ove Office of Evaluation and Oversight

Project Evaluation

Assessing Firm-Support Programs in Brazil

IDB Inter-American Development Bank

IIC Inter-American Investment Corporation
A Member of the IDB Group

Original: English

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Office of Evaluation and Oversight, OVE

November 2017

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Washington, D.C. 20577
www.iadb.org/evaluation

RE-489-1
November 2017

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Acronyms and Abbreviations

ABDI	Brazilian Agency of Industrial Development
APEX	Brazilian Trade and Investment Promotion Agency
BNB	Northeast Bank of Brazil
BNDES	Brazilian Development Bank
CNI	National Confederation of Industry
CNI-IEL	National Confederation of Industry - Euvaldo Lodi Institute
CNPJ	Brazilian firms' identification number
DID	Difference-in-difference
EU	European Union
FAMPE	Micro and Small Enterprise Guarantee Fund
FCO	Constitutional Fund of the Mid-Western Region
FINAME	Financing Fund for the Acquisition of Machinery and Equipment
FINEP	Brazilian Innovation Agency
FNE	Constitutional Fund of the Northeastern Region
FNO	Constitutional Fund of the Northern Region
GDP	Gross domestic product
IBGE	Brazilian Institute of Geography and Statistics
IDB	Inter-American Development Bank
INPI	National Institute of Intellectual Property
LAC	Latin America and the Caribbean
MI	National Integration Ministry
MSE	Micro and small enterprises
OVE	Office of Evaluation and Oversight
PAC	Annual Survey of Retail - Enterprise
PAPPE	Firm Research Support Program
PAS	Annual Survey of Services - Enterprise
PDP	Productive development programs
PIA	Annual Survey of Manufacturing – Enterprise
PINTEC	Innovation Survey
PSM	Propensity-score matching
RAIS	Annual Social Information Report
SEBRAE	Brazilian Small Business Support Service
SECEX	Secretary for External Trade
SMEs	Small and medium-sized enterprises
TFP	Total factor productivity

Acknowledgments

This study was prepared by Jose Claudio Pires and Nathaniel Russell under the guidance of Cheryl Gray (OVE Director). The team benefitted from the technical support of Claudia Berg, Simon Lodato, and Paulo Jacinto, while Loreto Setien, Mayra Ruiz, and Victor Beltran offered publishing support, and Melanie Putic, Patricia Sadeghi, Ana Ramirez, and Patricia Rogers offered editing and formatting support. Leandro Justino also provided technical collaboration at IBGE's offices. Cesar Bouillon, Roland Michelitsch, Anna Crespo, Maria Fernanda Rodrigo, Juan Palomino, Alessandro Maffioli, Luciano Schweizer, Mauricio Mesquita Moreira, Ricardo Quiroga, Maria Schneider, Daniel Hernaiz, and Tulio Cravo provided valuable comments on earlier drafts of the report, while Filipe Souza, Rodolfo Stucchi, Miriam Bruhn, Vanderlea Radaelli, Jose Luiz Rossi, Tomas Teixeira Lopes, and Edwin Goni contributed valuable input at various stages of the study.

OVE would like to thank ABDI, APEX, BNB, BNDES, CNI, CNI-IEL, FINEP, IBGE, INPI, SEBRAE and the Ministries of Labor and National Integration for their cooperation and for sharing with OVE the data necessary for the preparation of this document. Special thanks to Carlos Lessa and Luis Carlos Pinto of the Center for Information, Documentation, and Dissemination Management at IBGE for allowing OVE access to their surveys and assisting OVE during the work at IBGE's offices. We would also like to thank the following people for their contributions, either in technical meetings or in one-on-one discussions: Jackson de Toni, Roberto Sampaio Pedreira, Eduardo Rezende, Luis Claudio Franca, Carlos Henrique Silva, Ana Sofia Peixoto, Raphael Ribeiro, Junia Motta, Cassio Rabelo, Lanna Dioum, Claudionel Leite, Carlos Frees, Mirolavia Uchoa Pinto, Roberta Nunes, Eron Campos, Ricardo Amorim, Ana Carolina Nogueira, and Erdelene Lessa from ABDI; Tiago Terra, Igor Celeste, Ana Paula Repezza, Paulo Roberto Silva, Manoel Ribas Junior, Manuela Lima, and Guillerme Nacif from APEX; Laura do Socorro da Rocha Santos from BASA; Luis Esteves and Marcos Falcão Goncalves from BNB; Paulo Faveret Filho, Daniel Grimaldi, Breno Albuquerque, Leonardo de Oliveira Santos, Luciano Machado, Fabio Roitman, Marcio Gold Firmo, and Sergio Guimaraes Ferreira from BNDES; Renato da Fonseca, Joao Emilio Goncalves, Marcelo Prim, Sarah Saldanha, Cristiano Silva, Rodrigo Kurek, Michele Mamede, Cristiano Silva, Gustavo Ferreira, Samantha Cunha, and Maria Marques from CNI; Paulo Mol, Suely Lima and Ricardo Penzin from CNI-IEL; Andre Cabral de Souza, Marcelo Nicolas Camargo, Wanderley de Souza, Richard Correa and Ana Chaloub de Oliveira from FINEP; Alessandro Pinheiro, Maria Deolinda Cabral and Luisa Abreu from IBGE; Vívian Íris Barcelos, Felipe Veiga Lopes, Fernando Linhares de Assis, Vicente Freitas, Sergio Paulino de Carvalho, Ana Claúdia Nonato and Marina Filgueiras Jorge from INPI; Fernando Veloso from IBRE; Fernanda de Negri from IPEA; Andre Castro, Thiago Rodrigues, Hebrida Fam, Ana Caroline Suzuki Bellucci, Fabiany Vellasco, Rafael Leao, Herlon Brandao, Paulo Felipe Oliveira, Marcus Lima, and Carlos Antonio dos Santos from MDIC; Jorge Arbache and Carlos Eduardo Lampert Costa from MP/SEAIN; Mansueto Almeida, Pedro Calhan Miranda, Angelo Duarte, Alexandre Manoel da Silva from MFAZ/SEAE; Carlos Henrique Rosa, Kleber da Silva Bandeira, Grayce Goncalves, Clecio Santos, Renato Popov, Priscila Franco, and Victoria Dopazo from MI; Rosangela de Souza Farias from MTE; and Alexandre Comin, Joao Silvério Junior, Ramon Bispo, Rafael Moreira, Alexandre Vasconcelos Lima and Alexandre Guerra de Araujo from SEBRAE.

Finally, OVE is grateful to the attendees at the special sessions of the 37th and 38th Econometric Brazilian Society Meetings in 2016 and 2017 for their comments on preliminary presentations of the study.

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Executive Summary

Increasing productivity is generally considered to be the only sustainable way of improving living standards in the long term. The Brazilian economy has had periods of strong growth, particularly until 2010, but the country has performed poorly in terms of aggregate productivity. The federal government has implemented many programs aimed at boosting firm growth and fostering competitiveness in Brazilian industries, though knowledge about their results to date is scarce.

This study provides an overview of various Brazilian programs of firm support — including productive finance, business consulting, value chain, export promotion, and innovation support — as well as an assessment of the effects of a subset of these programs on productivity, employment, and real wages. Access to a unique dataset on Brazilian firms and beneficiaries allowed the Office of Evaluation and Oversight (OVE) to analyze these programs over an 11-year period, 2002 to 2012.

Firms and Programs

Brazilian firms are on average small and operate predominantly in the retail and services sectors. Average firm size differs by sector, with manufacturing firms being larger than services firms and much larger than firms in the retail sector. Average firm employment grew little over the period, and fewer than half of firms with 50 employees or fewer survived. Though the average education levels of employees grew slightly, in no sector did it reach high school completion (12 years).

OVE had access to administrative data on 34 programs offered by 10 different Brazilian institutions. Nearly 900,000 firms participated in at least one program, and the number of participating firms per year increased over the period. Provision

of investment capital accounted for about two-thirds of the almost 1.5 million treatments in the data. Firms receiving export training and innovation support were larger on average than firms receiving other types of support, and they paid above-average wages and hired more educated workers. Working capital support, and to a lesser extent investment capital, reached firms that were smaller, paid lower wages, and hired less educated workers than the national average.

Impacts

The intertwined nature of these programs makes it difficult to attribute effects to a single intervention, a problem inherent to impact evaluations of complex or multiple interventions. In addition, the large size and complexity of overlapping programs made it infeasible to run regressions controlling for multiple treatments using the full data set of treatments. OVE thus decided to limit the regression analysis in this evaluation to firms that received treatment from only a single program. This study thus covers around 600,000 firms, each of which participated in only one of the 6 programs that could be evaluated given this criterion.

Although the survival rate of the treated firms was higher than the expected value for the average Brazilian firm, only a few treatment types were associated with statistically significant increases in firm productivity, and even fewer with increases

of a large magnitude. Programs supporting firms in the manufacturing sector fared better, while there were very few positive results in the retail and services sectors. Regressions also revealed few positive impacts of the programs on other outcomes. Indeed, the interventions studied were likely to be associated with reductions in wages, and they were just as likely to show negative as positive results on employment. To summarize, there were few positive results on productivity or other indicators; in most cases either no impact was found or regression results were inconclusive.

The paucity of positive impacts suggests a need to revisit the scope, design, and monitoring of firm-support programs in Brazil. The programs studied in this review did not require firms receiving support to invest in new technologies or take steps to enhance efficiency, and the programs did not explicitly define productivity as an outcome to pursue or establish mechanisms to monitor productivity gains. A key challenge going forward will be to design programs in a more focused way to achieve results and to build in, from the beginning, better systems for the monitoring and evaluation of impacts.

Brazilian firms are on average small and operate predominantly in the retail and services sectors. Average firm size differs by sector, with manufacturing firms being larger than services firms and much larger than firms in the retail sector.

Introduction

The Office of Evaluation and Oversight (OVE), as part of its 2017 work program, conducted a study of the main types of firm-support programs (or productive development programs, PDPs) implemented by Brazilian institutions. The study has two objectives, each of which will be addressed in its own part. Part I describes the profile and reach of PDP programs in Brazil. Part II assesses whether and how approaches implemented by Brazilian institutions affected firm-level outcomes, specifically productivity, but also employment and real wages. The Inter-American Development Bank (IDB, or Bank) Group supports these types of programs around Latin America and the Caribbean (LAC). However, rather than evaluating Bank projects, the overarching objective of this exercise is to learn from the Brazilian experience to inform future strategic decisions about the targeting of Bank support for productive development in the Region.

Increasing productivity is generally considered to be the only sustainable way of improving living standards in the long term. An increase in productivity allows for a reduction in the use of resources and an increase in output at the firm or aggregate level. In the aggregate, productivity growth generally transfers into higher per capita GDP, and typically an increase in labor productivity is also a necessary (but not always sufficient) condition to increase wages.

Yet in recent years Brazil has performed poorly on labor productivity and total factor productivity (TFP).[1] Brazil saw gains in productivity up until 2008, largely because the basic education of the labor force improved, increasing human capital.[2]

Yet little growth in efficiency came from incorporation of technology, expansion of scale production, improvement of the business environment, or other factors that affect labor and TFP.[3] After 2008 productivity growth slowed drastically, particularly because of the financial crisis and the ensuing slowdown of the Brazilian economy.[4] From 2002 to 2012, TFP showed a slight decrease of 0.01%.[5] Labor productivity has declined in the manufacturing sector and stagnated in the services sector, while employment in both sectors has increased (World Bank, 2016).

Maintaining GDP growth will require growth in productivity over the coming years. The Brazilian Institute of Geography and Statistics (IBGE) does not project substantial increases in population or labor participation rates in the near future; this suggests that GDP growth be increasingly depend on increases in productivity and will be difficult without them.[6] The evolution of productivity has been a topic of increasing economic debate in Brazil. Regardless of the measure used—labor, capital, or TFP—studying the evolution of productivity, whether at the aggregate or the firm level, is needed to understand and monitor the country's competitiveness.[7]

The literature describes a range of macro- and micro-level policies to overcome the root causes of low productivity.[8] Some broad policies aim to enhance the functioning of the market and the overall efficiency of factors of production by reducing informality; reforming labor and financial markets; improving infrastructure, fiscal regimes, and education systems; and boosting the business climate.[9] More targeted policies aim to address market failures hampering firm productivity through subsidized credit, grants, and tax exemptions. Although broad policies are extremely relevant for the public policy agenda, this study focuses on the more targeted programs whose main beneficiaries are firms.

During the early 2000s, the Federal Government implemented several policies and programs aimed at fostering competitiveness in Brazilian industries: including the 2003 Industrial, Technological and Foreign Trade Policy, the 2008 Productive Development Policy, and the 2011 Bigger Brazil Plan.[10] The government encouraged many Brazilian agencies to support firm growth, innovation, and exports. Other programs have been in place for longer, and they grew substantially as a result of several governmental initiatives put in place to mitigate the effects of the global financial crisis of 2008.

These programs are part of a growing regional trend within LAC of creating PDPs to support firms.[11] The institutional arrangements, policies, and financial instruments vary to fit the diverse circumstances in sectors and countries in the region, but the rationale for PDP policy and lending support at the firm level is that market failures keep firms from reaching their potential to generate jobs and income. Support that correctly addresses these market failures could allow the firm to operate more efficiently and in turn lead to increased social welfare that stems from greater competition,

innovation, and access to external markets or from improved coordination in clusters and value chains (Agosin and Fernandez-Arias, 2014; Stein, 2014). More specifically, a firm's productivity would be expected to increase if the PDP support effectively helped it become more efficient by funding innovation, upgrading capital, and improving managerial skills.

Yet PDP support has also been criticized. Previous implementation of import-substitution industrialization policies in the Region showed that targeted policies in particular could lead to rent-seeking and the capture of public policy by private interests (Agosin and Fernandez-Arias, 2014), and could undermine the functioning of markets (Rodrick, 2004). Protectionist barriers and subsidies usually benefit well-organized sunset and low-productivity industries (Fristchtak and Moreira, 2015). Credit subsidies can lead to inefficient allocation of funding in the economy if inefficient firms crowd out more efficient and productive ones (Johnston and PerBrekk, 1999). Similarly, development banks' provision of subsidized long-term interest rates has been criticized as impeding the development of a long-term credit market by crowding out credit that would otherwise be supplied by private agents in a free market (McKinnon, 1973; Cohen and Noll, 1991).[12]

The Bank has made significant efforts to evaluate the effectiveness of different individual PDPs and their spillovers.[13] This study aims to complement those efforts by providing robust evidence on the impacts of different PDP support models in a country where the IDB Group has been active.

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This study provides an overview of various Brazilian programs of firm support as well as an assessment of the effects of a subset of these programs on productivity, employment, and real wages.

1 Productivity and Firm Support in Brazil

A. Categories of PDP support in Brazil

The various PDPs in Brazil can be categorized into five main approaches linked to a chain of results: productive finance, business consulting, value chain, export promotion and innovation support. Table 1.1 maps these categories of interventions with their expected outputs, outcomes and impacts.

Table 1.1. PDP support in Brazil

	Productive finance	Business consulting	Value chain	Exports	Innovation
Main justification/ market failure	Asymmetry of information/ adverse selection/moral hazard in credit markets	Asymmetry of information	Coordination failure/ unexploited agglomeration externalities	Asymmetry of information/ adverse selection/ moral hazard in credit markets; information externalities	Capture externalities
Output	Provision of working and investment capital/ guarantee for firms	Training	Consolidation of firm's network	Enhanced knowledge of potential external markets: missions, fairs, certifications/ training	Technology transfer/R&D/ equipment/ training
Outcome	Firm growth	Firm growth	Capture externalities	Firm growth/ exports	Process innovations/ product differentiation
Impact	Productivity growth	Productivity growth	Productivity growth	Productivity growth	Productivity growth

Source: OVE

Productive finance. Average financing to the private sector in Brazil (59% of GDP) is much lower than the average for advanced economies (112% of GDP).[14] Constraints on access to finance hamper firm expansion and modernization plans. The root causes may lie in both government failures (poor rule of law, informality, lack of legal basis for credit bureaus, etc.) and market failures, such as adverse selection and moral hazard in credit markets.[15] Thus, in Brazil, in addition to regulatory reforms, a significant number of interventions have been designed and implemented to alleviate credit constraints and provide firms with the capital they need to expand and modernize. OVE categorized productive finance into two types: working capital and investment capital.

- *Working capital:* Financing classified as working capital support met the firm's daily financial obligations including wages, raw material suppliers, taxes, and overall operating expenses.

- *Investment capital:* This type of support financed long-term projects, such as firm expansion, modernization of installations and machinery, and the creation of new goods and services.

Business consulting.[16] Firms, particularly SMEs, often lack adequate information on basic regulations, environmental management, and business management. The programs OVE classified as business consulting supported the development of business plans and the design of business strategies to improve firm performance, growth, and productivity.[17] This support is usually combined with other kinds of support, such as productive finance or value chain.

Value chain.[18] Value chain support is based on the idea that individual firms can benefit from productive associations, and it aims to provide a localized network of specialized organizations, services, and knowledge.[19] The value chain concept has been widely adopted as a policy tool for local economic development programs by development agencies in various countries, including Brazil, France, Japan, and South Korea.[20]

Exports. The lack of cross-border knowledge on markets, suppliers, and technologies and limited access to credit are barriers to firms' access to international markets (Crespi et al., 2011). Export promotion programs aim to correct market failures (information asymmetry/adverse selection/moral hazard) that serve as obstacles to exporting. They also benefit the domestic economy, as "learning by exporting" may lead firms to innovate and be more productive (Greenaway and Kneller, 2007), and increased competition in foreign markets forces firms to be more efficient to tackle external competitors. OVE classified export-promoting supports into two types: *export credit and export training.*

Innovation support. Social returns to innovation may exceed private returns, so that investors do not reap all the benefits. Thus, firms may lack incentives to innovate. Furthermore, firms face obstacles to innovation. Information asymmetry may hamper

cost-benefit analysis of projects, and innovation may entail coordination problems as it depends on complementary investments in human capital, technological infrastructure, and knowledge.[21] Since innovation has intangible, positive spillover effects, public policy is necessary to address these issues. Policy instruments may include financing for science and research projects, subsidized lending to firms, start-up funding, and training in the adoption of new products and processes.[23]

B. Providers and their programs

Figure 1.1 diagrams nine Brazilian entities that provide the categories of PDP support described above. OVE partnered with these organizations to obtain data for this study.

The Brazilian Agency of Industrial Development (ABDI), a direct subordinate to the Presidency of the Republic, was created to strengthen the link between Government policies and business strategies.[24]

- *Export Training:* ABDI provided export training through a technical cooperation funded by the European Union (EU), the Support Program for International Insertion of SMEs. Implemented from 2008 to 2012, the project consisted of export training, research support, and improved access to high-tech equipment to promote cooperation between Brazilian and EU institutions. The initiative was financed by Brazil and the EU and executed by ABDI.

The Brazilian Trade and Investment Promotion Agency (APEX) was created in 2003 to promote exports of goods and services and open Brazilian companies to external markets. It is responsible for coordinating and implementing export promotion policies and attracting foreign direct investment for companies of all sizes.[25]

- *Export Training:* APEX sponsors export consortiums, trade promotion in international business fairs, market research, trademark development, and trade information. To provide these supports, APEX partners with the private sector, non-governmental organizations, SEBRAE and public institutions. The agency predominantly targets SMEs.

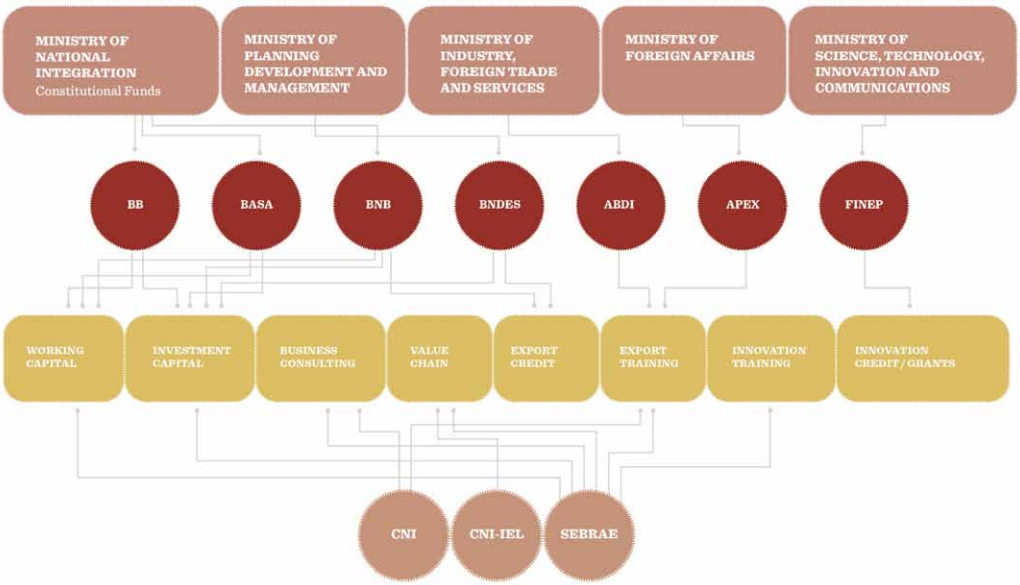
The Brazilian Development Bank (BNDES) has had a strong role in long-term investment funding for firms in all sectors. The majority of BNDES programs offer credit and leasing to firms of all sizes, though BNDES Card specifically targets SMEs.[26]

- *Investment Capital:* BNDES offers investment capital through BNDES Automatic, the Financing Fund for the Acquisition of Machinery and Equipment (FINAME), and BNDES Card.[27] Recipients of investment capital from BNDES are required to buy machinery and upgrades locally.

Figure 1.1

The Institutional Diagram

Source: OVE



- BNDES Automatic focuses on financing investment projects valued under R$20 million. Financing is provided indirectly through accredited financial institutions. Loans target investment in the building, expansion, and modernization of fixed assets, as well as research, development and innovation projects in sectors as varied as manufacturing, retail, services, agriculture, forestry, fishing and aquaculture.

- BNDES card is a pre-approved credit line that specifically targets SMEs (defined as companies whose annual revenue does not exceed R$90 million) throughout the country. The credit is issued through participating banks at below-market interest rates, and all transactions are conducted over the internet.

- BNDES Finame finances up to 80% of the value of the production and trade of national machinery and equipment of recipient firms. Purchases should be previously accredited by BNDES and can be parceled up to 120 months. Financial intermediaries accredited by BNDES are responsible for the selection, credit risk analysis, and credit limit for each firm that applies. Financing targets firms of all sizes in compliance with their fiscal and social obligations.

- Export credit: The BNDES export credit line is called Pre-embarque. To receive support, recipients must meet a certain index of nationalization (usually 60% defined in value and/or weight terms) or domestic production thresholds defined by BNDES. Like BNDES Finame, financial intermediaries are responsible for the selection, credit risk analysis, and credit limit for each applying firm, and the program targets firms of all sizes in compliance with their fiscal and social obligations.

The National Confederation of Industry (CNI) is a syndication union representing the interests of the industrial community with the aim of boosting the competitiveness of Brazilian industries. CNI coordinates a system of 27 federations in the states and Federal District of Brazil, the National Industrial Training Service, the Social Service of Industry, and the Euvaldo Lodi Institute (CNI-IEL), the link between industry and academia.

- *Business Consulting:* CNI offers business consulting through entrepreneurial qualification and business and management training. It also offered competitiveness diagnostics in three Brazilian states (Ceara, Paraiba, and Pernambuco) through the FINPYME DIAGNOSTICS program.[28] Projects are implemented through manufacturing associations in each state. SMEs should pay a symbolic enrollment fee, and they should have been operating for at least 3 years, preferably having audited financial statements available and expansion projects planned.

- *Value Chain* support was provided through both CNI and CNI-IEL.

  - CNI targets MSEs in the manufacturing sector through the Competitivity Support Program to Micro and Small Manufacturing Firms (PROCOMPI). It provides value-chain-oriented training support and certification in conjunction with the Brazilian Small Business Support Service (SEBRAE) and regional manufacturing trade unions and associations. The partners seek out SMEs to participate, and firms pay a symbolic enrollment fee.

  - CNI-IEL provides value chain support through the Supply Qualification Program. It aims to upgrade and enhance the productive capacity of value chain suppliers through training, advising, and providing certification to SMEs that are a part of value chains.

- *Export Training:* CNI also offers export training support through its Sectorial Action Plan. It provides courses, diagnostics, and specialized services such as trade promotion and market information to improve SMEs' access to external markets. The activities are promoted together with industrial associations at state-level and APEX. Participants pay a fee for their enrollment, but attendance is free for entrepreneurs affiliated with unions. The program predominantly targets SMEs.

The Brazilian Agency for Innovation and Research (FINEP) is the public agency responsible for managing and directing national fund resources for innovation projects. A subordinate of the Ministry of Science, Technology, Innovation and Communications, FINEP aids firms' innovation efforts through subsidized credit and non-reimbursable grants.

- *Innovation Support.* FINEP offered innovation support through a mixture of credit and grants channeled through centralized and decentralized programs.

Centralized programs:

- Reembolsável (Reimbursable) is a subsidized credit line launched in 2004 under the umbrella of the national industrial policy. Reimbursable funds up to 90% of the costs of the acquisition of equipment, goods, training, consulting services, and software by firms of all sizes pursuing innovation efforts in line with the federal government's Greater Brazil Plan. The program aims to increase the competitiveness of firms domestically and abroad, increase R&D throughout the country, and make firms more technologically compatible within their sectors.

- Subvenção Econômica (Economic Grants) was created to subsidize business innovation through government policy, the first instrument of its kind in Brazil, with the objective of increasing the competitiveness of firms and the national economy. It provides publicly funded grants to fund operating expenses of innovation projects as counterparts to funding put forth by the firms themselves. Firms are selected based on their technical capacity, the adequacy of their R&D facilities, the degree of innovation of the project, and the expected market revenues and impacts. The program is open to firms of all sizes in capital goods, semiconductors and software, pharmaceutical, aerospace, nanotechnology, biotechnology and renewable energy sectors.

- Subvenção Pesquisador (Research Grants) was a short-lived program (2006-2007) that provided grants to innovating firms to reimburse firms for three years of wages paid to researchers they hired with limits of R$7,000 and R$5,000 a month for PhDs and masters respectively. Firms submitted their projects online to FINEP and defended them orally to a selection panel. FINEP also considered the firm's history of project implementation when making the final decision. Projects needed to be consistent with the priorities of Brazil's Industrial Policy. 30% of the program's resources were earmarked for the North and Northeaster regions, though the program was otherwise open to firms of all sizes nationwide in compliance with their fiscal and social obligations.

Decentralized programs:

- Juro Zero (Zero Interest): The Zero Interest program, created at the end of 2005, provided interest-free loans, indexed by inflation, to SMEs with annual revenues under R$10.5 million. The program was demand-driven and implemented through partnerships with research institutions, business associations, and industrial chambers that prequalify SMEs' proposals. FINEP partnered with regional agencies in five states[29], though it provided final approval, and the program required 20% in guarantees from SME owners.

- Firm Research Support Program (PAPPE): FINEP launched PAPPE with state-level research support foundations, aimed at strengthening and integrating the national and regional innovation systems through grants to SMEs. This program has had three versions so far that differ basically only in their geographic coverage and the date they started.[30] At the end of 2003, FINEP launched the first PAPPE with partnerships in 17 Brazilian states to select firms based on the innovation intensity of the firm and the market feasibility and social and economic impacts of the projects. In 2006 the program was expanded as PAPPE Subvenção (Subvention) with the aim of decentralizing the government funded economic subsidies to SMEs and establishing new collaborative partnerships on a state level. In 2010 FINEP started PAPPE Integração (Integration) with the aim of stimulating the innovative capacity and competitive advantage of SMES from the North, Northeast and Midwest regions, areas that were identified as having been neglected by the previous programs. In all cases, firms applied on line using standard pre-qualification forms, and their proposals were vetted by partners, with FINEP providing the final approval. The programs target SMEs in compliance with social and fiscal obligations with annual revenue of less than R$2.4 million.

- PRIME: In 2009, FINEP launched PRIME, a grant program targeting technology-based SMEs in existence for no more than two years in their pre-operational stage. PRIME is based on institutional cooperation agreements signed between FINEP and decentralized operators to provide the resources and infrastructure necessary to address the needs of high value-added, nascent companies. The program provides non-reimbursable funds of up to R$120 million to support technology-based SMEs in financing human resources and consulting expenditures. To participate, companies must have a high propensity for innovation in products or services and a business plan that includes viable challenges and goals.

The Northeast Bank of Brazil (BNB) has been the Government's primary financing agent in the country's northeastern region since 1954, two years after its foundation. BNB extends working and investment capital credit lines to micro, small, and medium-sized enterprises, while also providing other traditional business solutions, such as savings accounts and certificates of deposit, as well as checking accounts, insurance products, and bill collection services. It also offers export credit. In all cases, BNB is responsible for the credit risk analysis and defining the credit limit based on firm reciprocity and guarantees. Credit is available for firms of all sizes in compliance with their fiscal and social obligations.

- *Working Capital:* BNB provides working capital through its own funds and co-funding working capital support offered by the Constitutional Fund of the Northeastern Region (FNE).

- *Investment Capital:* BNB provides investment capital through its own funds while also co-funding support offered by FNE.

- *Export Credit:* BNB has provided export credit lines to micro, small, and medium-sized enterprises since it started operating in 1954.

Created in 1989, the Constitutional Funds—the Constitutional Fund of the Mid-West (FCO), Constitutional Fund of the North (FNO), and the Constitutional Fund of the Northeast (FNE)—are overseen by the National Integration Ministry (MI), which defines their guidelines and priorities for investment as well as the monitoring and evaluation of the programs they finance. The resources of FNO, FCO, and FNE come mainly from a 3% income tax and an industrial products tax, of which 60% is dedicated to FNE and 20% each to FCO and FNO. FNO and FNE are managed by the Amazon Bank and BNB, respectively. The administrator of the FCO is the Bank of Brazil.

- *Working capital:* FNO, FNE, and FCO provided working capital through the Amazon Bank, BNB, and Bank of Brazil, respectively. In all cases, the intermediary is responsible for the credit risk analysis and the size of the credit limit which varies from 70 to 100% of the total project amount depending on the size and location of the firm. Interest rates and loan tenures are determined based on the firm size and the purpose of financing. The program services firms of all sizes in compliance with their fiscal and social obligations.

- *Investment capital:* All three funds also offered support classified as investment capital support, using the same financial intermediaries, financing conditions, and program requirements above.

- *Export credit:* FNE provides subsidized export credit lines in the country's northeastern region. Like the working and investment capital it offers, the financial intermediary is BNB, and the conditions of credit and participation are the same.

SEBRAE is the main contributor to micro and small enterprise (MSE) support programs in Brazil.[31] Historically it collaborates with both BNDES and FINEP in venture capital and private equity funds aimed at fostering innovative start-ups, and with APEX and CNI in export promotion. It provided nearly all types of PDPs.

- *Working capital:* SEBRAE's MSE Guarantee Fund (FAMPE) provided working capital through guarantees of up to 80% of the total loan amount, contingent on company size, for lending through institutions accredited by SEBRAE at the national level, and the lending institution is responsible for the selection, credit risk analysis and credit limit for each applying MSE.

- *Investment capital:* SEBRAE's FAMPE also provided support categorized as investment capital in the form of lending guarantees offered through the same financial intermediaries as their working capital support under the same conditions mentioned above.

- *Business consulting:* SEBRAE promotes a range of business consulting activities for MSEs, including free guidance, training, management and self-diagnosis tools, call center and online support, and financial education regarding the use of credit lines. These supports are available for MSEs and individuals alike.[32]

- *Value chain support:* SEBRAE offered diagnostic studies, certification, action plans design, and facilitated training for MSEs to better connect them to value chains. Projects are proposed by private sector organizations in partnership with SEBRAE, unions, universities, city halls, and government authorities that mobilize the firms. The program targets MSEs.

- *Export training:* SEBRAE promotes export fairs, courses, and internationally-recognized export certification to MSEs, usually in conjunction with APEX, CNI, and business associations.

- *Innovation training:* SEBRAE offers certifications, technology transfer programs, incubators, and product development support geared at fostering innovation among Brazilian MSEs.

C. An overview of Brazilian firms and program beneficiaries

1. A profile of Brazilian firms[33]

Firms in Brazil tend to be small. The Annual Social Information Survey (RAIS) provided by the Brazilian Ministry of Labor and Employment includes data on 5,429,239 unique firms over 2002-2012. Average firm size measured by the number of employees was 24.7 in 2012. The median number of employees for Brazilian firms in 2012 was four, and 75% of firms had 10 employees or less. Nearly all (99%) of the 1.8 million firms included in RAIS data in 2002 have fewer than 250 employees, and the overwhelming majority (97%) have fewer than 50 employees. Firms with 50-99 employees make up 1.86% of the sample for that year, those with 100-149 comprise make up 0.57%, and those with 150-199 and 200-249 make up 0.28% and 0.18%, respectively.

Average firm size grew less than 1% per year during the years 2002-2012. The firms of the South and Southeast grew at the biggest rates (10%) over the years, but employed the lowest number of employees (25.6 and 20.1, respectively) in 2012. Conversely, the firms of the North grew at the lowest rates (4%) but hired the highest number of workers in 2012 (34.4).

Average education and average age among Brazilian workers grew slightly over the period, while real wages grew substantially. However, it took over a decade for the average worker's education to increase by just one year, from 10.1 years in 2002 to 11.2 in 2012, just under high school completion.[34] The average age of the workforce grew from 31.2 years in 2002 to 33.1 in 2012, and real wages rose 36% over the same period (from R$722 to R$975).

Firms are predominately from the retail and services sectors, and the sectorial composition of firms did not change very much over the period. Nearly half of firms consistently fell into the retail sector (48% in 2002 and 46% in 2012). The share of firms in the services sector changed slightly more, growing from 28.2% in 2002 to 31.7% in 2012, while the share of manufacturing firms fell slightly from 13.2% in 2002 to 11.5% in 2012. The rest of the firms were in agriculture and miscellaneous sectors.

Box 1.1. The National Classification of Economic Activity (CNAE) Sector Breakdown

Agriculture	–Agriculture, forestry, fishing, and livestock activities.
Manufacturing	–Manufacturing activities and extractive industry (mining, oil, natural gas exploitation).
Services	–Hotels and restaurants, transportation and communication services, real estate, advertisement, security, sports and cultural activities.
Retail	–Wholesale and retail trade of goods and services, domestic appliances repair services.
Others	–Utilities, construction, public administration, education, health and social services, household services, financial sector, and international organizations.

Source: OVE

Firms in the manufacturing sector were larger than those in the services sector and much larger than those in the retail sector. In 2002, manufacturing firms employed on average 33.72 people, while services employed 21.97 and retail employed 8.72. By 2012, firms in all sectors had grown, but the basic order remained: manufacturing (39.51), services (23.82), and retail (11.65).

In all sectors average employee education failed to reach the equivalent of high school completion, while average employee age and wages diverged slightly across sectors. While average employee age over the period 2002-2012 was higher in the services sector (34.39 years) than in manufacturing (32.95 years) and retail

(30.99 years), and average education level was higher for firms in the retail (11.11 years) and services (11.08 years) sectors than in the manufacturing sector (10.32 years), these differences were small. The disparity between wages in services and manufacturing (R$541.59 and R$536.80, respectively) and wages in retail (R$464.72) was higher.

Foreign employees constituted less than 1% of the Brazilian workforce throughout the period. The highest rate of foreign participation was 0.19% in 2012.

OVE followed firms that existed in 2002 through 2012 to calculate the rates of survival of Brazilian firms. Given this skewed nature of employment distribution, the analysis of firm closures focuses mainly on companies with 50 employees or fewer. Firms present in 2002 were marked as closed if they failed to appear in RAIS in both 2012 and 2013. While the main analysis used data from 2002 to 2012, this section used 2013 as well to allow more certainty in saying that a firm had ceased to exist. Furthermore, for the same reason the analysis only takes into account firms that had zero gaps in the data.

The overall survival rate of Brazilian firms was 67%, while firms with 50 employees or fewer had a survival rate of only 46%. Of the 1,301,973 firms present and reporting 50 employees or fewer in 2002, 702,945 had closed by 2012. The percentage of surviving firms increased for each incremental size bracket (from 60% for 50-99 employees to 72% for 200-249 employees), but given the small percentage of firms represented in those brackets, the numbers should be taken with caution. Of the 46% of firms with 50 employees or fewer that were still present in 2012, 4% increased employment (at an average of 1.59%). The 54% of firms that closed lasted on average three years. Again, each of these statistics improved for firms in larger size categories.

2. Overall profile of supported firms

Of the 5,429,239 firms in the RAIS database, 890,543 (16.4%) received support from at least one the programs described in Section B above, and the number of supported firms increased substantially over the years. Table 1.2. shows the total number of firms by year that received support from each program. It grew from around 5,000 in 2002 to about 350,000 in 2012, with about 80% of beneficiary firms supported after 2008. These 890,543 firms received about 1.46 million PDP supports over the panel years.

Investment capital programs account for the largest share of PDP supports (68%). Working capital lines (12%), value chain support (9%), and export credit lines (5%) reached far fewer firms in comparison.

Table 1.2. Total Number of Supported Firms by Year in RAIS

	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	Total
Working capital												
BNB	34	17	294	1,148	2,658	4,864	7,491	9,062	9,576	10,332	8,294	53,770
FNE	234	294	740	2,353	4,334	5,423	7,265	7,202	7,355	7,943	10,510	53,653
FCO	160	97	2,022	1,814	2,089	3,166	9,583	8,275	12,848	10,456	7,595	58,105
FNO	257	334	1,216	685	840	1,075	1,211	1,584	1,588	1,413	2,500	12,703
SEBRAE FAMPE	-	-	-	-	-	-	-	-	-	-	104	104
	685	742	4,272	6,000	9,921	14,528	25,550	26,123	31,367	30,144	29,003	178,335
Investment capital												
BNB	89	16	16	65	133	215	334	536	811	621	664	3,500
FNE	223	432	714	1,231	2,075	2,546	3,129	4,276	4,743	4,746	4,605	28,720
FCO	2,502	1,225	2,984	2,971	3,362	3,864	4,294	3,602	4,598	3,749	4,112	37,263
FNO	1,334	2,102	2,796	1,835	2,327	2,938	3,579	3,657	3,222	2,436	3,783	30,009
SEBRAE FAMPE	-	364	158	63	219	366	43,157	30,183	24,390	19.528	16,408	134,836
BNDES Automatic	-	1,086	659	416	1,127	2,116	500	2,198	1,356	1,518	1,628	12,604
BNDES Card	-	61	550	2,318	7,317	14,862	21,850	54,621	89,150	137,408	161,851	489,988
BNDES Finame	-	14,654	11,629	13,348	13,756	18,246	23,040	30,881	52,131	41,375	45,991	265,051
	4,148	19,940	19,506	22,247	30,316	45,153	99,883	129,954	180,401	211,381	239,042	1.001,971
Business consulting												
CNI	-	-	-	-	-	-	-	-	-	26	-	26
SEBRAE	-	-	69	1,889	4,587	5,447	5,633	3,843	2,719	4,396	19,608	48,191
	-	-	69	1,889	4,587	5,447	5,633	3,843	2,719	4,422	19,608	48,217
Value chain												
CNI	-	-	-	-	356	707	710	459	838	626	876	4,572
IEL	12	20	36	52	84	84	64	39	31	28	37	487
SEBRAE	-	65	681	6,717	9,768	11,883	10,397	7,129	8,382	16,426	49,695	121,143
	12	85	717	6,769	10,208	12,674	11,171	7,627	9,251	17,080	50,608	126,202
Export credit												
BNB	133	13	278	1,077	2,438	4,447	6,742	7,595	7,356	7,823	5,813	43,715
FNE	49	7	121	828	1,878	3,153	4,963	4,949	4,812	5,198	4,097	30,055
BNDES	-	332	112	137	138	112	127	208	468	235	194	2,063
	182	352	511	2,042	4,454	7,712	11,832	12,752	12,636	13,256	10,104	75,833
Export training												
ABDI	-	-	-	-	-	-	242	246	264	242	222	1,216
APEX	-	-	-	-	-	3,689	3,860	4,490	5,148	2,074	2,205	21,466
CNI	-	-	-	-	5	42	46	343	297	522	287	1,542
SEBRAE	-	-	-	22	56	324	459	450	524	311	790	2,936
	-	-	-	22	61	4,055	4,607	5,529	6,233	3,149	3,504	27,160
Innovation credit/grants												
Reimbursable	-	-	6	36	66	70	62	70	70	102	76	558
Economic Grants	-	-	-	-	-	158	126	183	230	75	48	820
Research Grants	-	-	-	-	-	14	32	-	-	-	-	46
Zero Interest	-	-	-	-	17	29	14	5	14	6	-	85
PAPPE I	-	-	37	130	100	40	4	-	-	-	-	311
PAPPE II	-	-	-	-	-	-	82	152	-	-	-	234
PAPPE Integration	-	-	-	-	-	-	-	-	17	38	21	76
PRIME	-	-	-	-	-	-	-	1,271	-	-	-	1,271
	-	-	43	166	183	311	320	1,681	331	221	145	3,401
Innovation training												
SEBRAE	-	-	-	1	4	4	15	6	33	29	2,599	2,691
	5,027	**21,119**	**25,118**	**39,136**	**59,734**	**89,884**	**159,011**	**187,515**	**242,971**	**279,682**	**354,613**	**1,463,810**

Source: OVE using RAIS data

A program by program breakdown of recipient characteristics can be found in Tables 1.3 and 1.4.

Programs labeled as working capital reached smaller firms than any other support type. All five working capital supports were in the bottom 10 when all programs were ranked from largest to smallest in terms of gross employment. The average gross employment for recipient firms for all programs was 307.59, yet the range for working capital programs was from 10.88 to 21.71. The top 10 programs when ranked in terms of gross employment of beneficiaries were mostly located in either export training or innovation credit and grants.

Firms reached by working and investment capital support generally paid among the lowest wages of recipients from the treatment types studied, while firms that received innovation credit and grants paid among the highest. Wages paid by export training recipients were above average as well, though the average wages of export credit recipients depended on the program they received money from. BNDES was among the top third of programs in terms of average employee wages of recipient firms, while BNB and FNE were in the bottom third.

The same divisions were clear when looking at the average employee education levels at recipient firms by program. Programs that offered innovation credit and grants, and to a lesser extent export credit, reached firms with more educated employees, while programs that offered working and investment capital generally reached firms with less educated employees. However, this could be a function of geography, as recipients of innovation and export-oriented programs were located predominantly in the South and Southeast, where education levels are greater.

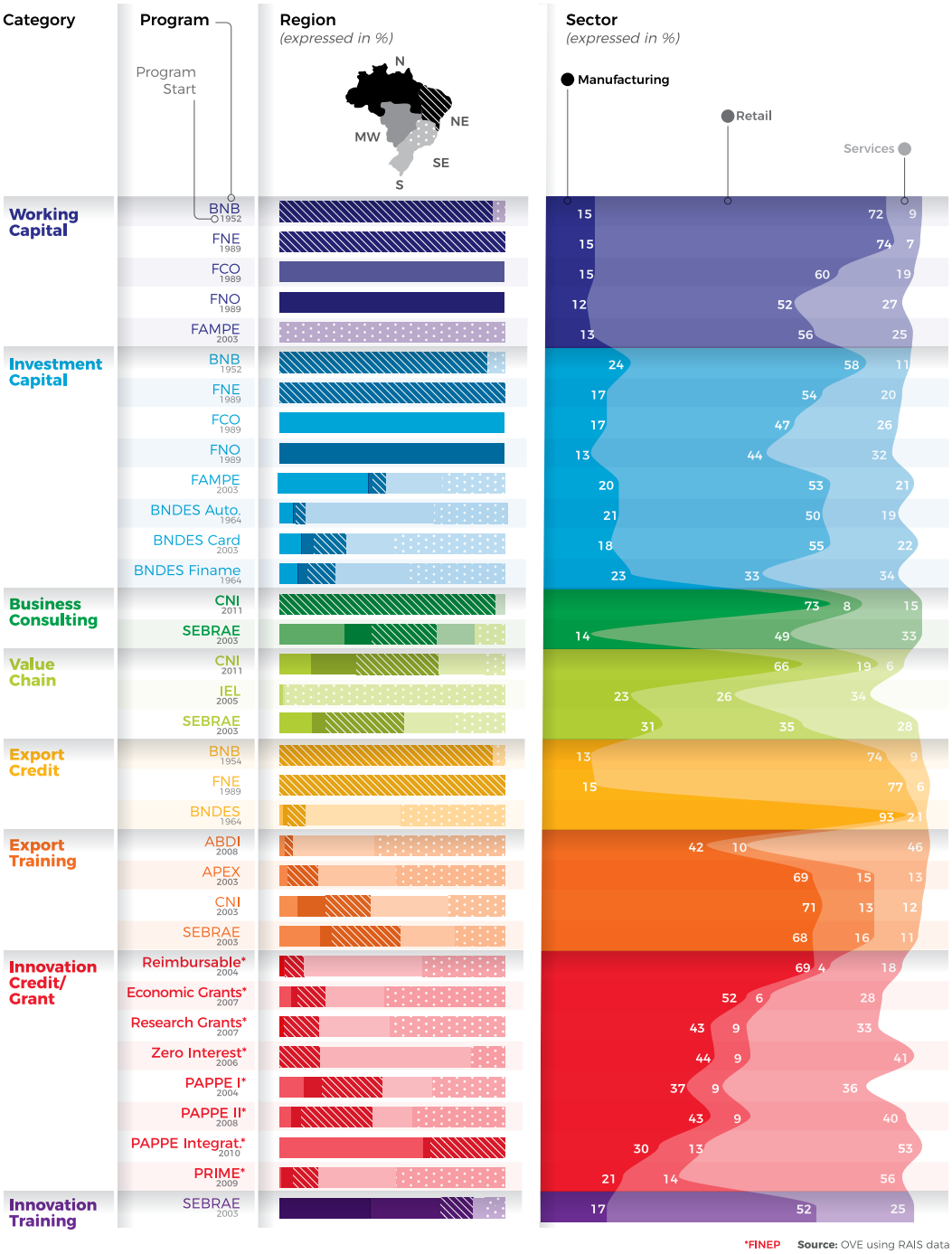
Average employee age at recipient firms varied more across support types than firm education, yet no clear pattern emerges. Three of the five working capital supports were in the bottom 10 when programs were ranked by the average employee education level at recipient firms, though one working capital support was in the top 10.

The majority of beneficiaries for most programs were located in the South and Southeast. This makes sense, as most Brazilian firms are in those regions.

Working and investment capital supports mainly targeted firms in the retail sector, while export training supports mainly targeted firms in the manufacturing sector. Innovation and credit grant supports seemed to more evenly target manufacturing and services sectors, with few recipients in retail.

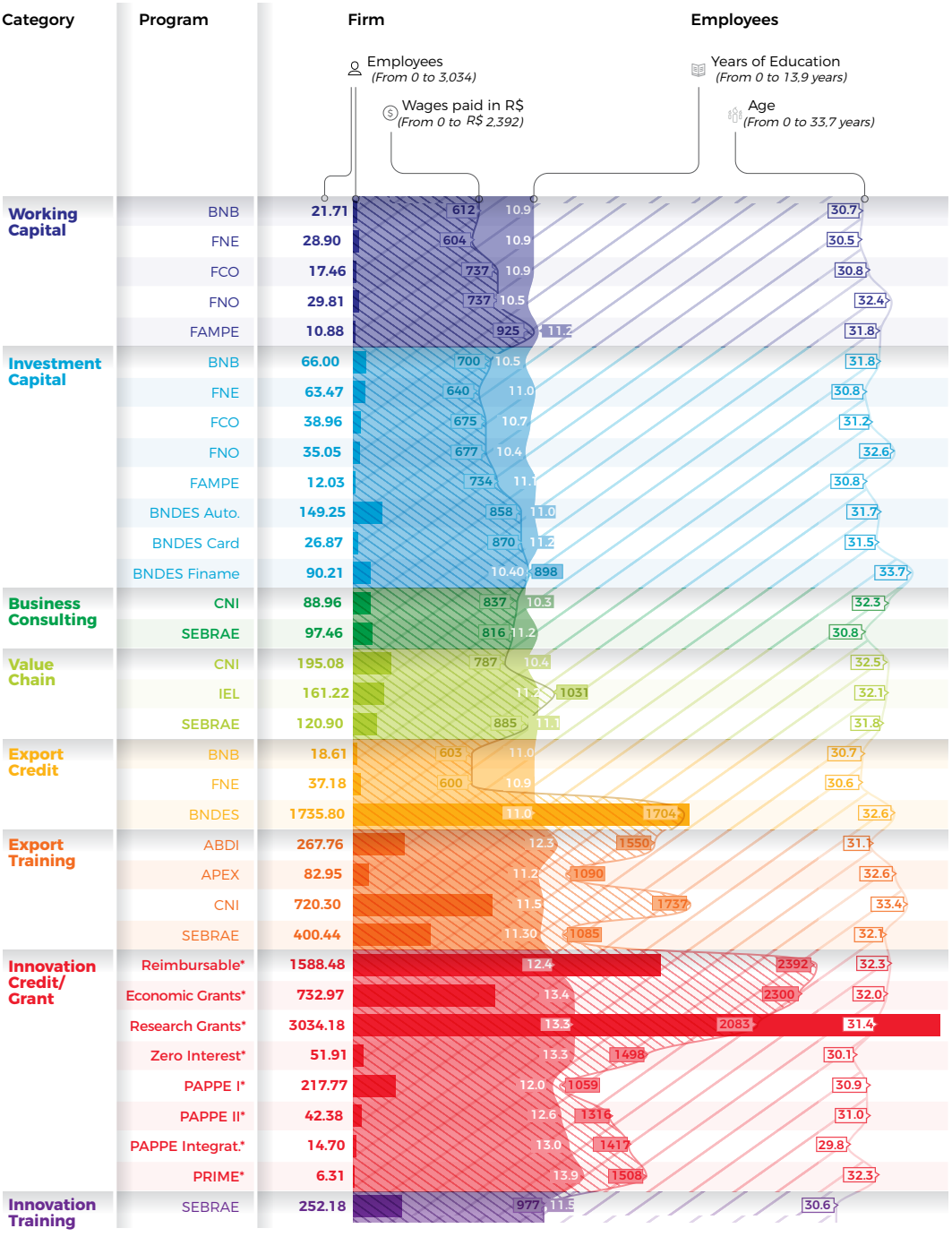
While 67% of Brazilian firms present in 2007 in RAIS survived until 2012, the survival rate of supported firms was 90%.[35] Thus, at least in survival alone, firms that received PDP support were very different from the average Brazilian firm, although the average age of firms in both groups in 2007 was similar (four years, on average, compared to 3.8 years).

Table 1.3. Program Reach by Sector and Region



*FINEP **Source:** OVE using RAIS data

Table 1.4. Characteristics of Firms and their Employees by Support Type[36]



*FINEP **Source:** OVE using RAIS data

3. Overlapping treatments among beneficiaries

Several programs often reached the same firms, as the programs were highly intertwined. A full breakdown of overlaps can be found in Table 1.5. While only 30% of beneficiary firms received support from more than one program, they received 53% of the total treatments given. The other 47% were given to firms that did not seek support elsewhere. While overlap existed in all programs, a few programs were affected more than others.

Recipients of BNB programs had the highest average number of supports per recipient of all programs. BNB investment capital recipients received support from 6.46 other programs on average, while BNB export credit (4.46) and BNB working capital (4.43) fell shortly behind. Only FNE's export credit support (5.04) had as high an average of treatment overlaps. Much of the overlap was with

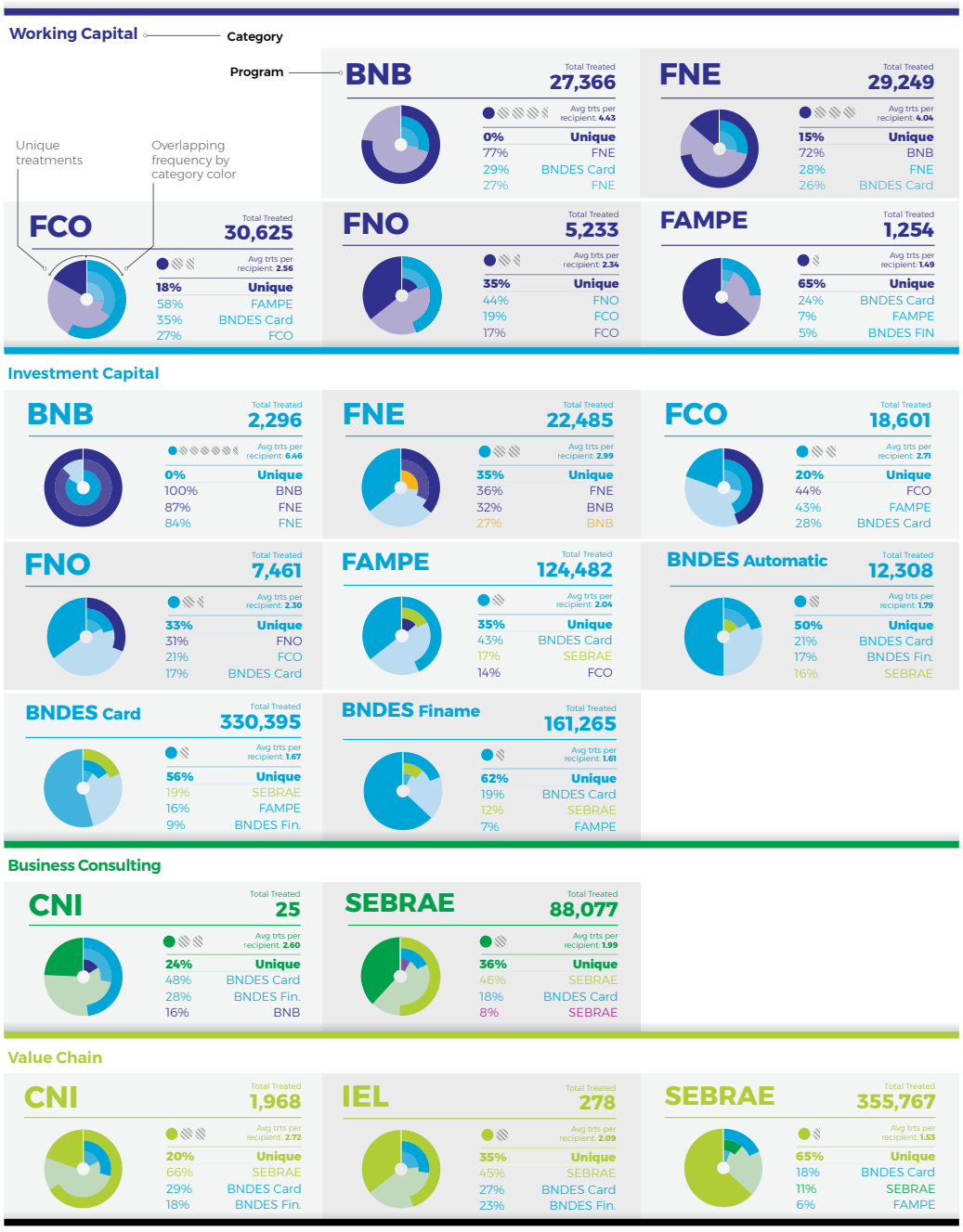
other BNB programs, as nearly all of BNB investment capital (99.8%) and BNB export credit (99.7%) recipients received working capital support from BNB as well. The reverse was not true, as 89% of BNB working capital recipients received BNB export credit, while more received FNE working capital (77%) and FNE export credit (65%) than BNB investment capital (8%).

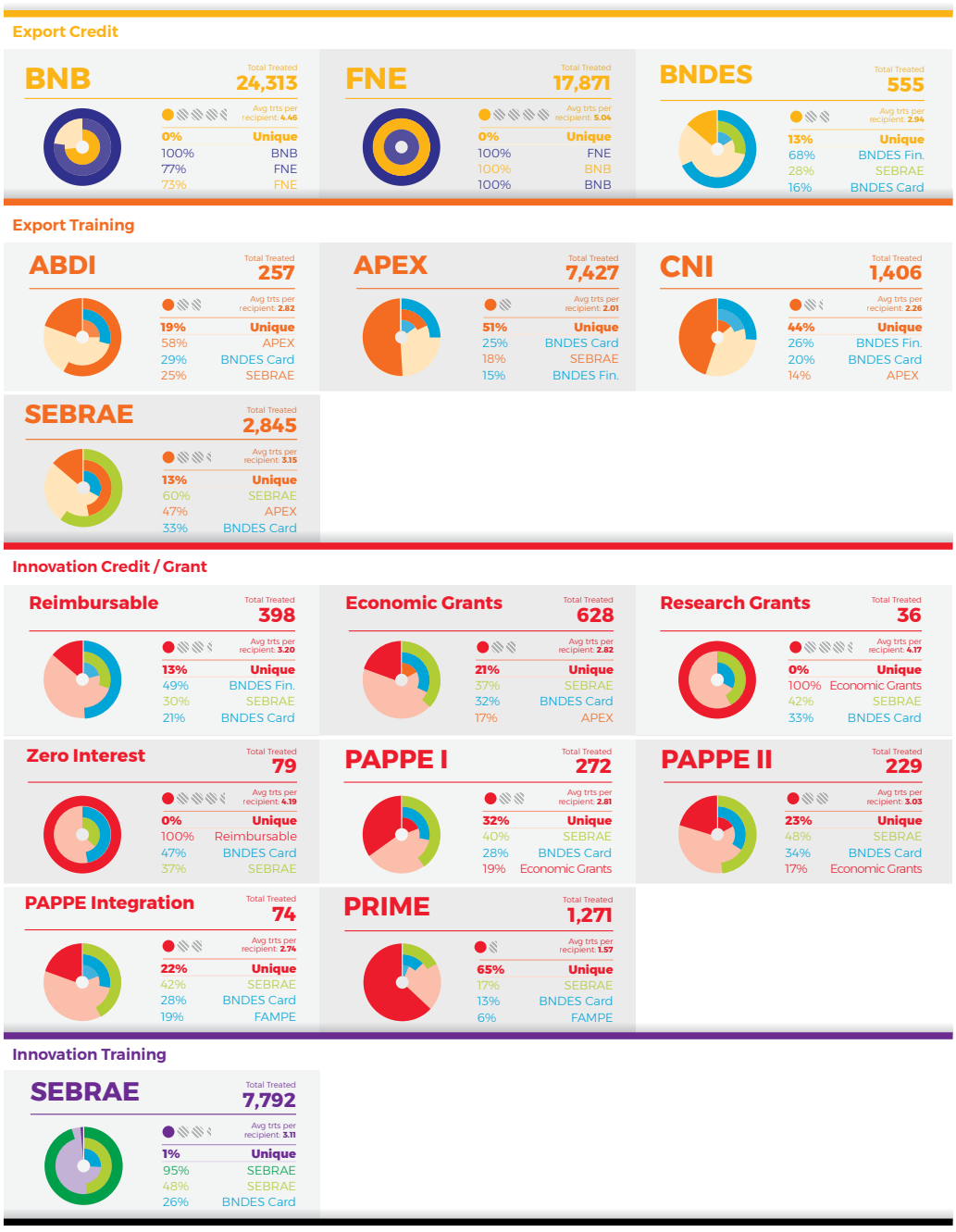
There was a great amount of overlap between beneficiaries of BNDES and beneficiaries of SEBRAE. SEBRAE value chain support was the first most overlapping program for BNDES Card, the second most for BNDES export credit and BNDES FINAME, and the third most for BNDES Automatic. Conversely BNDES Card appeared in one of the top three spots in terms of percentage of overlap for all four SEBRAE programs (business consulting, investment training, value chain and export training). Not surprisingly, both institutions tended to support the same firms across their own programs, with all of the remaining top three spots for BNDES programs occupied by other BNDES programs, save the second spot for BNDES Card and the third spot for BNDES FINAME, which were both occupied by FAMPE investment capital. The same is true for SEBRAE, whose remaining top spots were filled by SEBRAE programs.

For FAMPE investment capital in turn, BNDES Card was well ahead of the other programs in terms of overlapping support. The top 3 supports most recipients of FAMPE investment capital held in common were BNDES Card (43%), SEBRAE value chain (17%), and FCO working capital (14%). As FAMPE working capital had a lower rate of recipients with multiple treatments (35% compared to investment capital's 65%), the overlap of other programs with their recipients was much smaller: 24% with BNDES Card, 7% with their own investment capital support, and 5% with BNDES FINAME.

Some of this overlap was coincidental, and some was by design. Several agencies partnered among themselves to better implement initiatives. For example, CNI offered value chain support in conjunction with SEBRAE, and BNB provided export credit to firms using a mix of its own funds and those of FNE. SEBRAE also provided export support in collaboration with APEX and CNI. FAMPE guarantees are issued to firms that have received credit on the market, often from financial institutions included in this study.

Table 1.5. Overlap Among Programs





Source: OVE using RAIS data

2

This study thus covers around 600,000 firms, each of which participated in only one of the 6 programs that could be evaluated given this criterion.

2 An Impact Evaluation of Selected Firm Support Programs in Brazil

A. Evaluation objectives and data

1. Objectives

Part II explores the impact of selected PDPs on productivity, employment and real wages. While the programs differ in nature and goals, and are likely to produce different spillover effects and results in the short and medium term, OVE tested the assumption that these programs have strong commonality in their ultimate goals, aiming for firm growth, better paid workers and enhanced productivity.

As discussed in Part I, the investment capital interventions included in the study are designed to alleviate credit constraints and provide firms with the capital they need to expand and modernize. While productivity may not be an explicit goal of the programs, productivity growth would be expected if the support helped firms modernize and expand. The agencies offer loans with below-market interest rates to finance long-term projects leading to firm expansion, modernization of installations and machinery, and the creation of new goods and services. FAMPE guarantees aim to tackle credit constraints by reducing the risk aversion of banks that lend in a context of asymmetric information, allowing firms to make previously unavailable investments. Though Brazilian public funding is generally aimed at employment generation,[37] these investments do not necessarily result in higher employment. Firms may hire more skilled workers to deal with new technologies, but they might be able to satisfy demand using fewer workers overall if labor productivity increases. OVE's analysis looks at whether treated firms saw higher productivity, possibly the result of using funds to modernize and enlarge existing plants using frontier technologies, or stagnant or decreased productivity, possibly the result of having accumulated more physical capital and/or increased employment but not necessarily increased productivity.

Value chain programs can increase productivity by improving coordination efforts within supply chains and opening them to micro and small firms.[38] These programs facilitate networking between MSEs and larger companies and help to address the technical and managerial constraints of smaller companies to help them fulfill the supply needs of larger firms. The programs seek to enhance the competitiveness of not only the small companies but the value chain as a whole, which can lead to firm (though not necessarily employment) growth, better paid workers, and enhanced productivity.

This study follows-up on a previous evaluation that assessed the results of several approaches supporting small and medium-sized enterprises (SMEs) in Brazil's manufacturing sector (see Box 2.1). Adding to the previous study, this study looks specifically at productivity and includes firms of all sizes in the manufacturing, retail and services sectors. However, it does not seek to assess aggregate productivity effects of programs in the economy, dosage effects of treatments on recipients, spillover effects of programs on indirect beneficiaries, the extent to which results vary by region of the country, or the impact of loan size on the outcomes of interest.

Box 2.1. Impact Evaluation of SME Programs in Brazil

In 2014 OVE conducted an impact evaluation—*A Comparative Analysis of IDB Approaches Supporting SMEs: Assessing Results in the Brazilian Manufacturing Sector*—to assess the effectiveness of programs that support manufacturing SMEs in Brazil. The evaluation found that credit is the only type of support that significantly affects all outcome variables. The success of credit lines for SME support is related to the incentives created by program design, to the extent SMEs use the funds not only for working capital but also to invest in goods, such as transportation equipment and computers, that ultimately boost their performance. The evaluation also found that export support has a significantly positive impact on the value of exports and produces employment benefits. Business consulting interventions show a positive impact on employment, an impact that increases when combined with credit support. Overall, the results of the evaluation are positive and synergies have been found, highlighting the importance of coordination among institutions that support SME programs.

Source: OVE

2. Database

As discussed in Part I, OVE established a partnership with nine national agencies in order to understand their programs and analyze treatment data for this impact evaluation. Only firms identified as having received a single support were included in the regression analysis. Though beneficiaries of all programs were used included in the analysis in Part I, not all programs had enough single-treated beneficiaries to be included in the impact evaluation as discussed further below.

In addition to treatment data from program providers, OVE analysis was aided by access to the databases of four governmental institutions: the Brazilian Institute of Geography and Statistics (IBGE), the Ministry of Labor and Employment, the Secretary for External Trade (SECEX) and the National Institute of Intellectual Property (INPI).

IBGE provided the following data at the firm level, allowing for value-added calculations: net operating revenues, costs of resold goods, gross value of production, intermediate consumption, gross value added, personnel expenses, industrial operation costs, and consumption of raw materials in the manufacturing, services, and retail sectors.[39] IBGE compiles these datasets by conducting three annual surveys, of which OVE had access to those for 2001 on. The Annual Survey of Manufacturing - Enterprise (PIA-Enterprise) covers all firms that employed more than 30 employees, while the Annual Survey of Services - Enterprise (PAS Enterprise), and Annual Survey of Retail (PAC Enterprise) cover all firms that employed more than 20 employees. All three surveys randomly include firms that employed up to 10 (and up to 5 after 2005) employees.

IBGE also provided access to its Innovation Survey (PINTEC). The survey was conducted in 2003, 2005, 2008, and 2011 and included all firms from the manufacturing and services sectors that employed more than 500 and 100 employees, respectively. PINTEC also randomly included firms that employed up to 10 (5 after 2005) employees. The survey collected information about spending on innovative activities (products and processes), the sources of financing of these expenditures, the impact of innovations in business performance, the sources of information used, the cooperative arrangements established, the role of Government incentives, and the obstacles encountered in innovation activities.[40]

The Ministry of Labor and Employment provided access to its Annual Social Information Report (RAIS), which contains data on employees and establishments from 2001 onwards.[41] The RAIS dataset covers the universe of formal employment in Brazil and provides detailed information about firms and employees.[42] Currently, RAIS is a government instrument that regulates the concession of the "Salary Bonus," the minimum-wage supplement program. The payment of the annual wage supplement is exclusively contingent on filling out the RAIS; if an establishment fails to report the information required by RAIS, it faces automatic fines that are proportional to the workforce size and the length of the delay. The Ministry of Labor and Employment estimates that, currently, around 97% of all formal workers in Brazil are covered by RAIS.

Data for establishments can be retrieved according to geographic location (from municipality to macro-region level), sectorial classification, establishment size, and legal nature. The Brazilian National Classification of Economic Activities is compatible with the United Nations sectorial classification, and the most disaggregated level has 676 sectors. In addition, data for workers (that are linked to an establishment's data) has information about wages, age, gender, level of education, job duration (in months), declared hours worked, occupation, type of formal contract, nationality, admission, and redundancy.

SECEX provided data on firms' exports and imports and the country of destination for the exports.[43] SECEX microdata are available from 2001 on.

INPI provided data on patent and trademark registration from 2001 on. OVE used them to measure the effect of PDP programs on innovation.

3. Variables of interest

The main outcomes of interest are productivity, employment and real wages. As was mentioned before, all intervention models are expected to improve productivity, even when this objective was not the explicit goal of the Brazilian organizations.

Analysis was performed using a unique firm-level dataset merging the different sources of information described above, covering the period from 2002 to 2012. Firms have a unique identification number (CNPJ) that allows them to be identified across other databases used for the analysis.[44]

The information contained in these datasets allows for different measures of the main outcomes of interest, as follows:

- *Productivity.*[45] The information contained in IBGE surveys (PIA, PAS, and PAC) allows for calculating different measures of productivity. For *labor productivity,* OVE measured the most common indicator in literature, *value added per worker,* where added value is the net sales value of intermediate goods and services. OVE also *calculated industrial transformation value per worker,* which measures the difference between the manufacturing gross value and the manufacturing operational costs per worker. OVE calculated *capital productivity by using value added per capital stock and industrial transformation value per capital stock.*[46] Lastly, OVE calculated *total factor productivity (TFP)* using the Levinsohn and Petrin (2003) estimator, which handles endogeneity and bias by using intermediate inputs as a proxy for unobserved productivity.[47]

- *Employment.* OVE used the information provided by RAIS to define two indicators for employment. *Average effective hours* is a measure of the effective hours worked by each worker per month, while *average effective employment* consists of the total number of workers hired by the firm weighted by the number of days worked by the worker per month. Lastly, the IBGE's database allowed OVE to use total employment as an alternative indicator for number of employed workers at the firm.

- *Wages.* The indicator *average remuneration* provided by RAIS measures the average income of workers in December.

- *Exports.* OVE used SECEX microdata to test the impact of programs on *export diversification.*[48] This variable was constructed by counting, at firm level, the number of different export destination countries by year. However, in the end,

the limits of the count variable, the small number of firms exporting, and the concentration of responses near 1 led OVE to conclude that regressions using this variable were not conclusive. They have still been included in the Annexes.

- *Innovation.* The databases from IBGE and INPI provide complementary sources of outcomes of innovation efforts. IBGE's PINTEC survey provides information about investment in new products and processes aimed at both local and foreign markets, which allowed OVE to build two indicators, *innovation and innovation aimed at external markets.* Regarding INPI, considering the backlog in patent processing and trademark registration, OVE used *application for patents and trademarks* as a proxy for innovation. However, given the relatively few number of firms that registered patents and trademarks, and the inability of the dummy to distinguish between applying for a patent and applying for a trademark, OVE concluded these regressions were also not conclusive, though they have been included in the annexes.

Despite the richness of the database, there were several important data constraints. The average firm size in Brazil, as well as the average number of employees of program beneficiaries, was below the threshold set for annual inclusion in IBGE databases. Thus, for many programs, particularly those that targeted MSMEs, there were insufficient observations to achieve a balanced panel or so few observations that either no regressions could be run or IBGE suppressed regression output out of concerns of confidentiality. Further regressions were discarded by OVE if the number of observations was deemed too small to draw conclusions from. Furthermore, the Annual Survey of Services is not comprehensive, as it leaves out important sub-sectors like banking, education, and healthcare. Lastly, it was not possible to use quantity-based productivity measures, and the indicator used (value added) could be affected by factors external to the study such as market share and imports in tradable sectors.

4. Support programs evaluated

As stated in Part I, nine agencies established partnerships with OVE to conduct an impact evaluation of their programs: ABDI, APEX, BNDES, BNB, CNI, CNI-IEL, FINEP, MI, and SEBRAE. When categorizing the different supports offered by these institutions into the eight firm support types defined previously, a total of 34 support programs were identified.

However, as will be further explained in the following section on evaluation methodology, many of these support programs did not have enough observations for robust analysis. Some just reached too few beneficiaries in general. Others had a high degree of overlap, leading to a reduction of observations when OVE eliminated firms that had received multiple supports in order to deal with issues of attribution. Lastly, further programs were eliminated from the round of

analysis dealing with productivity, as size thresholds governing inclusion in IBGE surveys required analysis be limited to larger firms, of which many programs did not have enough.[49]

In the end, OVE evaluated six individual programs. Investment capital support accounted for five, FCO, FAMPE, BNDES Automatic, BNDES Card, and BNDES Finame, while SEBRAE provided value chain support. Only these six had sufficient firms large enough to be evaluated using IBGE data.

B. Evaluation methodology

1. Evaluation strategy

This impact evaluation empirically tested whether participation in a PDP program is related to better firm performance. The impact evaluation analyzes whether firms that received specific PDP supports performed better in terms of productivity, employment, and real wages than comparable firms that did not receive support. OVE broke down the results by the manufacturing, services, and retail sectors. Inputs from previous impact evaluations and academic studies are used to provide further evidence on the evaluation questions.

In the absence of random assignment, an evaluation strategy should overcome selection bias by constructing a counterfactual.[50] Program participants differ from nonparticipants in observable (region, activity, size, age, and education) and unobservable (entrepreneurial behavior, management skills, etc.) ways that can explain their participation or nonparticipation in the program. Furthermore, the treatment's providers can adopt specific criteria to select participants that could be related to outcomes (program placement bias). As a consequence, a simple difference in means between treated and non-treated groups does not yield an accurate estimation of the program effect, since it is contaminated by ex-ante differences between beneficiaries and nonparticipants.

OVE adopted a mix of techniques and estimation models to construct a control group, mitigating the selection bias. *Propensity-score matching (PSM) techniques* intend to control for the observable characteristics variables differing between treated and untreated groups.[51] The PSM defines the probability of firms participating in the programs given a set of observable - explanatory and dependent – variables. The explanatory variables include both firm (activity, revenues, size, and geographic location) and employee (age and schooling) characteristics.[52] Revenues, size, and geographic location were the most common selection criteria among the programs studied outside of creditworthiness, a variable OVE could not measure. Lagged outcome variables of interest in each regression are included as well, to further address selection bias. PSM was conducted at program baselines, or in 2004 for programs whose baselines were before the beginning of the panel.

First, OVE restricted the counterfactual group to the common support group. This group consists of only firms that are within the range of overlap in the distribution of the propensity score for the treatment and control group. This procedure eliminated from the sample non-treated firms that have very different probabilities of treatment, comparing only treated and non-treated firms with more similar probabilities of being treated.

Finally, OVE reduced the common support group by using nearest-neighbor matching. The nearest-neighbor matching technique selects from the control group only the most similar firm to each treated firm based on their probability of being treated as a function of past outcome trends and other observable variables.

Overwhelmingly, the differences in means of the outcome variables of treated and nearest-neighbor are statistically insignificant, showing that overall, the PSM strategy succeeded in finding unbiased control groups. Annex II displays the kernel densities and shows the similarities in propensity score distributions between treated and nearest-neighbor groups, contrasting with the uneven distribution before the matching. Annex III shows the results of the difference-in-means tests.

OVE complemented this graphical analysis by testing the significance of pre-trends in the outcome of interests between treated and control groups for all the regressions showed in the next section (see Annex VI). When those coefficients were not significantly different from zero, even when presenting positive and statistically significant results, OVE disregarded the regressions for lack of robustness. The PSM and difference-in-means tests were conducted at the baseline, while some firms were not treated until several years later, creating a gap in time across which treated and control firms could have diverged in key characteristics. This inclusion of this pre-treatment coefficient also serves to test that the two groups were still comparable in the years immediately before treatment. When this was not the case, regression results were considered non-conclusive.

OVE divided the observations into blocks according to the stratification of the propensity score at each program baseline. Then OVE ran the difference-in-difference (DID) model using these blocks as controls.

The DID estimation model controls for unobservable characteristics that are time-invariant.[53] While PSM tries to match treated and control groups based on their equal probability of participation predicted by observable factors and past outcome trends, DID aims to mitigate omitted variable bias—that is, a bias arising from unobserved and uncontrolled differences between these two groups.

The use of both techniques aims to guarantee that the estimations compare control and treated groups that are similar enough. The assumptions behind the DID model are more credible when treated and control are similar in these two groups, ideally showing difference in means for matching variables that are statically indistinguishable from zero, which suggests that the groups are comparable.[54]

OVE carried out regressions using DID models with both common support and nearest neighbor as controls groups. OVE also included pre-treated dummies variables to test for a trend in outcomes leading up to treatment.

Benefiting from the availability of a panel dataset at the firm level with a large number of observations, OVE addressed the problem of attrition bias, by building a balanced panel.[55] There are downsides to this approach. First, assessing some supports was not possible as using a balanced panel reduced the number of observations systematically, considering the survival rates of firms already analyzed before. Secondly, for supports that were analyzed, a reduction in their sample size could affect the average characteristics of the treated group.

OVE also conducted an impact assessment of two combinations of programs. They were chosen on the basis of the significance of the program and the number of beneficiaries/observations. The first regression used SEBRAE value chain recipients as a base to analyze the additional impact of receiving SEBRAE business consulting. For the second, BNDES Finame recipients were used as a base to calculate the additional impact of SEBRAE value chain. The rationale of the exercise is to extract lessons from eventual positive correlations between support combinations and outcomes and test synergies.

OVE applied the same estimation technique used for single treatments. The only difference was that OVE selected the firms that received investment capital and value chain as control group, depending on the combinations. OVE compared those firms to firms that received an additional treatment.[56]

OVE qualified impacts by significance and magnitude of results. Standard nomenclature was used for statistical significance levels, while impacts were classified as small if the treatment coefficient fell within 0-100% of the mean outcome in the regression, medium if it fell between 100-200% of the mean, and large if it was greater than 200%.

The details of the model specification can be found in Annex VII.

2. Specific challenges addressed by the evaluation

When conducting the PDP evaluation, OVE needed to address additional challenges that required different mitigation procedures. First, some programs did not have baselines. Second, the fact that the size thresholds of IBGE's surveys are higher than the average size of treated firms for some programs led to a large reduction in observations when administrative data were matched with IBGE data (an average of 13% per program, with some programs matching as little as 4% and some as high as 56%).[57] Third, for the programs that started slowly, IBGE data had a low number of beneficiaries at the baseline. Fourth, for programs for which it

was impossible to match a higher number of recipients in IBGE survey data than required to meet IBGE's confidentiality thresholds, some regressions were not disclosed. Fifth, the PINTEC survey was conducted only in four years during the panel span. Lastly, as discussed before, a significant number of beneficiaries (30% of firms receiving 53% of treatments) received at least more than one treatment simultaneously along the panel.

OVE dropped any beneficiaries that received treatment before 2004. This allowed three years of pre-treatment data on which to do PSM. Ultimately, only two pre-treatment years were used because limiting the sample to only firms that had three years of pre-treatment data resulted in too few observations to properly regress. However, dropping firms treated in the first three years of the panel also allowed OVE to address the fact that some programs such as BNB, FNE, BNDES Automatic, and BNDES Finame began before the panel, and treatment data from the beginning of the program did not exist. In this case, OVE cannot know with certainty that firms were not treated before the panel began. However, given the average lifespan of firms in Brazil, knowing that the firm had not received treatment in the first three years of the panel is sufficient in most cases to assume that a firm had not been previously treated. As this necessary measure led to a reduction in the sample size of treated firms for each program, the possibility of exclusion bias should be kept in mind when reviewing the results. The majority of treatments were concentrated in the post-2007 period, and this reduction in the treated group was small.

OVE defined proxy baselines for programs with a small number of observations during the program's first years of existence. This second-best strategy allows OVE to build more robust PSMs for business consulting and value chain programs. For some programs, such as SEBRAE's innovation training and FAMPE's working capital line, it was not possible to assess results since the number of beneficiaries was concentrated in the last year of the panel (2012).

For regressions on productivity results OVE used IBGE's databases, and other outcomes were assessed using the RAIS database. As mentioned before, IBGE's is the only dataset that allows for productivity measurements. However, the use of RAIS for other regressions allowed OVE to benefit from a larger number of observations. The evaluation strategy was the same regardless of the dataset used, but using different databases logically required building different treatment and control groups for regressions.[58]

3. Treatment overlap and issues of attribution

A further, more substantial challenge was the attribution problem inherent to impact evaluations that deal with the implementation of a multiplicity of interventions. As discussed in Section C3 of Part I, the programs were highly intertwined, with over 47% of treatments given to the same firms. If all firms were evaluated together, it could be difficult to attribute any impact to a single program.

Thus, this study examines only the 632,067 firms that received treatment from a *single* program. This decision affected the number of programs we were able to effectively evaluate, given that rates of single-treated recipients varied widely across programs.

For the most part, single-treated recipients were concentrated among the larger programs, those already most likely to have enough observations for robust analysis. Over three-quarters of single-treatment firms received treatment from SEBRAE value chain (36.4% of single-treatment firms), BNDES Card (29%), and BNDES Finame (11.2%). Only for seven of the 35 programs did single-treatment firms comprise 50% or more of total beneficiaries: FINEP Prime (65%), FAMPE working capital (65%), SEBRAE value chain (65%), BNDES Finame (62%), BNDES Card (56%), APEX export training (50%) and BNDES Automatic (50%).[59]

Furthermore, there were programs that only had multi-treated beneficiaries and thus could not be evaluated at all: BNB investment capital, FNE export credit, FINEP research grants, and FINEP Zero Interest.[60] SEBRAE export training, BNB export credit, and BNB working capital had 1% or fewer single-treatment recipients.

In the end, OVE evaluated six individual support types. Five offered investment capital support: FCO, FAMPE, BNDES Automatic, BNDES Card, and BNDES Finame. The sixth program was value chain support from SEBRAE.

4. Exclusion bias and single-treated firms

Beyond affecting which programs were evaluated, limiting analysis to single-treated firms also affects the nature of the treated groups as the subsample of single-treated group evaluated may not be representative of the entire sample of treated firms. This section contains a brief overview of key differences, while Annex X contains the kernel distributions of relevant characteristics for single-treated and multi-treated firms. The kernel distributions are of firm characteristics at the program baseline.

BNDES

BNDES Automatic. In terms of employee age and wages paid, single-treated firms are similar to multi-treated firms, though differences emerge in average employee education level and gross employment. The means for employee age and average wages paid for multi-treated and single-treated firms are nearly identical, as are their distributions, despite a nearly 60% reduction in sample size from the former to the latter. While the mean for average employee education among the two groups is also nearly identical, the distribution for single-treated firms skews slightly higher. Furthermore, with gross employment, the single-treated mean is substantially lower than the multi-treated mean, and the distribution skews to the right as well.

BNDES Card. Across most variables, the means and distributions for BNDES Card recipients were highly similar whether looking at all recipients or only single-treated recipients. With employee age and average wages, the two groups were nearly indistinguishable, despite a 49.5% decrease in sample size when reducing the treated group to single-treated recipients. Employee education level for single-treated firms was slightly higher (10.54 versus 10.49), and gross employment was slightly lower (17.35 versus 19.34), and in each of these two cases the shape of the density distribution was the same for both groups, though the distribution of single-treated recipients skewed slightly in the direction of the mean of the same.

BNDES Finame. With BNDES Finame, the mean and distribution of both wages paid and employee education were quite similar, though employee age and gross employment differed to some extent. The difference was greater for employment (an average of 56.3 for single-treated firms versus 72.7 for all recipients) than for employee age (33.2 versus 32.6, respectively). The shape of the distributions was similar, though in both cases the distribution of single-treated firms was slightly skewed compared to recipients in general.

SEBRAE

FAMPE's Guarantee for Investment Capital. The mean and distribution of employee wages for single-treated firms was nearly identical to that of multi-treated firms, but the means and distributions of other variables were different. Single-treated firms had a lower average employee education than multi-treated firms (9.12 versus 11.39), and the distribution skews to the right, while the opposite is true for average education (11.02 versus 10.97). The average employee age was similar for both (30.78 vs 30.59), though there was a larger difference in the shape of the distributions.

Value Chain Support. The mean and distribution of wages paid by single-treated firms was similar to that of all recipients, while the means for employee age and education were similar, though distributions differed. Gross employment for single-treated recipients was moderately lower than for recipients in general (44 versus 52.8), with a corresponding moderate shift right in the distribution.

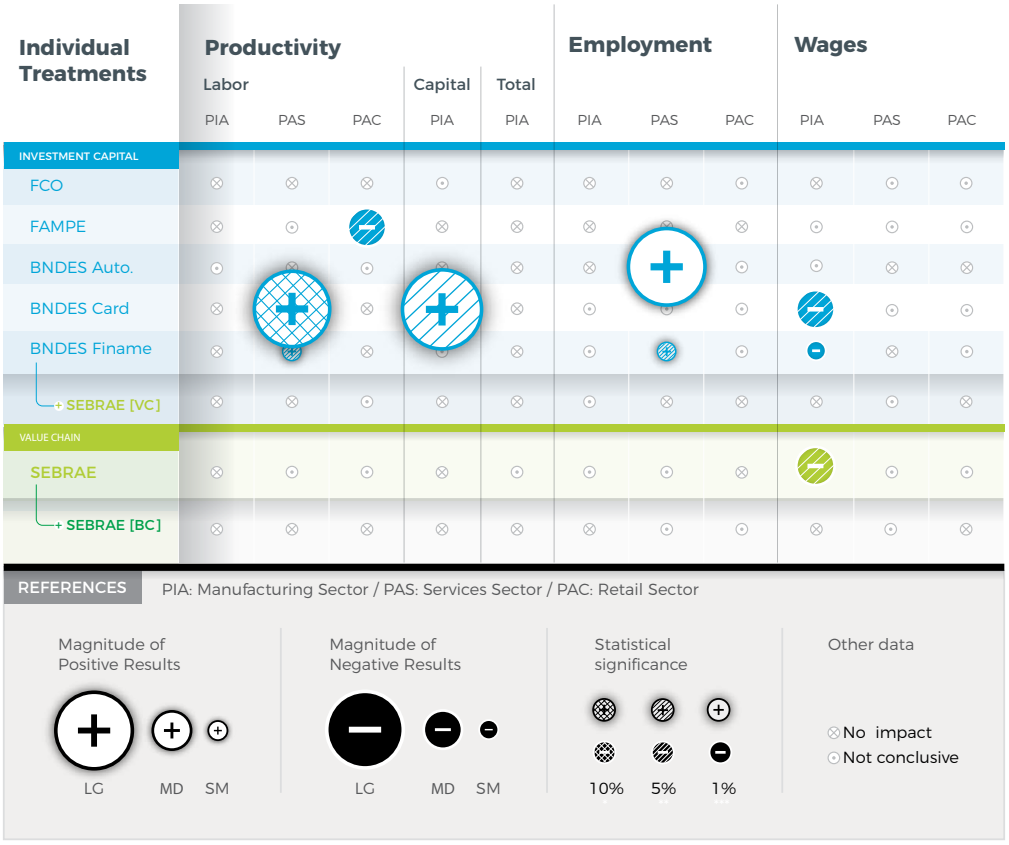
Constitutional Funds

FCO Investment Capital. While the subset of single-treated firms paid similar wages than the average for all recipients, gross employment, employee age, and employee education level at single-treated firms differed to various degrees. The largest difference, in both mean and distribution existed with gross employment (single-treated firms had lower employment). The mean employee education across the two groups was differed slightly, but the corresponding distributions differed far more. A small difference existed in both mean and distribution for employee age.

Summary

Thus, while the exclusion of multi-treated firms is necessary to avoid attribution bias, results should be interpreted with caution given the possibility of exclusion bias. The differences discussed in this section should be kept in mind as caveats when interpreting the results in the following section. The variables examined were included in regressions because they were identified as possibly important influencers of the outcomes, which means that if the averages for these characteristics change as the treatment group is reduced to deal with the issues outlined above, the average performance of the treated group in outcomes could change as well. Furthermore, the evaluation of a reduced subsample of treated firms, by definition, does not represent the full impact of treatment by any given program, though the subset of treated firms is matched to comparable non-treated firms. While this study hopes to be an important overall evaluation of the general impacts of these programs, it, as the body of literature on productivity in Brazil, would benefit from future studies with a narrower focus that enables better tailoring of the identification strategy to each support and more methods of dealing with the multiplicity of PDP supports that exist in Brazil.

Table 2.1 Results of Firm Support on Productivity of Larger Firms



Note: This chart is a visual representation of the regression results. For a full table of regression results presented in a more standard format, see Annex V.
Source: OVE

C. Results

Table 2.1 reports the regression results for each impact on the outcomes of interest. Results on productivity in the manufacturing sector reflect only the outcomes of firms with more than 30 employees, and results on productivity presented for the services and retail sector reflect only firms with more than 20 employees. Results on other outcomes reflect firms of all sizes. In both cases, results reflect only data on the subset of firms that received a single treatment.

Box 2.2. Innovation and Patents and Trademarks in Brazil

Previous studies have found a positive relationship between productivity and the registration of patents and the number of patentable innovations produced. Productive firms tend to innovate more, while firms with high levels of innovation tend to be more productive.[61] Thus, boosting the registration of patents and trademarks could be a way for programs to boost the productivity of firms. However, a strong culture of patents and trademarks has yet to fully emerge in Brazil. On average, only around 0.06% of firms in RAIS applied for a patent or trademark from 2002-2012. The number of firms applying for patents and trademarks each year remained steady, so as the number of firms increased overtime, the percentage of firms applying for patents actually decreased from 0.08% in 2002 to 0.05% in 2011. The firms that did so applied for an average of 2.38 patents per firm.

On average, firms that received treatment from any of the programs were slightly more likely to apply for patents than firms that did not (0.1% vs 0.02%). However, when used as an outcome in regressions similar to those conducted on productivity, only two programs, BNDES Card and BNDES Finame, were associated with any statistically significant impact on the registration of patents & trademarks. Recipients of investment capital support registered more patents and trademarks than comparable non-treated firms in both the manufacturing and retail sectors for BNDES Card and in retail only for BNDES Finame.

Source: OVE

1. Results for individual programs

BNDES

OVE was able to evaluate three programs from BNDES, all of them categorized as investment capital: BNDES Automatic, BNDES Card, and BNDES Finame.

BNDES Automatic. BNDES Automatic focuses on financing investment projects valued under R$20 million. Financing is provided indirectly through accredited financial institutions. Loans target investment in the building, expansion, and

modernization of fixed assets, as well as research, development, and innovation projects in sectors as varied as industry, commerce, services, agriculture, forestry, fishing, and aquaculture.[62]

No robust impacts on productivity were associated with BNDES Automatic financing for larger firms. Furthermore, no significant results were found in either the manufacturing or the retail sectors among single-treated recipients of BNDES Automatic. However, in the services sector, single-treated recipients were associated with a 10.8% increase (significant at the 0.01% level) in employment on average when compared to the control group.

BNDES Card. BNDES Card is a pre-approved credit line that targets the investment capital needs of SMEs (defined as companies whose annual revenue does not exceed R$90 million) throughout the country. The credit is issued through participating banks at low interest rates, and all transactions are conducted over the Internet.[63]

Results on productivity for larger firms varied by sector. When controlling for the presence of multiple treatments, BNDES Card recipients were not associated with higher labor productivity in the manufacturing or retail sectors. Recipients in the services sector saw on average a 3% increase in labor productivity, at a 90% significance level, compared to the control group. In the manufacturing sector, being treated by BNDES Card was correlated with a 22.7% increase in capital productivity at a 5% level of statistical significance, though no associated increases in TFP were found. Single-treated recipients of BNDES Card in the manufacturing sector were more likely to see a decrease in wages of 3.2% compared to the control group.

BNDES Finame. BNDES Finame finances up to 80% of the value of the production and purchase of national machinery and equipment of recipient firms. Purchases must be accredited by BNDES, and payments can be made over as many as 120 months. The many financial intermediaries accredited by BNDES for supplying credit lines are responsible for the selection, credit risk analysis, and credit limit for each firm that applies. Financing targets firms of all sizes in compliance with their fiscal and social obligations.

In the services sector, BNDES Finame recipient firms saw a 4% increase in labor productivity. In the retail and manufacturing sectors no impact was found on productivity. Among non-productivity outcomes, results vary by sector. In the manufacturing sector, the only results are negative (a 1.4% decrease in wages), while they are positive in other sectors. Firms treated by BNDES Finame had, on average, 9% higher employment compared to non-treated firms in the services sector.

SEBRAE

OVE evaluated two types of support offered by SEBRAE: investment capital (offered through FAMPE), and value chain.

FAMPE Investment Capital. FAMPE is a guarantee fund set up by SEBRAE to facilitate loans for investment projects through accredited financial intermediaries. It targets SMEs, and the guarantee is valued at up to 80% of the total financing, depending on the size of the firm. FAMPE is financed through institutions accredited by SEBRAE at the national level, and the lending institution is responsible for the selection, credit risk analysis, and credit limit for each applying MSE.

Among recipients treated only by SEBRAE's FAMPE, no impact was found in the manufacturing or services sectors. In the retail sector, however, treated firms had, on average, 5.9% lower labor productivity levels after treatment than comparable non-treated firms.

Value Chain Support. SEBRAE provides value chain support in the form of diagnostic studies, design of action plans, specific courses, trips to business fairs, and certifications. Projects are proposed by private sector organizations in partnership with SEBRAE, unions, universities, city halls, and government authorities that mobilize the firms. The program targets MSEs.

No robust impacts on productivity were associated with the receipt of SEBRAE value chain support. Single-treated recipients in the manufacturing sector saw a decrease in wages relative to the control group.

Constitutional Funds

OVE evaluated a single type of support offered by Constitutional Funds: FCO's investment capital support.

FCO Investment Capital. FCO is one of several funds created in the late 1980s to finance economic activity at a regional level. The program extends credit lines to finance working capital and the purchase of machines and equipment at interest rates and tenures that depend on firm size and the purpose of financing. The credit limit of the lines varies from 70% to 100% of the total project amount, depending on the size and location of the firm. The lender, the Bank of Brazil, is responsible for the credit risk analysis. The program services firms of all sizes in compliance with their fiscal and social obligations.

No statistically significant impacts on productivity were found for FCO in the general regression specifications. When including only firms that received support exclusively from FCO, no significant impact was found on other outcomes.

2. Combinations of treatments

As explained previously, OVE evaluated several treatments in combination. The first regression used SEBRAE value chain recipients as a base to analyze the additional impact of receiving SEBRAE business consulting. For the second, BNDES Finame recipients were used as a base to calculate the additional impact of SEBRAE value chain. However, none of the regressions showed additional impacts from any of the secondary treatments.

3. Possible interpretations of results

The evaluated programs consist of two broad categories – financing and training – and either address the overall needs for investment capital or fill informational gaps about business management and technical requirements. Gains in productivity would be expected to the extent that the alleviation of credit constraints or of information asymmetries led to investments in new equipment, skilled workers, or managerial capabilities.[64] The scarcity of positive results on productivity suggests that the programs may lack incentives to induce firms to invest in new technologies and efficiency gains.

As the programs did not explicitly define productivity as an outcome to be pursued, assistance was not conditional on investment in productivity or efficiency gains. As a result, public funding may not be leading to the acquisition of new technologies. The results are consistent with the idea that rather than investing in new machines and equipment, recipients of investment capital were replacing or complementing those items with inputs at the same technological stage. Furthermore, BNDES required recipients to purchase equipment from local suppliers it had accredited, and it is possible that this technology was outdated in some sectors compared to technology that could be acquired abroad.[65]

Interventions helped firms expand and alleviate credit constraints, but fell short of helping them gain productivity. Previous studies on BNDES programs corroborate OVE's findings. Ottaviano and Souza (2014) and Ribeiro and De Negri (2009) found evidence that BNDES lines relaxed credit constraints but resulted in no impacts on manufacturing firms' TFP, suggesting the importance of better program incentives to use frontier technologies to achieve better firm performance.[66] Ottaviano and Souza (2008) identified divergent results on direct (FINEM) and indirect (BNDES Automatic) lending lines on labor productivity. While the former led to increases in labor productivity, the latter did the opposite, suggesting that BNDES Automatic could be funding low-quality projects.[67] Calvancanti and Vaz (2017) found significant increases in productivity measures associated with BNDES credit intervention, but only when the resulting change in credit conditions was permanent as opposed to temporary.

The programs also failed to establish mechanisms to monitor productivity gains during the years of the panel (2002-2012). Although all interventions conducted project risk assessment and feasibility analysis at the appraisal stage, none of them included diagnostics about the firm's productivity or designed efficiency enhancement steps. Thus, these programs successively supported a significant number of beneficiaries without keeping records tracking gains in productivity from firms' investments and program supports.

Given that the data showed a correlation between program participation and survival rates, and that program results on productivity are scarce, it could be inferred that rather than strengthening firms' performance, interventions merely kept firms alive. The programs reduced investment capital costs, allowing less efficient firms to linger in the market. It is worth noting that although on average treated firms employed more workers, paid higher wages, and had a more educated workforce, they ultimately performed more poorly than non-treated firms in terms of productivity indicators, wage increases, and firm growth. The scarcity of results on these indicators could suggest that programs are reaching firms with low growth potential within a greater macroeconomic context of growth.

The Brazilian economy was enjoying robust growth over the period, reaching full employment and creating a disparity between real wages, which grew, and actual labor productivity, which did not. In this context, control firms also benefitted from the boom, making it harder for treated firms to distinguish themselves from the average non-treated firm across outcomes.[68] In addition, several countercyclical policies helped inflate employment levels: as De Negri and Cavalcante (2014) pointed out, labor market rigidities and lack of skilled workers in some sectors led firms to postpone layoff decisions even after the global financial crisis in 2008. Furthermore, while the domestic labor market was reaching full employment, restrictions on hiring foreign labor made it difficult for firms to import workers to meet demand for new labor. Indeed, as stated previously, the labor market share of foreign workers barely reached 0.19% in 2012 after a decade of minimal growth.

The relative underperformance of treated firms on the outcomes suggests a need to revisit the programs' incentives. An in-depth analysis could test the assumption that the combination of subsidies plus market protection created perverse incentives to the beneficiaries. Fristchtack (2017) suggests that in the face of macroeconomic uncertainty and a poor business climate, firms adopt risk-adverse behavior, using public subsidies to survive rather than attempting risky innovation strategies.

Some positive results on productivity outcomes encourage further analysis to explore replicability. The positive impact of BNDES Card on both capital productivity for single-treated firms in the manufacturing sector, although with a decrease in wages, suggests that support eased credit constraints and possibly allowed firms to

implement modernization plans, buy new equipment and plants, and ultimately boost their efficiency at the cost of paying lower wages in relation to comparable non-treated firms. Positive results on labor productivity for single-treated firms in some investment capital programs suggest that firms in the services sector are using funds to ease credit constraints and fill information gaps, resulting in a more efficient use of their workforce without corresponding gains in wages and, in the case of BNDES Card, employment.

Lastly, the lack of incremental results when looking at combinations of treatments could suggest a lack of coordination among programs. Even though several programs were designed to work in collaboration with, or at least alongside, others (see Section C of Part I), the results suggest existing mechanisms of coordination or communication between organizations that worked together could be improved.

D. Concluding remarks

This evaluation is a pioneer effort to use nationwide data to provide an overview of different firm-support interventions and their beneficiaries as well to examine the impact of selected PDP programs on firm-level productivity in Brazil. Overall there are some positive results in productivity and other outcomes, but in more cases either no impact was found or robust, conclusive readings of the results were not possible. This overall impact ignores general equilibrium effects, and not all program recipients were included in the treated group for regression analysis. Results should be read with caution. Nevertheless, it is illustrative of the overall potential impact of PDP support in Brazil.

The difficulty of evaluating some of the programs highlights the importance of including evaluation mechanisms in program setup to learn from the results. The programs need established baselines, clear targets and outcomes, and pre-treatment data from recipients related to those outcomes. The performance of these firms should be monitored post-treatment with continuous data collection to ensure that outcomes are being met.

At the same time, the findings recommend further, in-depth quantitative analysis of each intervention type. Further qualitative analysis and investigation of the implementation of the programs is also necessary—both for programs that did not present positive results, in hopes of improving them, and those that did, to explore replicability.

The universe of treated firms in Brazil is complex and intertwined, and further studies are also needed to understand how these programs interact with one another. This study provides a detailed look at a few large individual programs and their performance

and is a possible starting point for future analysis. While some combinations of treatments were evaluated, a more thorough analysis of how these programs compete with or complement each other will require more program-focused studies.

To better understand the full effect of PDP support on firms and the broader Brazilian economy, follow-up studies should refine the analysis and explore other topics of interest. Further evaluations that take into account spillover effects, variations in dosage, and regional heterogeneity could offer a more nuanced portrait of public spending on firm support in the country. Access to more complete data could allow more sophisticated analysis on exports and innovation outcomes, as well much-needed cost-effectiveness evaluations of these public-funded programs. Lastly, while this study hopes to be an important overall evaluation of the general impacts of these programs, it, and the body of literature on productivity in Brazil, would benefit from follow-up studies with a narrower focus that enable better tailoring of the identification strategy to each support and more methods of dealing with the multiplicity of PDP supports that exist in Brazil.

Notes

[1] This situation is like that in the broader LAC region. For instance, Aravena and Fuentes (2013) found that labor productivity was the main cause of low growth in LAC during the last three decades (with a negative contribution of 0.3%), while Busso, Madrigal, and Pages (2012) show that TFP in the region has not increased since the mid-1970s, and in fact has declined in many countries.

[2] Roughly two-thirds of Brazil's recent growth was driven by increases in the quantity and quality of the labor force, while only about 10% was due to gains in productivity. (World Bank, 2016).

[3] See De Negri and Cavalcante (2014), Messa (2014), and Mation (2014).

[4] See De Negri and Cavalcante (2014), Bonelli (2014), and Cavalcante and De Negri (2014).

[5] Federal Reserve Bank of St. Louis. https://fred.stlouisfed.org/series/RTFPNABRA632NRUG.

[6] See De Negri et al. (2014).

[7] Bonelli and Fonseca (1998), Rocha (1999 and 2007), Gomes, Pessoa, and Veloso (2003), Barbosa Filho, Pessoa, and Veloso (2010).

[8] For an overall description of these policies and their rationale, see Rodrik (2004), Agosin and Fernandez-Arias (2014), and Stein (2014).

[9] Productivity policies also aim to use existing factors of production better, which implies not only better use of resources within existing firms, but also reallocating resources from low- to high-productivity firms and sectors. Firm productivity in LAC is heterogeneous, even within narrowly defined sectors, with few productive firms and many firms with very low productivity (Busso, Madrigal, and Pages, 2012).

[10] The National Council of Industrial Development was created along the same lines.

[11] For an overview of the differences between import-substitution policies and the new industrial policies, see Rodrik (2004), Agosin and Fernandez-Arias (2014), Stein (2014), and Bartlett (2014).

[12] Mazzucato and Penna (2015) point out that numerous scholarly attempts to test the crowding-out hypothesis have reached contradictory conclusions. For a review, see Hemming. Kell, and Mahfouz (2022); Hur, Malick, and Park (2010); and David, Hall, and Poole (2000).

[13] For an overview of previous evaluations of PDP programs, see OVE (2014) and Crespi et al. (2014).

[14] Brazil showed a faster increase in country averages: from 36% in 2007 to 59% in 2014 (Brazilian Central Bank, 2015). As a reference, average financing to the private sector in LAC is even lower (40% of GDP)). See Fernandez-Arias, Panizza, and de Olloqui (2014).

[15] Potential lenders attribute a high risk of default particularly to SMEs—which often lack credit history, adequate collateral, and expertise to produce sophisticated financial statements—and thus deny them credit. See Beck and Demirguc-Kunt (2006); Michelacci and Silva (2007); and Canton et al. (2012).

[16] See McKenzie and Woodruff (2012) for a review of business consulting program evaluations in developing countries. The Bank supports several programs aimed at lowering transaction costs, reducing informality, and improving regulations and market operations. These interventions may include policies on business registration, property registration, and regulatory frameworks.

[17] See Rosholm, Nielsen, and Dabalen (2007).

[18] Value chain support includes also cluster and supply-chain support. OVE uses "value chain" to mean all supports that are related to enhancing firms' links in supply chains.

[19] See, for example, Schmitz (1995) and Martin, Mayer, and Mayernis (2011).

[20] Martin, Mayer, and Mayernis (2011).

[21] Crespi et al. (2011).

Notes

22 Lundvall and Borrás (2005).

23 Crespi, Maffioli, and Rastteletti (2014).

24 The National Council comprises 13 ministers, 10 entrepreneurs, and three trade unionists. ABDI is the executive secretariat for of this Council, and its board is named directly by the President.

25 The agency's top management body, the Deliberative Council, comprises representatives from the public sector (Ministry of Development, Industry and Trade, its Foreign Trade Chamber, the Ministry of External Relations, and BNDES) and the private sector.

26 This study looks only at BNDES support through financial intermediaries. Support offered by BNDES directly to clients is not included.

27 BNDES loans have three important characteristics. They have a longer term than private sector loans (5 years in the cases of BNDES Automatic and Finame, and 4 years in the case of the BNDES Card), with below-market interest rates, and beneficiaries must purchase equipment from local suppliers approved by BNDES. The cost of borrowing consists of three factors: (i) the basic interest rate, which is based on long-term interest rates; (ii) the risk remuneration of BNDES; and (iii) the risk remuneration of the financial intermediary.

28 FINPYME is the acronym for Innovative Financing for Small and Medium-Sized Enterprises (SMEs). This program was funded in part by the Inter-American Investment Corporation (IIC).

29 The partners are the Fundação de Amparo à Pesquisa do Estado da Bahia, the Associação Catarinense de Empresas de Tecnologia, the Federação das Indústrias do Estado de Minas Gerais, the Federação das Indústrias do Estado do Paraná, and the Porto Digital de Recife. They are located in the states of Bahia, Santa Catarina, Minas Gerais, Paraná, and Pernambuco, respectively.

30 PAPPE I reached 17 states, and PAPPE II reached eight. Given that 55% of total resources for PAPPE II were allocated to the Southeastern region, FINEP decided to launch PAPPE Integration to focus on the North, Northeast, Center-west and DF Regions. Ultimately, the dataset records beneficiaries for six states in these regions.

31 Created in 1972 as a public center responsible for providing managerial assistance to SMEs, SEBRAE became a private nonprofit organization in 1990. SEBRAE is funded by a monthly social contribution paid by employers.

32 OVE applied the term business consulting for the sake of consistency with previous studies and the literature. However, SEBRAE itself limits the term business consulting to "consulting activity provided on-site and focused on smaller firms." Thus, some of their support classified by OVE as business consulting is classified by SEBRAE as "business guidance and training."

33 This analysis was done using data from RAIS for the period 2002-2012.

34 The number of years necessary for high school completion has changed over time. See http://portal.mec.gov.br/ensino-fundamental-de-nove-anos.

35 In order to compare the rate of survival among treatment programs, a common year of treatment was necessary. 2007 was chosen as it was the earliest year where most of the programs were already in effect, allowing OVE five years over which to track firms first treated that year. To start, the same statistics were calculated for 2007 that were calculated for 2002 to establish expected values for that year.

36 SEBRAE includes in their database as beneficiaries the companies that purchase from the MSE suppliers they support. For this reason, the average number of employees of their beneficiaries reflects the size of both indirect (larger) and direct targeting of the institution (MSEs).

37 See for instance, Santos et. al. (2010), Silva at all (2014) for an overview of BNDES and Constitutional Funds objectives, respectively.

38 http://portalapl.ibict.br/export/sites/apl/menu/itens_menu/gtp_apl/reunioes/links/EIXO_CAPACIDADE_PRODUTIVA_xSEBRAE_DN_-_ENCADEAMENTOS_PRODUTIVOSx.pdf

39 IBGE provided OVE with restricted on-site access to data files that the statistical agency does not release to the public, enabling a more in-depth analysis.

40 PINTEC is based on the CIS-4 surveys of the European Community.

41 Law nº 76.900 of 23/12/1975 established mechanisms to compile labor market information for government and research purposes. Originally, RAIS was designed as a registry related to the Service Guarantee Fund, the Government severance employment fund. It was also used to provide information for tax collection and the concession of benefits by the Ministry of Social Security.

42 RAIS evolved slowly and became a well-established dataset by 1985. During the 1990s, RAIS benefited from important advances in data quality. Since 1997 the data have been collected via Internet, which makes data collection quicker and more reliable. The Ministry of Labor considers micro data as having good quality and coverage from the year 2000 onwards.

43 SECEX microdata are publicly available at http://www.desenvolvimento.gov.br/sitio/interna/interna.php?area=5&menu=2413&refr=603

44 The RAIS, SECEX, and INPI databases, as well as the beneficiaries' dataset, provided information at the establishment level with a 14-digit identifier (CNPJ). OVE converted them to the firm level using eight digits, matching these datasets with IBGE's database (eight-digit identifier) to measure productivity. Firm location was defined as the location of the oldest plant, which is a proxy for the firm's headquarters. OVE tested using the larger plant as alternative location definition, and firms' geographical distribution was similar.

45 For a brief discussion about productivity methods and calculations, see Annex IX.

46 Both measures use perpetual inventory methodology as a proxy for capital stock. However, while added value uses information regarding investments and depreciation, industrial transformation also includes rent and leasing information in the calculation.

47 Inputs in the production function are not independently chosen but rather determined by firm characteristics and past expectations of the productivity of inputs. Because productivity and input choices are likely to be correlated, straightforward estimations of TFP would introduce a simultaneity or endogeneity problem. The Levihsohn and Petrin estimator uses intermediate inputs as a proxy for unobservable productivity rather than investment decisions. For an in-depth discussion, see Van Beveren (2012).

48 The "export diversification" outcome was the only feasible one, given the information available to OVE. The SECEX database only provides information on export amounts by range at the establishment level. When the CNPJs were collapsed to firm level, it was impossible to aggregate the ranges.

49 Treatment overlap and attribution will be discussed in the methodology section below.

50 Heckman (1979) shows that if there are unobserved factors affecting both the outcome itself and the probability of selection into the sample, the regression coefficients are biased and inconsistent.

51 Rosenbaum and Rubin (1983) showed that instead of having to match on a multitude of dimensions in a vector of observable characteristics Z, it is only necessary to match on a single dimension P(Z), which is the propensity score. A treatment and control observation that are close in the propensity score space will also be close along Z.

Notes

[52] The age and education of firm employees were analyzed regardless of the job position. To conduct the PSM, OVE applied a probit (probability plus unit) model controlling for geographic location and sector. OVE matched treated and nontreated units using a propensity score for each that ranges from zero (no probability of participation) to one (high probability of participation).

[53] The estimation strategy uses a combination of PSM at baseline (between treated and untreated firms) and the DID estimator suggested by Crespi et al. (2011).

[54] See Bruhn and McKenzie, 2013.

[55] Attrition bias occurs when firm dropout generates a misinterpretation of results by changing the characteristics of treated and control groups and outcomes. The reduction in the number of firms along the panel may be the result of firms' mortality rates.

[56] OVE also assessed the timing in which each intervention might have had an effect. This was done with a separate regression that employed two separate treatment dummies: a short-term dummy for the year of treatment and the year following treatment and a long-term treatment dummy for four years after treatment until the end of the panel. This was done to distinguish between immediate effects and longer-term effects of each treatment following Lopez-Acevedo and Tan (2011). Those results are reported in Annex IX.

[57] See Annex VI.

[58] The database does not have many alternative variables to be used in the PSM. To reduce the chances of collinearity by adding too many dummy variables in the probit regression, OVE chose to control for sectoral variation in the DID model rather than in the probit regression. The literature for observational impact evaluation accepts as good practices either including exogenous variations in the probit regression or adding them as controls in the DID model.

[59] Robust analysis on the PRIME program of FINEP and FAMPE's working capital was not possible due to the small number of observations available to OVE.

[60] Robust analysis on FINEP's research grants and Zero Interest programs was not possible due to the small number of observations available to OVE.

[61] See, for example, Hall (2011).

[62] http://www.bndes.gov.br/wps/portal/site/home/financiamento/bndes-automatico/

[63] http://www.bndes.gov.br/SiteBNDES/bndes/bndes_en/Institucional/Press/Noticias/2011/20111006_cartao.html

[64] As Parisi, Schiantarelli, and Sembenelli (2006) pointed out, the subsidized credit would be used to implement innovation that itself depends on new machinery. Thus, appropriately designed credit support would emerge as an attractive policymaking tool to increase productivity in the manufacturing sector.

[65] Messa (2014) assessed the evolution of productivity in the Brazilian transformation industry from 2002 and 2010 and considers the decrease of the capital/labor input to be the main contributor to the reduction of labor productivity in the period (about 1.68% per year). The author suggests reducing import barriers to new machinery and equipment to allow the absorption of technology incorporated in these goods and so to achieve efficiency gains.

[66] The two evaluations adopted different methodological approaches but both used panel data from 1996 to 2006. Ottaviano and Souza (2014) evaluated separately the impacts of FINEM (equity acquisition lines) and BNDES Automatic programs on the productivity of manufacturing firms that received those loans from 1998 to 2006, and both lines performed similarly. Ribeiro and De Negri (2009) assessed the same impacts on firms surveyed by PINTEC (2000, 2003, and 2005), which reported the use of public lending (mainly BNDES recipients) to cover their R&D expenses, and found similar results.

67 OVE's results on BNDES Automatic on manufacturing firms should be taken with caution since the regression on labor productivity is not conclusive. However, OVE's regressions of the short- and long-term impacts of the programs are particularly interesting for this specific program. One could argue that BNDES Automatic finances investment on long-term projects; the period between contract signing and the end of installments lasts on average five years. When treatment effects are separated into short-term and long-term dummies (see Annex IX), BNDES Automatic shows a highly significant, high-magnitude impact on capital productivity in the long run.

68 Silva, Almeida, and Strokova (2015) pointed out that in the 2000s labor earnings grew faster than labor productivity in Brazil. According to these authors, since 2004 gains in real wages have outpaced labor productivity growth. Since 2002, formal jobs increased by more than 13% as the private sector created a total of more than 19 million formal jobs.

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