

FINANCING INNOVATION IN BRAZIL

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Challenges for financing innovation and the role of the public sector

Technical progress has long been known as one of the main drivers of economic development. Innovation, however, does not happen automatically or driven only by market forces. One basic feature of innovation is that it creates strong positive externalities in the economy—the social benefits of innovation far outweigh the private ones. These benefits justify the role played by the states in this area. As an example, innovations in health care, although generating greater profits for the innovator, also create several social benefits, such as improved quality of life and increased life expectancy.

In addition to externalities, innovation is subject to a series of market failures, which, in the absence of public policies, can lead to lower investment levels in innovation than is socially desirable. In developing countries, such as Brazil, these market failures are even more frequent and more consequential than in developed ones.

First, the risk associated with innovation projects is greater than for traditional investment projects, which makes market interest rates for these projects higher. In Brazil, the economic risks directly associated with innovation are deepened by political, macroeconomic, and social uncertainties. Therefore, the costs of investing in innovation are even higher than in developed countries. In addition, although the interest rate has been falling in the last few years, in recent decades, Brazil has maintained higher interest rates than the rest of the world, which also negatively affects the willingness of the business leaders to invest and take the risk of innovative projects.

Second, a relevant source of market failures for innovation is the asymmetry of information between an investor and the inventor, who often has the best information about the probability of success of their innovation. Given that investors find it more difficult to differentiate good innovation projects from bad, they would tend to invest in those with less risk and to charge everyone a higher interest rate. In other words, asymmetry of information increases the cost of investing in innovation, especially in a country where the cost of capital is already high.

These market failures mean that the banking system tends to be less likely to finance innovation projects. In addition, banks often require hard-to-find guarantees for innovative new companies, who then must become dependent on other sources of public or private funding, such as own capital or venture capital funds.

Another aspect of investment in innovation is that it is dependent on highly trained and qualified personnel. This type of professional is not easily found in the market, especially in countries like Brazil. According to the Global Innovation Index, Brazil had less than 900 researchers per million inhabitants in 2019—a number much lower than in more developed countries.¹ For this reason, even in times of economic crisis, companies would be hesitant to fire researchers. This makes the adjustments costs for R&D investments higher than those of traditional investments.

All of these reasons justify each state's role in stimulating—directly or indirectly—investments in R&D, especially in developing countries. This action has taken place in several ways besides the investments made by governments through budget allocations in science and technology. Tax incentives for innovation are used in several countries to reduce the cost of capital associated with innovation.² Public policies in several

countries have also stimulated venture capital funds, which are generally aimed at young companies in sectors with high technological dynamism. Worldwide, grants and subsidized credit for innovative companies are also common instruments amongst the public policies for innovation. In addition, in some countries, technology procurement is also widely used to stimulate the development of new technologies that are of interest to specific sectors of government, such as health or defense.

Considering the importance of financing innovation, the Business Mobilization for Innovation (MEI), created and coordinated by the National Confederation of Industry—Brazil (CNI), has innovation financing as one focus for its agenda. The MEI brings together Brazilian business leaders, with the aim of bringing innovation to the center of business strategies and increasing the effectiveness of innovation policies in the country.

In the next sections, we discuss support and financing mechanisms for innovation in Brazil, the main challenges, and how the country can overcome these challenges. To a large extent, the diagnosis and suggestions presented here are part of the MEI's innovation financing agenda.

Support for innovation in Brazil

During the last few decades, Brazil has built a relatively broad system of support for innovation. Policies implemented in the country range from direct support to scientific research—carried out mainly by universities and public research institutes—to tax incentives and subsidized credit for innovative companies.³ In health, for instance, Brazil has built a wide system of public research laboratories, such as the Oswaldo Cruz Foundation (Fiocruz), the Adolfo Lutz Institute, and the Butantan Institute, among others. This system has made Brazil an important center for epidemiological research, which has been critical in tackling the COVID-19 crisis.

Until the late 1990s, most of these policies did not exist. One of the main milestones in the policy for supporting and financing innovation in Brazil was the creation of Sectoral Funds in 1999, which directed specific taxes collected from various sectors to finance R&D activities in those sectors. For example, the government collects a specific tax on oil royalties to finance technological development in the oil sector. Other sectors, such as health, biotechnology, mining, aeronautics, and others, are also taxed. The levy, collected by the Ministry of Science, Technology, Innovation and Communications, must be used to fund R&D projects in these sectors. In 2004, the country approved the Innovation Law, which allowed, for the first time, the Brazilian State to grant subsidies directly to innovative companies. In addition, the law allowed companies to contract research projects from universities and public research institutes, regulating, among other things, the intellectual property derived from these contracts.⁴ In 2006, the Brazilian Congress approved the so-called *Lei do Bem* (Law of Good), which, along with incentives for production, instituted a simplified system of tax incentives for companies investing in

R&D. In 2013, the Brazilian Innovation Agency (Finep) launched a broad subsidized credit program for innovation, operated jointly by Finep and the National Bank for Economic and Social Development (BNDES). Finally, in 2014, the Brazilian Company for Industrial Research and Innovation (Embrapii) was created. Embrapii is an innovation agency inspired by the successful model of the German Foundation Fraunhofer, in which technological projects of interest to companies and performed by accredited research institutions can receive public subsidies worth up to a third of their total costs. Although it has a relatively small budget, Embrapii is an innovative model in the group of institutions supporting R&D in the country. The National Service of Industrial Training (SENAI) Innovation Institutes have participated in this initiative from the very beginning: 8 of the 42 research institutes accredited by EMBRAPII are from SENAI.

Brazil also establishes investment obligations in R&D for companies operating in regulated sectors, particularly in the oil and electricity sectors. Although the companies invest these resources, the R&D programs are under the supervision of their respective regulatory agencies: the National Petroleum Agency (ANP) and the Brazilian Electricity Regulatory Agency (ANEEL).

Table 10.1 details the volume of resources available in the main public instruments for supporting innovation in the country.

In 2018, the innovation credit programs of BNDES and Finep disbursed around US\$2 billion worth of new contracts. Subsidized credit resources for innovation in Brazil have grown significantly since 2010, when they were around US\$1.8 billion, to a peak of US\$4.6 billion in 2014. Much of this growth was due to Finep, which tripled its disbursements for innovation over the same period. In the same year, the total disbursements of BNDES reached US\$108 billion, which means that innovation represented around 4% of the total credit provided by the bank. In fact, the volume destined for innovation never represented more than 4% or 5% of the total subsidized credit disbursed by BNDES every year. The largest portion of BNDES credit has been directed towards activities other than innovation, such as investments in infrastructure and the expansion of productive capacity in the automotive and food industries, among others.

As for results, there has been evidence of the positive impacts of subsidized credit on companies' investments in innovation.⁵ Although few, these studies found an increase in investments in the R&D of companies benefiting from innovation credit programs, both from Finep and BNDES. In other words, the studies found no evidence of the *crowding out effect*— where public sector spending reduces or eliminates private sector spending—on companies' technological efforts. However, they have not considered the amount of credit received by firms in their estimations.

The Ministry of Economy estimates that tax incentives for research, development, and innovation reached US\$5 billion in 2018. The greatest share is provided by the Informatics Law, created in the early 1990s to stimulate the sector. It establishes a reduction in the Industrial Production Tax (IPI) for companies that comply with local content requirements and that invest in R&D. This incentive represented around US\$2.8 billion in tax

TABLE 10.1

Resources applied in the main programs and policies to support innovation in Brazil, 2018 figures unless otherwise specified (in US\$ millions)

Program/Policy	Funding agency	Resources available (US\$ millions PPP)
Subsidized credit	BNDES	889
	FINEP	1,200
	Total	2,089
Tax breaks for innovation	“Lei do Bem” (Law of Good)	1,052
	Informatics Law	2,837
	Other tax incentives	1,151
	Total	5,040
Mandatory R&D investments	ANEEL	432
	ANP	996
	Total	1,428
Government budget allocations for R&D (excluding general university funds)	Central government	6,786
	States	1,819
	Total	8,605

Sources: BNDES Annual Report (2018); FINEP Financial Report (2018); National Indicators for S&T/Ministry of S&T, Innovation and Communications; National Petroleum Agency (ANP); and Brazilian Electricity Regulatory Agency (ANEEL).

Note: The Purchase Power Parity—PPP conversion factor was used to convert to US dollars based on 2017 World Bank data.

breaks in 2018. The second most important fiscal incentive was established by the Lei do Bem, which provides a deduction in the income tax of companies that invest in R&D projects and represents a tax expense of about \$1 billion in 2018.

In the case of the Lei do Bem, the literature shows that tax exemptions have stimulated private investments in innovation. The observed increase in R&D investments in companies that received tax incentives ranges from 7 to 11 percent in one study,⁶ depending on the control variables used in the estimations, and more than 17% in another.⁷ Positive effects on productivity and the employment of highly qualified personnel have also been identified.⁸ Certainly, it is possible to improve the design of this incentive. An example of improvement would be to focus the incentive primarily on additional R&D investment and not on the total R&D performed by companies, as it is today. There are also unresolved oversight issues, which bring legal uncertainty to companies that use these incentives.

The incentive with the greatest tax exemption for innovation in the country, however, is the Informatics Law. Yet, there are several studies pointing out the reduced effects of this incentive in increasing companies' productivity or even their

R&D investments.⁹ It is important to note that, although the law provides for investment in R&D, it has several other objectives, including minimum levels of local content. Hence, one of the biggest bottlenecks of this law is the linking of incentives to local content requirements that are rigid, bureaucratic, and difficult to implement.

Regarding tax incentives, in 2018, the volume of exemptions in the Brazilian economy reached almost US\$140 billion, or 3.97% of GDP. Of this amount, only 3.6% were exemptions for investments in science, technology, and innovation. Assessing the impact—both negative and positive—of all of these exemptions is essential to build more effective and evidence-based public policies and to select which ones have the best cost-benefit ratio for the Brazilian economy.

Finally, an important gap in financing innovation in Brazil is the quasi-absence of venture capital funds. In the country, these funds represent only 0.01% of GDP, according to the Brazilian Private Equity and Venture Capital Association, compared to between 0.3% and 0.4% in countries like the United States or Israel.¹⁰ According to the Global Innovation Index, Brazil ranks 61st in venture capital deals, making this a weakness of the

country. In fact, venture capital represents less than 10 percent of total investment funds—including both private equity and venture capital—in the country. Despite this, according to Anjos do Brasil—an association whose objective is to promote the growth of angel investments in the country—there are more than 7,000 angel investors in the country, who invested about US\$400 million in 2016, which is still a small amount for the size of the Brazilian economy.

There are some public initiatives for venture capital investment funds as well, at both Finep and BNDES, but they are still incipient. For example, from the early 2000s—when FINEP started to invest in VC funds—to December 2018, Finep had made investments of only about US\$230 million.

To help Brazilian entrepreneurs find the best public or private instruments to support their innovation projects, Entrepreneurial Mobilization of Innovation has created a tool called MEI Tools.¹¹ MEI Tools is a periodic publication that summarizes all the innovation support programs available in the country, at various levels, including initiatives from the private sector. One of these programs is the *Edital de Inovação para a Indústria* (Innovation Call for Industry), an initiative of SENAI and Social Service of Industry (SESI) aimed at financing the development of innovative solutions and increasing the productivity of Brazilian industrial firms. Since it was created in 2004, over 1,150 innovative projects have been supported by this initiative, and more than US\$134 million has been invested. This initiative is the only support mechanism for innovative projects at a national level that has remained continuous over the past 16 years. In its 16th edition, the Innovation Call for Industry made available more than US\$20 million across different categories of projects, including new calls that allocated US\$6 million for solutions to problems generated by the coronavirus disease (COVID-19) pandemic.¹²

Trends in the federal budget for R&D

In the last few years, Brazil has faced a serious fiscal crisis, which has adversely impacted the public budget across many areas. Although necessary, the effort to contain public spending growth may have lasting impacts on the capacity of scientific and technological production in the Brazilian economy, causing unwanted effects on the country's growth.

Incidentally, the contingencies proposed by the federal government have roused the concern of research institutions and companies regarding the future of science and technology (S&T) in Brazil. In July 2019, the National Council for Scientific and Technological Development (CNPq) announced the suspension of an open call for graduate scholarships in the second semester. Three months earlier, CNPq had announced that thousands of researchers could go without their stipends starting in October because the budget available for the Institution would not be enough to reach the end of the year.

Within the federal R&D budget, the primary funding sources supporting research are the CNPq and the National Fund for Scientific and Technological Development (FNDCT). The

CNPq provides scholarships for undergraduate students, graduate students, and researchers. The CNPq also provides grants for research projects in Brazilian universities and research institutions. The FNDCT is the main source of funds for supporting research projects in universities, research institutions, and companies.

The budget allocations for these two funds have been sharply reduced over recent years. The FNDCT, which had a budget of nearly US\$1.3 billion in 2010, ended 2018 with a budget of less than US\$400 million.¹³ This represents a drop of more than 70% in the resources for research projects in Brazilian companies and research institutions. The same happened with the CNPq. In 2019, the approximate budget of US\$300 million was half of the budget in 2013 (Figure 10.1).

This sharp drop in the federal budget for R&D means that the total volume of federal resources to support R&D in the country is currently lower than it was in the early 2000s, when several of the innovation support funds had not yet been created. The consequence is that there are virtually no public resources available to support the development of new technologies in companies or research institutions across the country, aside from credit.

Another substantial result of this shortage is brain drain. Several Brazilian researchers and scientists are looking for professional opportunities outside the country due to the lack of opportunities in Brazil. Evidence of the difficulties faced by Brazilian researchers is that the country is losing positions in all components of the Global Talent Competitiveness Index—mainly in attracting and retaining talent. The country ranked 33rd in the capacity to attract talent in 2014 and moved to 96th in 2020. In a country where the number of scientists and researchers is still low compared to other countries, this loss of qualified personnel could impact the country's ability to innovate and compete in the long run.

Challenges and opportunities for improvement

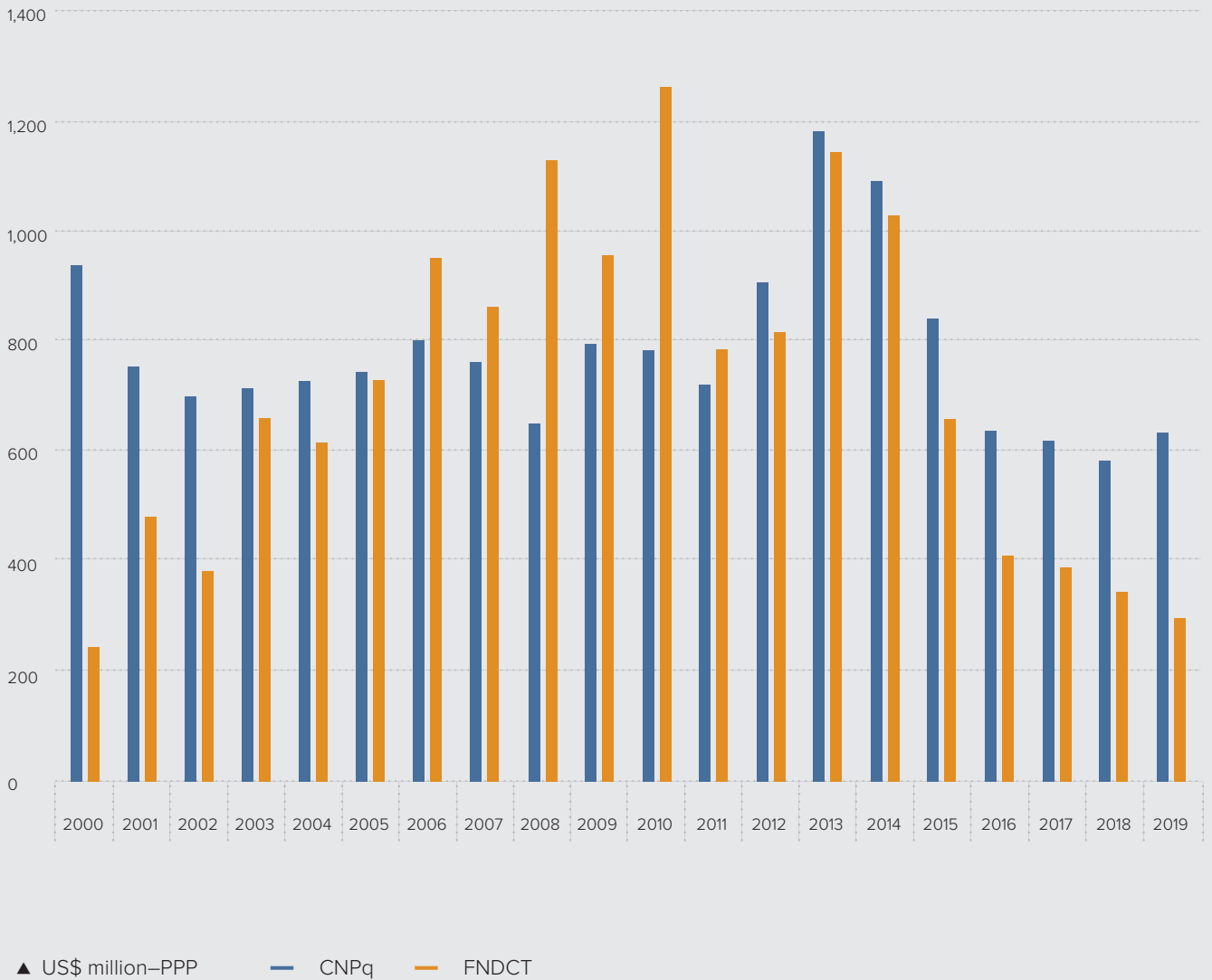
The high cost of capital and the risks associated with innovation limit companies' willingness to invest in R&D and innovation. To mitigate this impact, it is necessary to build a broad, effective, and well-structured framework of public policies for supporting R&D activities.

In this sense, a fundamental issue is how to guarantee the stability of the resources available for research in the country. R&D is a long-term effort subject to a series of uncertainties. Therefore, it is necessary to provide some predictability for the availability of funding sources to guarantee the continuity of these efforts and to produce significant results. The public sector has a fundamental role in assuring this predictability.

Brazil still has a long way to go to build stable policies capable of surviving government changes. While this is constantly being improved, more recent credit policies for innovation are an

FIGURE 10.1

Government budget allocations for the primary funds supporting S&T in Brazil: The National Fund for Scientific and Technological Development (FNDCT) and the National Council for Scientific and Technological Development (CNPq), 2000–2019



Source: Integrated System of Planning and Budget (Siop).

Notes: Available from: <<https://bit.ly/2OwIOA8>>. Accessed February 1, 2020. The PPP conversion factor was used to convert to US dollars based on World Bank data.

example of discontinuity. After accelerated growth between 2010 and 2014, credit policies have suffered a sharp reduction in recent years. The same happened to the resources allocated directly by the public sector for R&D. The sharp drop in S&T budgets observed in recent years puts the efforts made in the previous period at risk, given that the research infrastructure previously established requires constant maintenance and investments.

Tax incentives contribute to reducing the cost of capital and the risk of business investments in innovation activities. Although now more stable and predictable in the country, these incentives can still be improved to amplify their results. For this, it is essential to create permanent evaluation mechanisms that highlight necessary improvements. The continuity and expansion of the incentives provided by Lei do Bem is critical to guaranteeing the legal security of R&D investments in the country, even in a time of fiscal crisis.

Worldwide, credit has been increasingly used to support incremental innovation activities. The maintenance of financing lines for this type of innovation could contribute to a complete framework for financing innovation in Brazil.

However, it is also necessary to move forward in designing other mechanisms. Stimulating venture capital markets, for instance, is one way to facilitate the funding of disruptive technologies. Several legal and regulatory barriers to the complete development of the venture capital market in Brazil remain:

- 1) inadequate taxation, which does not take into account the complete portfolio of the investor;
- 2) the absence of tax incentives for venture capitalists;
- 3) lack of regulation for entrepreneurial capital;
- 4) the extensive time required to open and close a company and to change its organization; and
- 5) the investor's responsibility for the debts of the start-up.

The investor's responsibility in the new business was the subject of legislation for angel investors (Complementary Law n. 155) in 2016. However, in addition to other improvements, there is still a need to improve investment exit mechanisms, such as the development of secondary markets.

Another way to stimulate this market is to exempt from taxation the capital yields obtained by venture capital funds investing in start-ups. Finally, it is also possible to expand mechanisms for public co-investment in private venture capital funds, in order to share the risk and to stimulate technologies that meet the country's priorities.

The constant and open debate about the virtues and problems of the various mechanisms for funding innovation is critical. However, it is necessary that these mechanisms are considered as state policies and that the necessary improvements are based on effectiveness and evidence.

Notes:

- 1 Similarly, Brazil ranks 53rd for this data indicator in the GII, making it their lowest R&D-related GII indicator.
- 2 Kerr et al., 2015.
- 3 A broad analysis about innovation policies in Brazil over the last period can be found in De Negri et al., 2018 and in CNI, 2018.
- 4 In this regard, the Brazilian Innovation Law is similar to the Bay-Dole Act in the United States.
- 5 Rauen et al., 2018; Machado et al., 2017.
- 6 Kannebley et al., 2012.
- 7 Zucoloto et al., 2017.
- 8 Shimada et al., 2014; Zucoloto et al., 2017.
- 9 Salles Filho et al., 2012; Ribeiro et al., 2011; Kannebley et al., 2012.
- 10 According to the Organization for the Economic Cooperation and Development (OECD).
- 11 Available from <http://www.portaldaindustria.com.br/cni/canais/mei/biblioteca/publicacoes/>.
- 12 More information on the categories of projects supported by the 16th edition of the Innovation Call for Industry can be found at <http://www.portaldaindustria.com.br/senai/canais/edital-de-inovacao-para-industria/>
- 13 De Negri, 2019.

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