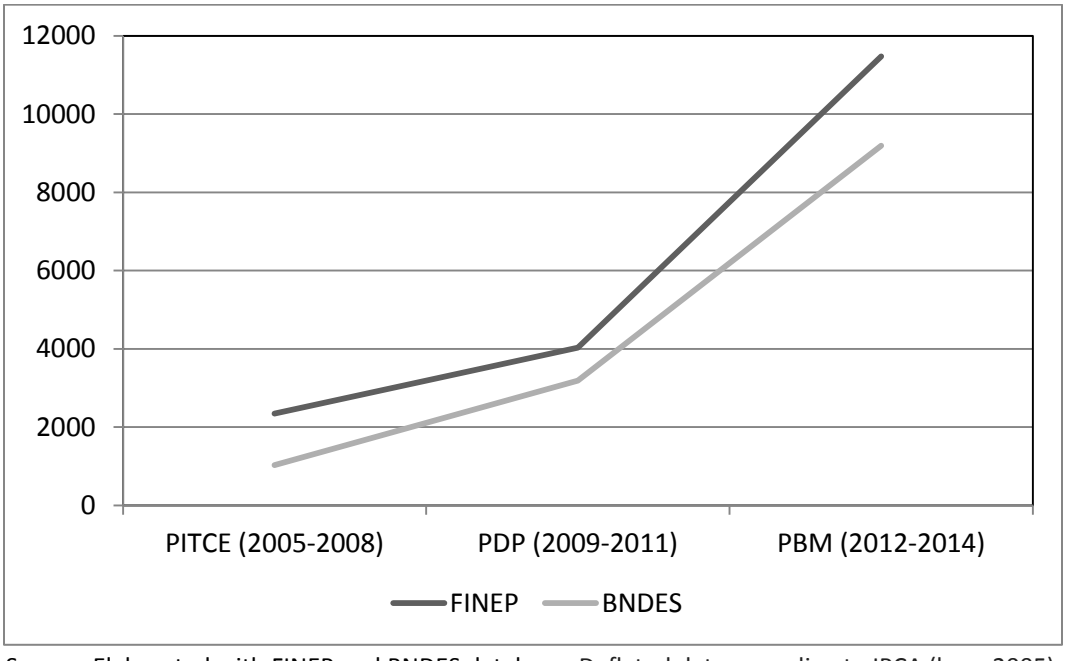
Sector	R$	% of Resources	Rank
Financial and insurance activities	2,192,656.31	12.23	1
Electricity and gas	1,133,724.54	6.3	2
Pharmaceutical products	1,121,075.73	6.3	3
Motor vehicles and trailer	1,106,057.26	6.1	4
Chemical products	1,104,778.35	6.1	5
Food products	970,998.96	5.4	6
Professional activities and from S&T	955,828.11	5.3	7
Machine and equipment	844,488.59	4.7	8
Computer. electronic and optical products	816,628.98	4.6	9
Information and Communication	792,028.98	4.4	10
Trade	754,050.10	4.2	11
Administrative activities and complementary services	499,797.78	2.8	12
Metallurgy	499,765.92	2.8	13
Machine. electric apparel and materials	499,472.57	2.8	14
Other transport equipment. except motor vehicles	484,585.02	2.7	15
Construction	470,273.40	2.6	16
Human health and social work activities	404,768.64	2.3	17
Agriculture	379,118.29	2.1	18
Extractive industry	352,055.04	1.9	19
Metal products. except machines and equipment	313,041.93	1.7	20

Source: Elaborated with FINEP database. Deflated data according to IPCA (base 2005).

4.4. A preliminary comparison between FINEP's and BNDES's sectorial resource distribution

First of all, we can observe that both the resources released by BNDES and FINEP grew considerably between PITCE (2005-2008) and PBM (2012-2014), as shown in Figure 3. The value contracted during the PBM corresponds in real terms to 8.9 times and 4.9 times the value contracted during the PITCE for BNDES and FINEP, respectively.

Figure 3: Evolution of the real values contracted between the Industrial Policies (R$ millions, base-year 2005)



Source: Elaborated with FINEP and BNDES database. Deflated data according to IPCA (base 2005).

About sectorial dimension, table 5 shows a traditional concentration ratio – the CR4 – for contracted resources from FINEP and BNDES. The first fact that can be observed is that FINEP and BNDES have different concentration of resources granted in some sectors: the 4 main sectors account for 59% of the total granted by BNDES between 2005 and 2014 and 31% for FINEP's case. So, the BNDES's resources are more sectorial concentrated than FINEP's resources. On the other hand, it can be observed that this concentration has been considerably reduced between the PDP and the PBM for BNDES, what can be explained by the increase of the amount of resources, by the size of the support programs or by the number of sectors supported.

Table 5 – Concentration sectorial rate from contracted resources

CR4	All period	PITCE	PDP	PBM
BNDES	59	78.5	78.2	56.45
FINEP	31,1	43.1	32.5	36.1

Source: Elaborated with FINEP and BNDES database.

In addition to the sectorial comparison, we can observe some similarities between BNDES and FINEP. First, the chemical sector received more resources from FINEP than from BNDES, even if it is among the ranked 10 sectors in both. This sector is related with different priority complexes of PDP and PBM. Another similarity between BNDES and FINEP is the participation of the information and communication sectors among the top

ten sectors in terms of received refundable resources, but with smaller participation in the amount contracted in the case of FINEP.

Second, tables 3 and 4 (p. 13 and 14) indicate that there is a significant similarity between the sectorial resources distribution between BNDES and FINEP (these sectors are market in bold). Although the magnitude of the support is distinct, among the 20 ranked sectors, 11 are the same for both institutions. More specific, we can observe 5 similar sectors in the top 10 of both BNDES and FINEP, as such: Pharmaceutical products; Automobile sectors; Chemical products; Computer, electronic and optical products; and Information and communication. About these sectors, only the automobile sector was not considered explicitly a strategic sector in the industrial policies during 2005 and 2014, except for PDP[7].

However, the most interesting point to note is the relevance of three sectors in both BNDES and FINEP: pharmaceutical; Information and communication; and automobile industry. The first two are important sectors for the innovative and economic development of the country, either through its transversal effects (such as information and communication) or its social and technological impact (pharmaceutical). Both appear as key sectors in the three industrial policies analyzed (see Box 1, p. 7), indicating a proximity between the discourse and the practice of industrial policies. On the other hand, the relevance of the automobile sector might be linked to its effect on employment and income.

The inclusion of the automobile sector among the sector priorities for the distribution of refundable resources from the main institutions that implement industrial and innovation policies may limit the effects and the outcomes from policies because this sector is dominated by multinational companies. In addition, this fact may also reflect a limitation of the Brazilian legislation that do not discriminate the firms by its origin of capital in the selection process to receive the support by industrial and innovation mechanisms. The relevance of the automobile sector in terms of refundable resources received also illustrates the influence of the political and social context (implicit policy) in the implementation of the explicit policies, something already explained by Gadelha (2001) and Herrera (1995). For example, Frassão (2016) identified empirically that the capability of the sectors to realize lobby[8] during PBM was determinant for them to obtain success in terms a high number of sectorial PBM's programs related to protectionism, credit and fiscal tax deduction (not innovation program explicitly). The automobile sector is one example of this successful sector (in terms of resources received) with a high lobby

[7]Other sectors or are defined explicitly as priority sectors (e.g. Information and communication and pharmaceutical products) or are related with some complexes (e.g. chemical products and computer, electronic and optical products)

[8] This capacity was defined using two indicators: (1) if the sector has a big number of effective associations in terms of participation in the governmental discussions; (2) if the sector acts via association or not (in an isolated way). Details about this variable can be found in Frassão (2016).

capacity[9]. Frassão (2016) found that sectorial characteristics – the high number of employment, revenues, and commercial balance deficit – also influence the benefits obtained by a sector in the PBM, but they were less important than lobby in this case.

5. Concluding Remarks

Explicit industrial and innovation policies, such as PITCE, PDP and PBM, should be articulated with other policies, in special with the implicit policies. The impacts and results of the policies are and will be conditioned by implicit elements such as social, political, institutional (HERRERA, 1995) and macroeconomic (COUTINHO, 2005). An effective systemic innovation policy must be able to coordinate different actors – companies, universities, public agencies etc. - in a context of a national project, changing the competitive environment of the companies in a selective way and inducing them to develop dynamic capabilities (GADELHA, 2001). This paper analyzed the relationship between the "discourse" about the priority sectors in the industrial and innovation policies of the period 2005-2014 (PITCE, PDP and PBM) and the "actions" in terms of the distribution of refundable funding to innovation of the two most important Brazilian public institutions in the innovation area: BNDES and FINEP. For this purpose, data on the sectorial distribution of refundable resources of BNDES and Finep was compared with the sectorial priorities of three industrial policies implemented during this period.

It was possible to note that, in general, there are important differences between the explicit objectives (“the discourse”) of the industrial policies and the effective distribution of the refundable resources of FINEP and BNDES regarding the "priority sectors". The first point worth to mention is the importance of the automobile sector in terms of refundable resources received during the periods of the three programs, especially from BNDES. This sector was only mentioned as a priority in the PDP (among other twelve productive sectors), but was among the top 5 in terms of refundable resources received from both institutions. The mentioned sector occupied the first place in terms of refundable resources received from BNDES.

This fact may reveal one of the important aspects of Brazil's recent industrial policy: the effect of implicit policies. For example, during the PDP specially, when the excess of priority sectors suggested the absence of a clear policy strategy (SZAPIRO; VARGAS; CASSIOLATO, 2016), the automobile sector concentrated more than 40% of resources released by BNDES in the period. That is, the lack of clear definition of sector priorities in the industrial and innovation policy might have resulted in the support of sectors with strong political lobby, as suggested by Frassão (2016). Of course, the automobile sector is a very important one in the Brazilian economy, as it has a substantial impact in terms of employment. However, the industrial and innovation instruments might not be the most appropriate ones to stimulate this sector. It is interesting to note that even during the PITCE, when there was a more clear choice of priority sectors, the

[9] Other successful sectors were: agroindustry; electronic complex (including information and communication technologies); renewable energies; capital goods.

automobile sector - which was not among those priorities - received 10.1% of BNDES refundable resources (third largest) and 11.2% of FINEP (second highest). This paper suggested that, to understand the effectiveness of explicit policies it is important to consider social, political and economic environment, since implicit policies have a considerable impact.

A point of coherence between the explicit objectives of the policies and the distribution of the refundable resources by BNDES and FINEP in practice refers to the importance of the pharmaceutical and information and communication sectors in terms of refundable resources received. In this case, they are among the policy priorities in the analyzed period and, at the same time, they are among the top 10 sectors in terms of refundable funds received from these institutions. Thus, it is suggested that a deeper analysis of the impact of the funding on these sectors should be undertaken, using, for example, the PINTEC's database. The causality hypothesis here, especially in the pharmaceutical sector, is that the continuous presence of the sector among the priorities in the successive industrial and innovation policies allows for a sustainable flow of resources that can promote structural changes in this sector. In addition, Szapiro, Vargas and Cassiolato (2016) emphasize that the industrial and innovation policy for the pharmaceutical sector had a more systemic character in terms of articulation of several policy instruments including innovation funding, regulation and public procurement, among others. In addition, the pharmaceutical sector showed a real upward trend in terms of refundable resources received in the analyzed period, especially in the case of the BNDES[10]. This observation enhances the importance of a future analysis about the effect of these refundable public resources on the technological capabilities of the main sectors supported by this policy instrument.

In addition, there are some important differences between BNDES and FINEP. For example, it should be noted that refundable resources released by FINEP covered a more diverse range of sectors, while BNDES concentrates its distribution of refundable resources on a more restrict number of sectors. However, as noted before, among the top 10 sectors for BNDES and FINEP, five sectors are the same.

The differences between FINEP and BNDES may result from different factors. The first difference between the two institutions regards the organizational structure, as BNDES usually has more freedom to define its internal policies. Nevertheless, it has formally to follow the objectives of the current industrial policy. On the other side, FINEP is subordinate to the former MCTI and formally must follow the innovation and scientific policies (TAVARES, 2013) and faces a greater instability of resources (COSTA, 2013). Another explanation may be that BNDES acts more as a "bank", aiming at funding lower risky activities, which would also explain the strong support to the automobile sector.

[10]For pharmaceutical sector, the real growth of refundable resources received from BNDES was 116% between PITCE and PDP and 336% between PDP e PBM.

Finally, it should be emphasized that the simplification of the production systems to make it similar to the industrial sectors and make possible the comparison proposed in this paper showed some limitations. This was especially true in the PDP and PBM cases, which focus on productive systems or complexes and not on specific sectors, as PITCE does. This requires more detailed sectorial analyses or analyses of individual programs. A higher level of disaggregation that allows for a more detailed identification of the productive systems and complexes can be a future development of this paper.

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