

GLOBAL ECONOMIC GOVERNANCE

Financing Sustainable Infrastructure in the Americas

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INTRODUCTION

Latin America and the Caribbean (LAC) has achieved considerable social and economic progress in the past three decades. However, the region still lags behind many other parts of the world when it comes to key infrastructure areas - including sanitation, telecommunications, transportation and energy. These infrastructure gaps are now proving to be hurdles for productivity and competitiveness, which in turn threatens continued sustainability of growth paths.

Besides positively affecting growth, infrastructure investments shape future energy and transportation matrixes, urban landscapes, and a significant part of the supply and quality of public goods and services. They define how natural resources will be used in the future, and consequently are an opportunity to address other interrelated threats to the well-being of the people living in LAC, namely environmental degradation and climate change. Therefore, investing in **sustainable infrastructure** may be virtually a “silver bullet” to the long-term prosperity, environmental sustainability, and the well-being of people of the region.

Brazil is a particularly dramatic case where sustainable infrastructure investments may be critical for the future. The country is already the 8th largest economy in the world and has achieved remarkable poverty reduction, but still has an infrastructure

that lags behind nations of comparable, and even lower, stages of socioeconomic development. And even though Brazil has one of the largest share of the world's natural resources (water, forestry and biodiversity) - on which future prosperity significantly depends upon - the country is already facing severe consequences from climate change and environmental degradation such as persistent droughts, contaminated water, air and soil, and the occurrence of climate-related diseases.

In times of low growth and rapid climate change, expanding investments in sustainable infrastructure in the region, and particularly in Brazil, are critical. And yet it is an enormous challenge for many reasons. A important one is related to the financing of projects - LAC nations face tremendous fiscal challenges, and the sources of long-term private capital needed for such investments are scarce.¹ This paper analyzes the challenges and potentials of LAC national development banks in playing a role in closing the infrastructure gaps with climate-smart investments. Most of the analysis will focus on the Brazilian case, and on the role of its own national development bank (BNDES) in supporting sustainable infrastructure projects. It is organized as follows: following this introduction, section 2 will present a regional overview on both the infrastructure financing gaps and on development banks. Section 3 will analyze the case of Brazil and its current role of its BNDES as a main long-term financier – particularly of sustainable infrastructure. Section 4 will use a simple **analytical framework** to illustrate the potential role development banks can have in expanding sustainable infrastructure financing; section 5 will use this same framework to analyze BNDES's role in leveraging and crowding-in finance for sustainable infrastructure investments. Finally, Section 5 will present our main findings and policy conclusions.

2. A REGIONAL OVERVIEW: INFRASTRUCTURE GAPS AND DEVELOPMENT BANKS

As mentioned in the introduction, Latin America and the Caribbean (LAC) still lag behind other regions of the world when it comes to key infrastructure areas. These gaps are now proving to be one of the biggest hurdles for regional productivity and competitiveness, and a significant bottleneck for the region's development, as clearly indicated in a recent World Economic Forum (2015a) publication: *“[t]oday's market is driven by innovation, and the pace of doing business has never been faster. As new products and services continue to emerge, the element of access to consumers will determine where start-ups and enterprises choose to invest their resources. If Latin America is still catching up on providing adequate infrastructure – high-quality ports, modernized*

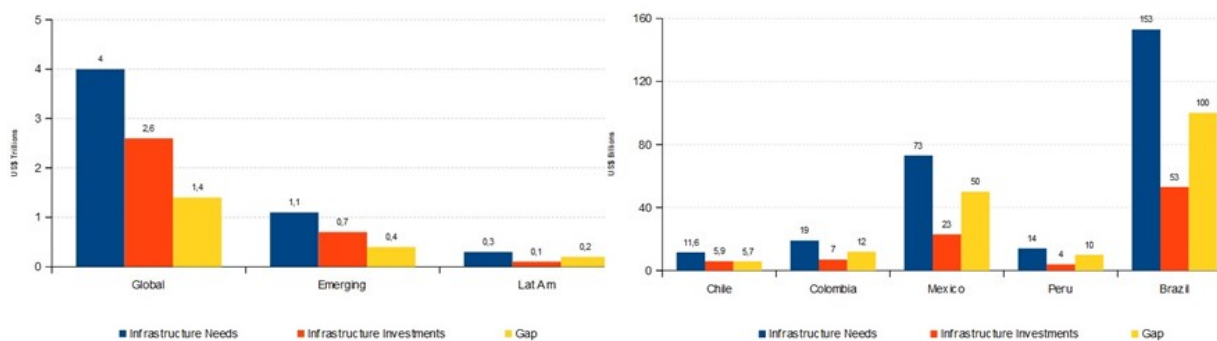
¹ The scarcity of long-term financing is of course one of the many reasons underpinning low infrastructure investment – for instance, the lack of “bankable” projects, the macroeconomic environment (still perceived as inherently volatile), the excessively high domestic interest rates and so on. Our focus here in financing constraints does not imply a neglect for such factors.

technology, paved roads and airport runways – it’s likely to miss out on opportunities that could help fuel sustained growth.” In this section we look at some main causes of these gaps, and the role that national development banks in the region play in helping close them.

2.1. LAC: INFRASTRUCTURE GAPS AND FINANCING

A long history of low investment levels has created a sizable overall infrastructure gap in Latin America and the Caribbean. According to the United Nations Economic regional commission (ECLAC), infrastructure deficits are significant in four specific sectors that are critical to national and regional prosperity: transport, energy, water and sanitation, and telecommunications. According to several empirical studies (e.g. IDB, 2013, 2014; ECLAC, 2011), in order to fill this gap, investments would have to increase to 5 percent of GDP for a prolonged period of time, from the current 2-3%. If such estimates are correct, the region requires additional investment of \$120–\$150 billion a year (based on the region’s 2013 GDP). As indicated by another report (Tuesta, 2015), most of these needs are related to Brazil.

Figure 2-1: Infrastructure gap in LAC

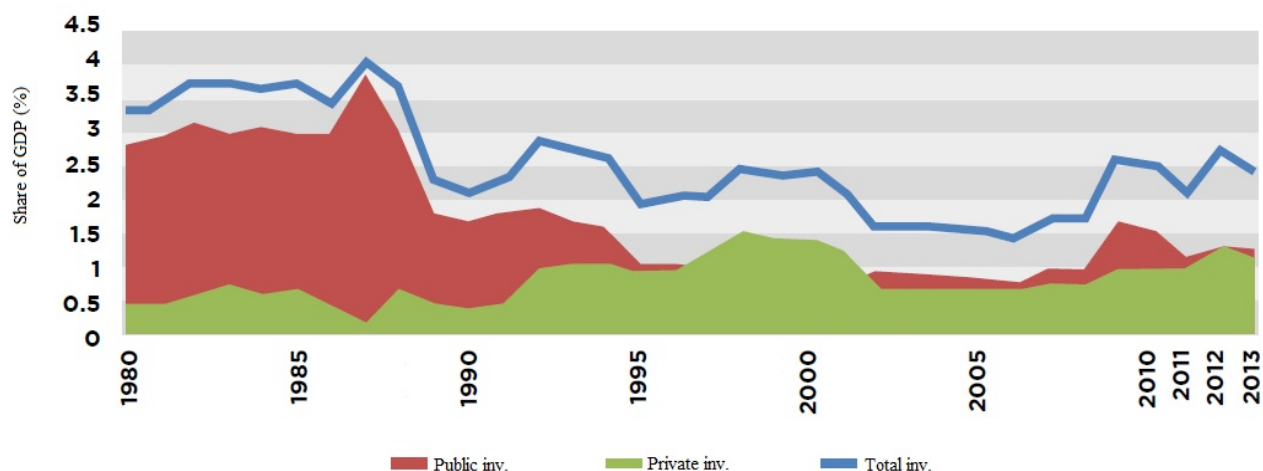


Source: Tuesta (2015).

Compared to global needs, or even those of other emerging-market economies, the infrastructure gap of the LAC region may seem small.² However, if compared to developed economies and even South Asian developing nation, this region faces some important obstacles to long-term investments – such as the long-term decline in public investment; the timid response of private investors and financial intermediaries preparing and financing infrastructure investments; and the lack of appropriate long-term financing conditions.

² For instance, a recent study (Tuesta, 2015) indicates the worldwide gap – for business-as-usual (BAU) needs – is around US\$ 1.4 trillion, whereas in all emerging markets it is US\$ 400 billion.

Figure 2-2: Annual public and private investment in infrastructure in Latin American selected countries, between 1980 and 2013



Source: IDB (2015).

With regards to the role of public investment, for at least the past three decades, policy-makers and market analysts have placed a significant hope on the possibility of private sector participation increasing as the public sector retreats from such investments. Some of that has happened, but not in the speed required. Indeed, the volume of private infrastructure investment as a percentage of GDP, which was already low in the 1980s and 1990s, fell for almost 10 years until 2003. Only since then has it recovered due to a significant recent hike - according to EIU (2014),³ between 2010 and the first half of 2015, 572 projects reached financial closure in Latin America with total investment amount of US\$ 376 billion. In this group, the sector with the largest investment share was electricity with 33%, followed by telecom with 32.3%. The type of PPI with largest share in investment was greenfield project, with 56% of the total.⁴

This recent hike in private investment participation has a lot to do with the second challenge often mentioned by analysts (e.g. Calderon et al, 2010): the business environment. In fact, there has been a significant improvement on this front; for instance, by using a benchmarking index that assesses the capacity of the countries to carry out sustainable public private partnerships (PPPs) in infrastructure,⁵ the average overall ranking for the region improved by nearly 10 points

³ EIU- Infrascope is a database that records contractual arrangements with and without investments in which private parties assume operating risks in low- and middle-income countries (as classified by the World Bank). The projects included in the database do not have to be entirely privately owned, financed or operated. Some have public participation as well. With few exceptions, the investment amounts in the database represent the total investment commitments entered into by the project entity at the beginning of the project (at contract signature or financial closure), not the planned or executed annual investments. To the complete methodology, see: <http://goo.gl/xfCrSu>.

⁴ It is interesting to observe that Brazilian undertakings represent eight projects in the top ten largest PPI investments. More on this below.

⁵ This index is an informational tool and benchmarking index that assesses the capacity of the countries to carry out sustainable public private partnerships (PPPs) in infrastructure. The complete index and its methodology, as well as

between 2009 and 2014 - from 32.9 to 42.5, due to improvements in all six categories (legal and regulatory framework, institutional framework, operational maturity, investment climate, financial facilities, subnational adjustment factor). The same source indicates that the regulatory and institutional framework categories have improved the most, as many countries have updated their PPP and concession laws, and have set up new PPP agencies or specialized units within existing institutions.

But despite all these improvements, as mentioned before, private participation in infrastructure investment and financing has not improved by much. Overall, it has stagnated since 2012, indicating little change in terms of deepening financial markets or tools and products that facilitate private infrastructure investment (EIU, 2014). And despite the decline of public investments in infrastructure over time, it still remains more important than private investment in all countries in LAC; only between 1996 and 2002 was private investment bigger than a public one.

Financing constraints are a significant part of the problem. This explains why public banks in general, and development banks in particular may have a significant role in breaking a vicious cycle of low investment, poor infrastructure, and poor growth performance. This is our next topic.

2.2. DEVELOPMENT BANKS IN LATIN AMERICA AND THE CARIBBEAN

Before we begin our analysis, two observations need to be made. The first one concerns the issue of public access to information. Readily available, and time-consistent data for the public has not been made available by NDBs in the whole region.⁶ Non-financial information is even more scarce. Overall the lack of data and information is an issue that should be of major concern for the NDBs in the region, as it is elsewhere.⁷

The second has to do with a necessary distinction between public financial institutions (PFIs) and NDBs. The former, such as public commercial and mortgage banks, are frequently used as mechanisms to provide services - credit being only one of them - to targeted agents, activities or sectors that are under-served by private institutions. And because of their public nature, they can accept higher levels of perceived risk in order to provide these potential borrowers with better credit conditions – either lower rates and/or longer maturities. In sum, PFIs tend to mitigate financing gaps caused by “market failures” within the boundaries of the existing financial and non-financial

detailed country analyses, can be viewed on this website: www.eiu.com/lacinfrascope.

⁶ It is important to notice that the problem is not lack of best accounting practices, because a significant number of them is evaluated by rigorous rating companies.

⁷ Access to information to any public institution is an obvious important requirement of good governance. After all, like most shareholders of any institutions, society need be able to evaluate the mandate of such institutions, how they allocate public resources and how they perform. It furthermore makes it possible to rethink and redesign such mandates according to the new challenges presented throughout the development process.

structures.⁸ In most case, these failures are an inherent part of market economies, and therefore PFIs of even developed nations tend to stick to specific mandates (for instance, financing SMEs).

In contrast, NDBs are often public financial institutions with mandates, policies, and operations meant to fill both common and extraordinary financing gaps - sometimes with the objective of promoting structural (microeconomic, sectorial and macroeconomic) *transformations*⁹ as part of a broader development strategy. Thus, they are indispensable development policy instruments that interact with other government entities to pursue specific goals, and their role as financier is only part of their mandates. Bearing these caveats in mind we can proceed to the analysis of the public development banks in the southern cone, focusing on their recent performance and activities.

Unfortunately, most NDBs in the region are dedicated to what we have called “common gaps” – these are related to market failures in SMEs, agricultural production and/or long-term productive investments. There is little evidence that they play significant roles in financing infrastructure, which is often left to pure public investment or to PPPs structures, which are highly leveraged with budgetary resources and guarantees.

As mentioned above, LAC economies face many infrastructure and competitiveness gaps - a few challenges need to be addressed to achieve a sustained path of growth and economic development in this region. It is important to push for meaningful gains in productivity, which, in turn, will partly depend on increased investments in upgrading productive systems and infrastructure and logistically. A lack of appropriate financing is only one of the constraints to advance on this front, and it will be a crucial part of these efforts, especially when financial resources worldwide have become scarcer and more short-term oriented.

In this scenario, national development banks (NDBs) may have an important role in overcoming the existing financing constraints.¹⁰ Their activities go beyond filling the gaps created by market

8 Financial inclusion however can be transformational not only of the economic situation of those who have access to subsidized credit. It can transform existing market structure. This is the case for instance when access is denied simply because private financial institutions have no means of evaluating credit worthiness, for lack of track record of potential clients. By providing credit to those underserved by private institutions, public banks allow for the creation of track records. More on this latter.

9 But no means this is meant to be that all NDBs have been successful in promoting transformations. But that is what they have been created to promote.

10 In our view, in order to evaluate the perspectives of such institutions on the above-mentioned challenges, it requires a look at them with unconventional lenses and a description that goes beyond some possible misunderstandings created by their very denomination as development banks. Indeed, it is often assumed that NDBs are exceptional, government-owned institutions in developing economies that fill gaps created by market failures by delivering subsidized credit to specific economic agents and sectors. In fact, NDBs are not uncommon and their role as policy instruments is not restricted to early stages of socioeconomic development. On the contrary: the largest ones can be found in high-income economies and in the largest emerging economies. It is important to highlight that NDBs are not mere financiers, or substitutes for private institutions in face of market failures and/or in the early stages of financial development.

failures and frequently they were created to fill market extraordinary financing gaps - such as those created by destructive conflicts (wars), natural disasters (earthquakes) or moments of inflection of development paths (government-sponsored industrialization, rapid urbanization or even rapid socioeconomic transformations). As such extraordinary financing needs dissipate, however, they tend to focus more on “common financing gaps” associated with market failures and in many circumstances they have played significant roles in creating private instruments and markets that contribute to filling such gaps.

NDBs perform quite well in many countries around the world, and in different development stages, even where little or no public funding is provided to them. Some of their operations attract the resources from private investors and lend them with healthy “exit strategies” through crowding-in. In our opinion, the following should be a part of NDBs policies: i) fostering the development of domestic financial institutions; ii) maintaining flexibility in changing business models and iii) focusing when required and maintaining relevance throughout the process of development.

Latin American NDBs do not differ that much from others in different developing regions. They operate in financial sectors in bank-based systems, where securities markets have a limited role in financing long-term and riskier undertakings in an environment of still limited financial depth.¹¹ When it comes to long-term financing, domestic private sector financing is extremely limited in most of these economies, except somewhat in Chile. Mostly, but particularly in case of Brazil, long-term financing is mainly provided by development banks.

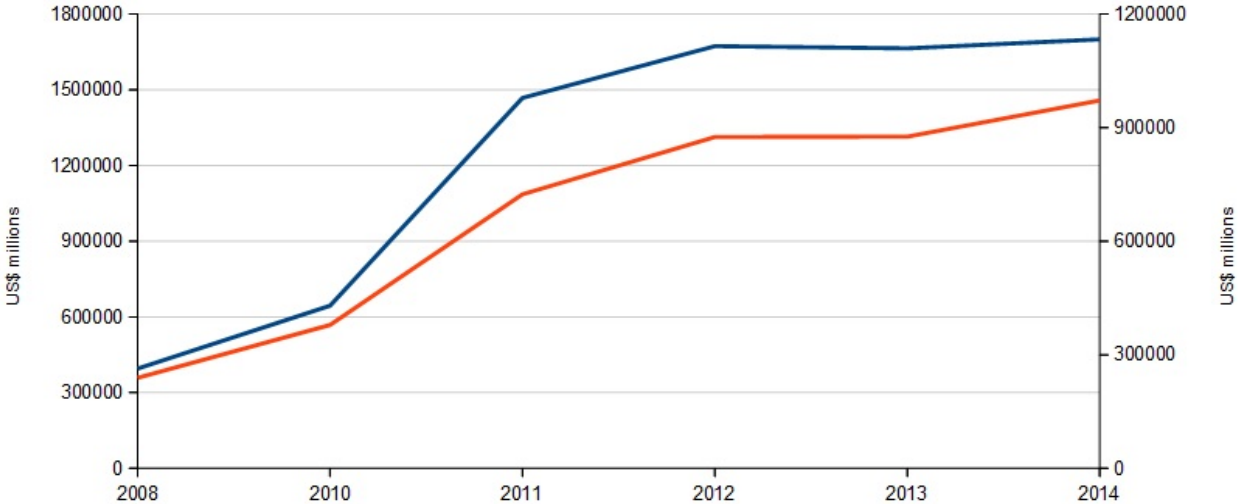
The 1980s and 1990s financial reforms in the region meant the closure and/or overhaul of the business models of a significant number of public banks. Most NDBs were privatized, closed down or restructured, a process which was reflected in the decrease in membership of the Latin American Association of Development Financing Institutions (ALIDE) from 171 institutions in 1988 to just 79 in 2013. Most of the surviving NDBs did improve their “efficiency” however, as measured by standard performance indicators (Stallings and Studart, 2005). More recent studies, such as World Bank (2012) and De Ollouqui et al (2013), confirm that this positive trend has continued: public banks in the LAC region seem to have achieved degrees of efficiency and operational performance that match and sometimes even exceed that of private institutions.

Lately, these banks have been mandated with the difficult task of playing a countercyclical role. For that purpose, some public banks were capitalized or their profits were reinvested, which

¹¹ Indeed, throughout the past two decades’ financial instruments and markets are expanding, but even those that have developed relatively sophisticated financial sector, such as Brazil and Chile access to private finance is limited. Short and medium term credit is also provided by a relatively sophisticated private banking sector, but, again with the exception of Brazil and Chile, credit over GDP is significantly lower than the world average, and much lower other developing regions that also possess bank-based system – for instance, East Asia. Interest rates spreads and therefore costs tend to be high, but even higher to small and medium enterprises. See Stallings and Studart (1997).

allowed them to increase lending with their own resources. In addition, they could increase their access to resources coming from international financial institutions - such as the World Bank, the Inter-American Development Bank and the Latin American Development Bank (CAF) – which were also mandated by their shareholders to expand their lending as a contribution to the global countercyclical efforts. The overall result was a significant increase in the total assets, and particularly in the loans, of regional NDBs, as shown in figure 2- 3.

Figure 2-3: National development banks in LAC, Total Assets and Loans (stocks) between 2008-2014



Source: ALIDE Database

Such an expansion was well spread among the following traditional target sectors: i) agriculture and rural investment (25,7%); ii) housing, construction and infrastructure (18,9%) and iii) trade (12,1%). The main beneficiaries were small and medium-sized enterprises (38,9%), but very large ones also benefited with 19,5% of the total disbursements. The majority of contracts, 62% of the total, are long and medium term loans.

Despite this rapid expansion, NDBs remained extraordinarily solid, both operationally and financially, as indicated by Table 2-1.

Table 2-1: NDBs in LAC: selected operational and financial indicators

Bank Name	Total Assets (th USD)	Total Assets / GDP (%)	Net Income (th USD)	Net Interest Margin (%)	Return on Average Assets (ROAA) (%)	Return on Average Equity (ROAE) (%)	Net Loans / Total Assets (%)
2014							
Banco Nacional de Desenvolvimento Economico e Social - BNDES (Brazil)	330.328.145	14,08	3.236.067	2,11	1,04	13,54	74,24
Banco Nacional de Mexico, SA - BANAMEX (Mexico)	74.787.198	5,78	550.007	7,37	0,72	5,81	41,35
Banco Nacional de Obras y Servicios Publicos, SNC - BANOBAS (Mexico)	38.871.109	3,00	245.550	1,43	0,68	10,80	52,48
Banco del Estado de Chile (Chile)	46.290.962	17,94	288.556	3,31	0,65	15,08	57,49
Nacional Financiera S.N.C. (Mexico)	26.481.179	2,04	113.602	1,12	0,45	7,15	37,55
Banco de Comercio Exterior de Colombia SA - BANCOLDEX (Colombia)	2.799.904	0,74	26.190	1,83	0,95	4,39	79,93
Banco Del Estado (Ecuador)	1.770.700	1,75	39.700	4,64	2,20	7,91	60,01
Banco de Inversion Y Comercio Exterior SA - BICE (Argentina)	642.209	0,12	50.047	5,83	8,37	15,08	47,11
Median	26.481.179		113.602	2,11	0,95	7,91	52,48
Standard Deviation	109.940.800		1.086.191	2,28	2,63	3,71	14,97
Average	67.954.349		608.738	3,48	2,06	9,24	56,09

Source: Bankscope

The question that remains is how this expansion has been useful in addressing the enormous infrastructure financing gap in the region. From earlier analysis (Stallings and Studart, 1997 and Studart et al, 2004) it is clear that three cases are interesting in this respect: Brazil, Chile and Mexico. The latter two will be briefly reviewed below, whereas the former will be analyzed in more detail in the subsequent sections.

Chile is one of the most successful cases in financing infrastructure, with private sector resources backing and a large experience in private-sector participation in the infrastructure undertakings. Certainly, despite the swings in national politics in the past two decades, different governments have been extraordinarily consistent in building an infrastructure financing architecture, and which subsequently became a state policy with cross-party support. Two institutional advancements were crucial in this regard: the creation of the Ministry of Public Works (MOP in Spanish) in 1993, and within it the establishment of one department specialized on concession plans in 1995. The latter department has an important role in originating projects, preparing bidding documents, and managing and supervising the planned works.

The concession system is based on a very efficient risk managing and sharing system, which includes the possibility that the government may grant certain guarantees or cover certain risks so that socially profitable infrastructure concession could be viable. Thus, it sought to free up public resources for infrastructure that, while socially necessary, could be socially unviable by paying a fee or toll.

One of the main features of this action was the risk sharing. The Chilean concession system is based on the general principle that risks should be transferred by the dealer, to the extent that

can be controlled by it. If the risk is not diversifiable or fully transferable to the market, the state must assume full or in part. In this vein, the Ministry of Public Works helps control the risk of construction, commissioning and delivering engineering projects almost definitive way the dealer. Other risks, arising for instance from changes in the design, availability of materials and equipment, transportation costs and change in unit prices etc. must be borne (managed and diversified) by the concessionaire.

Another relevant feature of this model is the strong regulatory framework that protects the investors. This is based on two main legal “pillars”: the 1991 Concessions Law and its 2010 Amendments. Together they worked to create an enabling environment for PPPs and addressed all phases of a PPP project, from the proposal to the eventual transfer of the completed asset at the end of the concessions agreement.

In addition, Chile provides strong legal protection and minimum income guarantees for all investors. For instance, in 2005, a currency risk management program was put in place, whereby the government began to insure concessionaires against exchange rate risk if financing had been secured in foreign currency.¹² This program shifted financing currency risk from the concessionaire to the government by requiring the government to reimburse the concessionaire if the peso weakened below an agreed level, but, in turn, requiring the concessionaire to reimburse the government if the peso strengthened.

With regards to the funding model, the concession system is project finance, and has three well-defined types of structure: bridge loan for construction and infrastructure bonds; bridge loan for the construction; and long-term credit during the operation and long-term loans. In the case, a bank loan is secured during construction, and after which an infrastructure bond is issued to fund the operation of the concession (when the dealer is already operating the service).¹³ The second mechanism separates the risks of construction, operation and the absence of negative carry. Its disadvantages are the risk of interest rate for long-term refinancing, the banks’ ability to finance large projects and the demand for greater guarantees to the project promoters. The third type has become very competitive in recent

12 If a project’s revenues are indexed to the exchange rate, a currency swap is effectively built in to the contract. As a result, the currency risk is transferred to the buyer, often a state utility or government entity. While this strategy solves the currency risk for the developer and financiers, it does not solve the issue for the buyer/ government. For example, for highway concessions in Chile, the government has provided an exchange rate guarantee for the dollar-denominated financing component, which effectively translates the local currency payment mechanism into a hard currency payment mechanism, according Lorenzen, Barrientos and Babbar (2001).

13 There are both advantages and disadvantages in this funding operation. The advantages are: i) the separation of the risks of construction and exploitation, which implies a tighter business and stage of project financing margin, and ii) the reduction of haulage and longer terms, even over 20 years. A disadvantage is that the rate of long-term interest is determined only after construction, which generates interest rate risk and gives less flexibility to modify contracts in the exploitation phase. Due to the costs of the placement of the bonds, including the cost of insurance, this type only serves to finance investments of over \$ 15 million.

years, partly because banks have extended deadlines to compete with the first embodiment.¹⁴

The results of this infrastructure financing architecture are solid. Public-private partnerships have permitted the construction of highways, intercity roads and airports. Between 1995 and 2008, 55 projects were implemented under the concessions systems and voluminous direct public investment, representing a total of investment of close to US\$ 11, 5 billion. Already in 2014, the total of projects was 68 in an amount of US\$17,635 billion. It is important to highlight that over 120 companies, including foreign investors from at least eight countries, have participated in concessions bid. In addition, the system has incorporated new actors such as insurances firm, risk rating agencies, banks, construction enterprises and infrastructure operators. Another interesting example is **Mexico** – for quite diverse reasons. Despite the efforts and incentives created to increase private sector participation in infrastructure, the predominant source of financing for the sector continues to be the State and its dedicated public bank, BANOBRAS (National Bank of Constructions and Public Service).¹⁵

BANOBRAS was created in 1933 with the sole objective of intermediating resources for projects receiving direct or indirect public funding in the areas of infrastructure and provision of public services. In addition, an important objective of the bank is to support the institutional strengthening of state and local units of government, and to further sustainable development. BANOBRAS-supported project goals include defined targets in areas such as a development of basic social infrastructure, enhancement of national competitiveness, support to economic growth, and generation of significant net public benefits.¹⁶

BANOBRAS is also responsible for managing the National Infrastructure Fund (FONADIN). FONADIN is a national trust fund that was created in 2008 with the mission to finance infrastructure. This fund provides grants, loans, and guarantees (for stock, credit, damage and political risk), subordinated lines of credit, and grants for technical assistance, with initial capitalization and its own operating revenue sources. FONADIN was assigned to support and coordinate investments focusing on the highways, ports, airports, environment, urban mass transportation, communication, water and tourism projects.¹⁷

14 There is no interest rate risk and have lower transaction costs. Its disadvantages are the limited creditworthiness of banks and the term because despite being long, so far the most has only been 18 years.

15 NAFINSA is the main Mexican development bank, however it is mainly dedicated to the financing of small and medium-sized companies. See Studart (2005).

16 According to USTDA (2014), in 2012, BANOBRAS reported providing assistance in various forms in the amount of US\$1.2 billion, 63% of project credit in this year was dedicated to road projects (particularly public-private partnership toll roads), another 15% to energy, 13% to security, and 6% to water and sanitation. In 2014, this institution was holding a total asset of US\$ 38.87 billion, its loan Loss Reserve / Gross Loans ratio was 2,53% and its net interest margin was 1,43%.

17 FONADIN-supported projects have private participation, are bid competitively and must generate revenue streams sufficient for full or partial repayment and.

In an attempt to crowd-in private resources to infrastructure investment, BANOBRAS has shifted its focus away from traditional direct financing since 2001. It has fostered the development of instruments to boost municipal access to credit, enhance the provision of technical assistance, and work towards the strengthening of the sub-national debt market through guarantees and development of the project financing market. More recently emphasis has been placed on assisting projects that generate their own income streams, with private participation in development and operations.

In addition to providing very long-term financing channel, BANOBRAS has had key role in bearing project financing risks that are not usually taken by private sector and enable leveraging of the maximum private participation in projects with high net public benefits, but higher risk and lower levels of financial profit. On the other hand, it provides know-how for the planning, design, construction and final transfer of projects developed by the private sector.

FONADIN also allows BANOBRAS to have a central role in fostering public - private partnerships. Today, the fund is one of the most important conduits for PPPs in Mexico. The financial capacity of this architecture is substantial, but insufficient. In 2012, FONADIN authorized support for more than US\$ 2.4 billion in projects.¹⁸ In recent past, all of the federal toll roads under PPP projects have received some kind of support from FONADIN. In the Private Equity program, FONADIN has committed US\$400 million to support eight different private equity funds, with a total market cap of US\$2.4 billion. This is particularly relevant because México simply did not have these kinds of funds pre-2009, conforming USTDA (2014).

The first one is the so-called Development Capital Certificates¹⁹ (CKD's), a hybrid capital/debt security, designed primarily for the financing of long-term infrastructure projects in Mexico and to finance investment mid-size Mexican companies. These CKDs are listed in the stock exchange, which ensures market discipline and transparency, and have been a useful instrument to tap funds specialized in infrastructure development.

To ensure that these financial products are consistent with the best interests of members, investors, beneficiaries and other stakeholders, the National Banking and Securities Commission has established specific regulation regarding CKD's issuances, including shareholders' rights and responsibilities. Additionally, this commission has developed monitoring and surveillance processes according to

¹⁸ FONADIN to improve the amount of capital applied a strategy to allocate the revenues from a portfolio of publicly owned toll roads.

¹⁹ CKDs are a form of trustee market certificates aimed primarily for placement among institutional investors through the Mexican stock market designed to foster investment in real estate and infrastructure projects; thus, creating opportunities for large scale investments in real estate and other projects and unparalleled liquidity in the Mexican market. CKDs are issued and offered by a Mexican trust (the "Issuer Trust") which shall invest the proceeds of the offering pursuant to an investment schedule and according to specific policies, in one or several companies or projects, that do not need to be listed in the Mexican stock market. As a result of the foregoing, the Issuer Trust may acquire any type of assets or rights, including money, receivables or in rem rights.

with best international practices.

The second example of efforts to attract private resources is the National Infrastructure Program for 2014- 2018. It is a very broad program of Mexico's federal government that aims to increase the country's economic growth and productivity, based on three guiding principles: i) sustainable urban development, ii) balanced regional development and iii) intermodal connectivity (upgrading the interconnection of highway networks, ports, airports and cities). This plan also includes the participation of Mexican public banks, complementing commercial banks' lending, with adequate risk sharing, that could allow increasing credit growth, in particular in areas that are not fully covered by commercial banks, like infrastructure and SME's.²⁰

The Chilean and Mexican cases seem to be extremely representative of the reality of infrastructure financing in the region. Only very few, like Chile, succeeded in creating a strong private participation in financing any long-term undertakings, particularly infrastructure. A number of them have public dedicated banks and funds, that either channel or complement budgetary resources or funds coming from international financial institutions. Even though there is significant evidence that part of the problem of infrastructure financing has to do with the supply of "bankable" projects, lack of interested private investors limited significantly their availability of finance at reasonable costs. This leaves infrastructure investment very vulnerable to changes in fiscal and/or external financial conditions. Last but not least, private and public resources to finance sustainable infrastructure investment seem to be even more scarce.

Brazil seems to be another interesting case on many levels, and the topic of the next section of this article.

3. BRAZIL, SUSTAINABLE INFRASTRUCTURE AND BNDES

As mentioned in the introduction, Brazil is a relatively open economy with a consistently high path of urbanization, which recent years has gone through a rapid change towards eliminating extreme poverty and creating a large new middle class. Despite its enormous natural endowments, it is likely to be one of the nations mostly affected by global warming. Therefore there are at least three ways to look at infrastructure gaps in Brazil – these are the following: i) to assess the adequacy of its physical capital against that of its exports competitors²¹; ii) to add the necessary requirements to maintain a

20 Additionally, the new plan redefines the strategies and objectives of national development banks, towards i) inducing credit expansion; ii) fostering the participation of commercial banks in infrastructure financing (mini-perm financing, mezzanine products); iii) contributing to channel institutional investors' resources for infrastructure (guarantees); iv) fostering infrastructure development by local governments. v) strengthening credit and guarantee programs for SME's, which will contribute to creating a credit history record for these enterprises.

21 Garcia-Escribano Goes and Karpowicz (2015) take this approach, which focuses infrastructure investment as a

socially inclusive path, and with provision of infrastructure to all citizens; iii) to lack investments for adapting existing and creating new infrastructure undertakings, that are both climate resilient and compatible with a low-carbon growth path. In this section we will present an overview picture of infrastructure financing in Brazil, and the role of BNDES in particular in financing sustainable infrastructure projects.

3.1. INFRASTRUCTURE INVESTMENT GAPS: OLD AND NEW

Brazil is a particularly dramatic case of a country with a lagging infrastructure that has become a true impediment for sustained, and sustainable inclusive growth. It is the world's 8th largest economy, and in the past two decades has achieved remarkable socioeconomic progress and poverty reduction. Yet its infrastructure lags behind a significant number of middle-income countries, particularly considered to be emerging-market economies.

Indeed, whatever measure used, the infrastructure gaps in Brazil are extremely large - based on the World Economic Forum (2014), in overall infrastructure quality, Brazil ranked 120 out of 144 countries surveyed, with particularly poor results for roads and air transport quality; whereas in other types of infrastructure, Brazil ranked in the bottom third of countries surveyed. Only in the area of electricity and telecommunication does Brazil have a better ranking than some competitors, areas in which it has invested comparably more in recent years and more efficiently through greater participation of the private sector. Despite the significant efforts by national authorities to expand investment (more on this below), these rankings remained low in the past decade, and have generally worsened over the past 5 years.

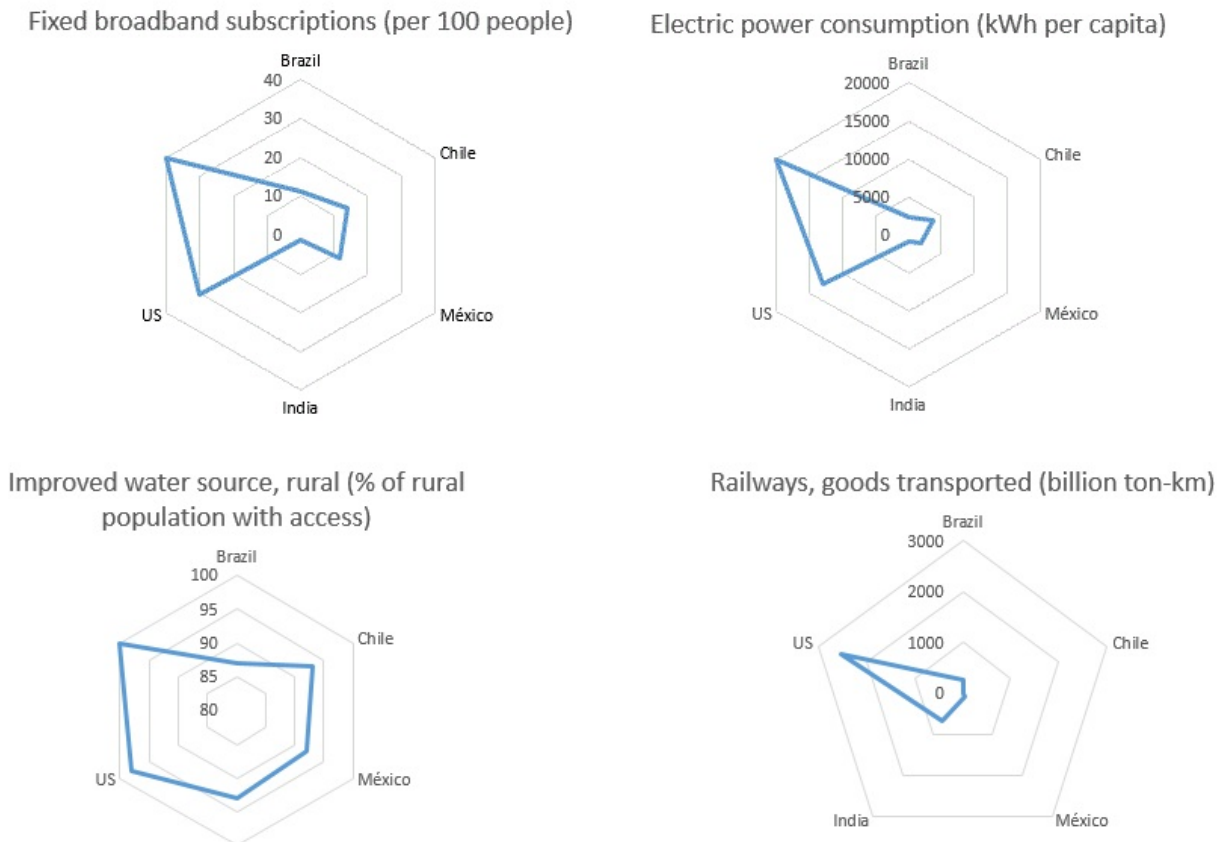
Table 3-1: Brazil: rankings and other indicators of the quality of infrastructure

	Overall	Electricity supply	Roads	Ports infrastructure	Railroads	Air transportation
2006	83	58	95	91		59
2007	97	61	110	116		87
2008	98	58	110	123		101
2009	81	55	106	127	86	89
2010	84	63	105	123	87	93
2011	104	69	118	130	100	122
2012	107	68	123	135	103	134
2013	114	76	120	131	95	123
2014	120	89	122	122		113

Source: World Economic Forum (2014)

strategy to promote internal integration and export competitiveness, or as a facilitator or a bottleneck for sustained growth of an open market economy

Figure 3-1: Brazil: other infrastructure indicators



Source: World Development Indicators.

The negative impact on Brazil of its relatively poor infrastructure cannot be understated: across all areas of transport infrastructure—roads, ports, railroads and air transport infrastructure—its WEF scores for adequacy of physical capital are substantially lower than those of its main export competitors. Only in the area of electricity and telecommunication does Brazil have a better ranking than some competitors, areas in which it has invested comparably more in recent years and more efficiently, through greater participation of the private sector. Still, according to the Enterprise Survey (2010), 46 percent of firms in Brazil indicated that electricity was a major constraint to activity (against 38 percent in LAC) while 28 percent of firms considered transportation to be a major constraint (against 23 percent in LAC).²²

This lag naturally influences adversely its competitiveness, and creates bottlenecks constraining its growth, and even affects the future path of inclusive development, and indicated in a World Economic Forum (2014) report.

²² See Garcia-Escribano, Goes, and Karpowicz (2015)

Figure 3-2: Some indicators of how infrastructure affects Brazil's competitiveness



Source: World Economic Forum (2014).

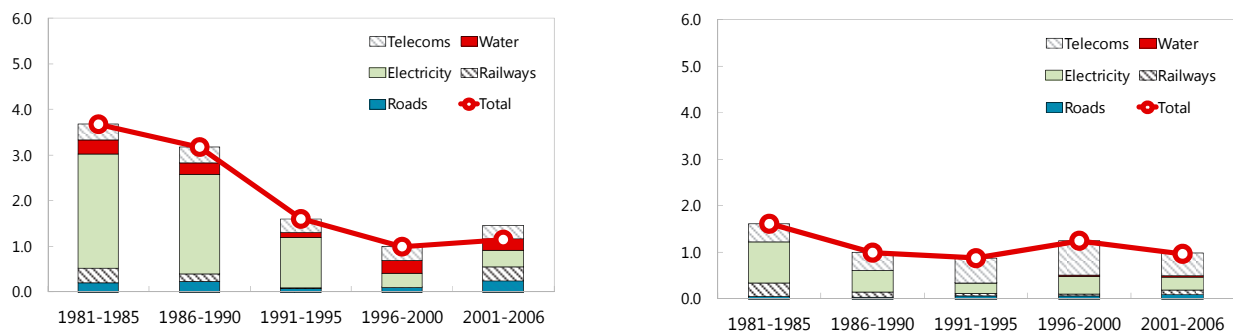
As mentioned before, the reason for such an enormous infrastructure gap has to do with the subsequent decline of public investment, which was not compensated by a significant increase of private investment. This trend cause Brazil's overall infrastructure investment to fall from around 3-4% of GDP in the 1980s, to less than 2% in the 1990s and 2000s – similar to those of other much poorer and less dynamic neighboring LAC nations.

Figure 3-3: Brazil's investment in infrastructure, % of GDP

Period	1971/80	1981/89	1990/2000	2001/10	2011/14	2015p
Electricity	2.13	1.47	0.76	0.62	0.70	0.58
Telecommunications	0.80	0.43	0.73	0.69	0.49	0.34
Transport	2.03	1.48	0.63	0.63	0.90	0.71
Water & Sanitation	0.46	0.24	0.15	0.18	0.19	0.17
Total	5.42	3.62	2.29	2.12	2.29	1.8

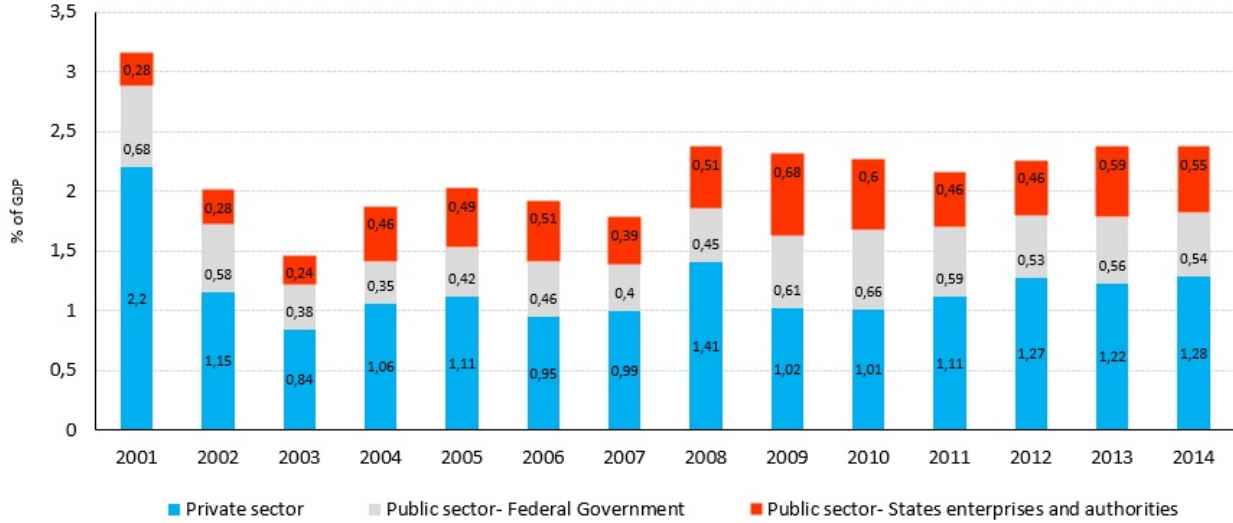
Source: Gambia and Castelar Pinheiro (2012), Frischtak (2011) and Inter.B (2014).

Figure 3-4. Brazil: Infrastructure investment, % of GNP and in comparisons with countries in the LAC region



In face of these shortcomings, more recently the federal government renewed the interest in the rapid expansion of infrastructure investments in Brazil. Infrastructure was indeed the heart of the Program for the Acceleration of Growth (PAC for the acronym in Portuguese), first launched in 2007, and this partly explain the slight increase of infrastructure investments as a percentage of GDP. But bridging the infrastructure gaps discussed above will require significant higher investment levels, estimated to be as high as R\$1.1 trillion, the equivalent of one-fourth of Brazil’s 2012 GDP (Wagner et al, 2015).

Figure 3-5: Trends in public and private infrastructure investments in Brazil.



Source: Giambiagi and Castelar Pinheiro (2012), Frischtak (2011) and Inter.B (2014)

Since the outset of Brazil’s current crisis, initiated in 2014, filling the gap using public resources has become an even more difficult challenge. Indeed, when the government is attempting to promote a long-term fiscal adjustment, and with enormous fiscal constraints,²³ its capacity to pull this out without leveraging and crowding-in private capital is very limited. We will come back to this issue later. For now, let us briefly discuss the landscape and potential for sustainable infrastructure projects and financing.

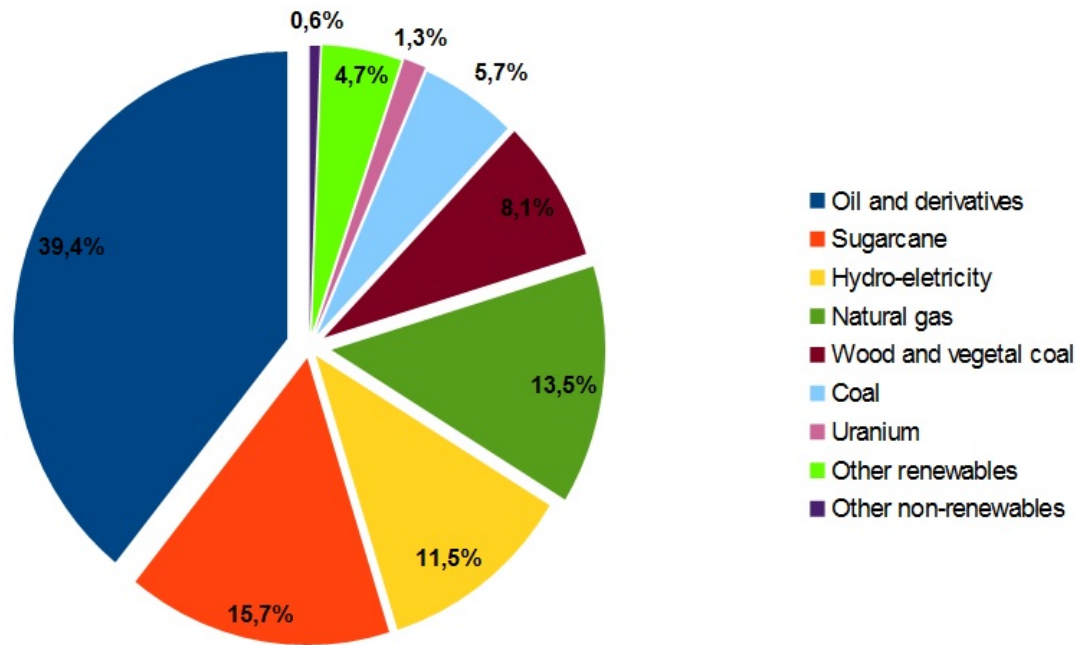
3.2. SUSTAINABLE INFRASTRUCTURE IN BRAZIL

Brazil already possesses one of the greenest energy matrix in the planet, due to the centrality of hydroelectric power in its energy matrixes and renewable fuels in transportation. Nevertheless, there is much scope for the expansion of sustainable infrastructure in the country. First even its clean energy matrix has not been able to cope with fast increase of demand, which in-turn triggered the

23 Some would say that this is a “self-imposed” constraint, created by a very restrictive capability of government (federal, state and municipal) spends resources and enforces infrastructure projects, based on “law of fiscal responsibility” and years of exceptionally high interest rates.

more intensive use of coal-generated energy (coal still represents over 8% of its energy supply). In addition, there is significant space for other alternative, cleaner sources of energy, and definitively for more energy efficiency.

Figure 3-6: Brazil energy matrix



Source: Brazilian energy balance (2015).

Second its freight and transportation systems are still highly geared towards automobiles and trucks – and this explains why almost 40% of its energy is produced by oil and derivatives. In addition, the existing roads are in poor state and unfit to address the current demand, which is a main source of traffic jams in urban areas and inefficient freight transportation system.

Social infrastructure is also of poor quality, with obvious negative social effects but also highly carbon-inefficient. Other indicators also paint a grim picture of the bottlenecks created as infrastructure lags behind the increased needs generated by economic growth, socioeconomic inclusion and rapid urbanization. Indeed, less than 15 percent of Brazil’s roads are paved (including municipal roads) and congestion is a major concern in any of its largest urban centers.⁷ As a share of paved roads, congestion levels are among the highest against comparators. Moreover, multi-lane roads are still relatively rare in Brazil, although they have doubled over the past half-decade.²⁴

Finally, most of the existing infrastructure is not climate-resilient, whereas the effects of climate change are already being felt. In fact, as reported by the World Wildlife Fund, Intergovernmental Panel on Climate Change (IPCC) 4th Assessment Report has found enormous impacts of global

²⁴ The estimated number of vehicles per km of road was 25 in 2008 and this number has likely increased in the wake of the recent boom in auto loans as vehicle sales have more than doubled over the past ten years.

warming in Brazil.²⁵ In sum, building an infrastructure that simultaneously helps the country to be on a climate-resilient, low-carbon and inclusive growth path may be the greatest policy challenge in Brazil. Considering the fiscal constraints and the shortcomings in the provision of private long-term financing, this may require a new financial architecture. And BNDES may have a fundamental role in achieving this goal. This is the topic of the remainder of this document.

3.3. *BNDES, LONG-TERM FINANCIER AND SUSTAINABLE INFRASTRUCTURE*

For the past two decades, Brazil's financial sector has gone significant transformations that increased its sophistication and links with international financial markets. One characteristic has not changed though: private banks continue to be short-term oriented and securities markets are relatively small; therefore, the financing of long-term and/or riskier undertakings are mainly offered by public banks such as Brazil's national development bank (BNDES).

Analyzing the reason for this phenomenon goes beyond the scope of this paper. Instead we intend to analyze policy efforts towards increasing the role of private players in the financing of long-term undertakings, focusing on the efforts directly associated with the role of BNDES in promoting *crowding-in*. Before we do that, a brief description of the evolution of BNDES should be useful.

3.3.1. *BNDES: BUSINESS MODEL*

BNDES was created in 1952 as part of an industrialization strategy that followed a spontaneous import substitution process. It never abandoned its initial mandate to support industrial development, but its de facto mandate evolved throughout the years. For instance, in the early years its main role was to finance infrastructure projects that were critical for industrialization based consumer durables. In the 1960s, it helped finance the development of the cattle-raising and agricultural sector, and of small and medium-sized companies.

BNDES played a fundamental role in 1970s import substitution programs that strengthened several industrial sectors, and even created completely new ones (e.g. information technology and microelectronics), helping shape what is now the most diversified industrial sector in Latin America. In 1974, three subsidiaries were established to operate in the capitals market, aimed at expanding the types of capitalization for Brazilian companies. They merged in 1982 and became a

²⁵ In the northeast part of the country, semi-arid and arid areas will suffer a decrease of water resources due to climate change. Semi-arid vegetation is likely to be replaced by arid-land vegetation, and in tropical forests, species extinctions are likely. Computed groundwater recharge has decreased dramatically by more than 70% in north-eastern Brazil (reference climate normal 1961-1990 and the 2050s). Increases in rainfall in southeast Brazil have had impacts on land use, crop yields, and have increased flood frequency and intensity. In the future, sea level rise, weather and climatic variability, and extremes modified by global warming are very likely to have impacts on mangroves. 38-45% of the plants in the corrido (Central Brazil savannas) committed to extinction with temperature increase of 1.7°C above pre- industrial levels". See <http://goo.gl/CQ6rGg>

new subsidiary named BNDESPAR.

In 1982 the Bank added to its mandate a social component, and changed its name to Brazilian Economic and Social Development Bank (BNDES). During the 1980s, the Bank additionally encouraged Brazilian import substitution, and promoted exports of goods and services. In the 1990s, it became a crucial part of the federal privatization program, begun in 1991, by assisting in the sale of large state-owned Brazilian companies. Later in the 1990s, as part of a policy to reduce regional economic disparities, BNDES helped the development of important projects in less developed regions in Brazil, as well as support for exports of micro, small and medium-sized companies. As BNDES expanded in its activities, it started widening its safeguards and investment “frontiers”.²⁶

Today BNDES’s mandate is quite open, as it states that its main goal is “to foster sustainable and competitive development in the Brazilian economy, generating employment while reducing social and regional inequalities”.²⁷ Through its three integral subsidiaries, (FINAME, BNDESPAR and BNDES PLC) it covers a significant range of the long-term financing gap that is missing in Brazil.

FINAME for instance finances purchase, sales operations and exports of Brazilian machinery and equipment, as well as imports of goods of the same nature produced overseas.²⁸ BNDESPAR carries out capitalization operations of undertakings controlled by private groups. In addition, in recent years BNDES has produced extraordinary new instruments to finance SMEs²⁹ and added innovation. Even more recent, BNDES has boosted its support for the internationalization of Brazilian companies or those searching for opportunities in the international market. It also became an important bridge between international investors and investment opportunities – which largely means investing in infrastructure, the sophisticated industrial sector, and agribusiness with incomparable competitiveness in global terms.

The overall financial performance of BNDES has been impressive in the past decade, as

26 This expansion sometimes had to do with the need to incorporate new mandates as determined by higher levels of awareness of important potential negative externalities of the projects supported by BNDES, and sometimes were informed by public pressure to foster activities that have extremely positive externalities, but that lack access to appropriate funding. One example of the former was the incorporation of environmental sustainability as important part of the overall classification of the risk of projects. An example of the latter case was the increased support to the cultural sector in 1995 through investments in movie production and the preservation of Brazilian historical and artistic heritage.

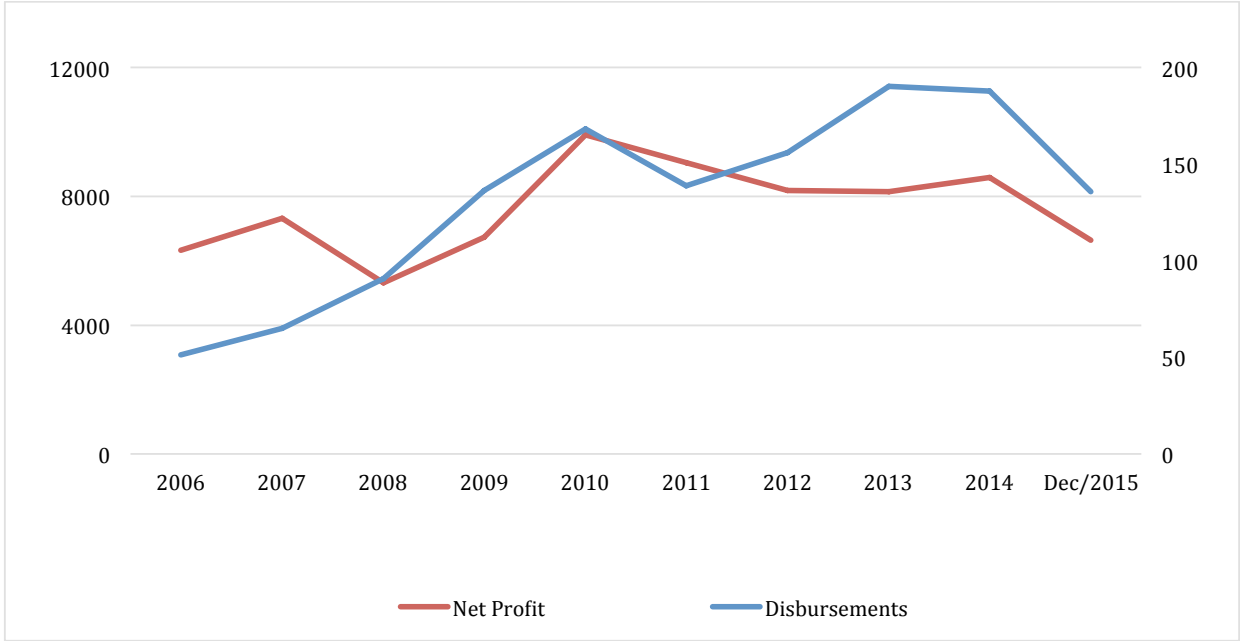
27 See <http://goo.gl/SQuTIy>. Site accessed in 11/09/2015.

28 FINAME activities are developed in conjunction with the collaboration of BNDES, which in turn is responsible for FINAME. However, the management of this agency is responsibility of its Board.

29 Such as the BNDES card, which allows small entrepreneurs to use a revolving fund of credit to acquire inputs and to invest in productive capacity.

disbursements have multiplied by more than four times (in average US dollars), whereas profits have almost quadrupled. This performance is partly due to the countercyclical role that many other (national and multilateral) banks have had since the beginning of the current global crisis, and partly due to its role in supporting the new government policy to boost investment.

Figure 3-7: BNDES - Disbursements and profits (R\$ bi)



Source: BNDES.

As mentioned earlier, in Brazil long-term financing is dominated by public banks – as indeed indicated by the fact that over 90% of loans with more than three years maturities are in the balance-sheets of BNDES, Caixa Economica Federal and Banco do Brasil. Even though other public financial institutions also provide loans with relatively long maturity, BNDES has become by far the largest provider of long-term financing. This explains why it has become one of the five largest development banks (be it national, regional or multilateral) in the world, and the one with the largest participation in overall domestic credit among its peers.

This market position did not come with challenges.³⁰ And one of them became increasingly controversial in Brazil: BNDES’ funding structure which has become highly dependent on fiscal and quasi-fiscal source, and particularly on transfers from the national treasury. This issue will be addressed next.

³⁰ There has been an increasing debate on the recent expansion of BNDES’ size and activities, and the lack of rationale underpinning such a rapid trend. See for instance Lazzarini et al (2011).

3.3.2. BNDES: FUNDING OF OPERATIONS

Until very recently the main sources of funding to BNDES were provided by four sources: “quasi-fiscal” sources³¹; by the returns of its outstanding loans and equity investments; from bond issuance; and/or borrowing from multilateral institutions. This has changed substantially since 2009, when BNDES stepped in to fill the post-crisis 2008 crisis created by the retrenchment of private financing. From then on, the volume of resources coming from the National Treasury increased substantially, becoming higher than 50% of the total funding as from 2011.

This extraordinary growth of transfers from the national treasury sparked a controversy on the fiscal costs of BNDES expansion and even on the validity of approach strategic. For many of the critics, the difference between the roll-over cost of the national public debt and the long-term interest rate charged by BNDES represents a fiscal burden that is not fully disclosed to society, and that has damaging impact on the fiscal discipline of the country. In addition, some claim that BNDES strategy to lend to large companies, as part of its mandate as an instrument of public policy, are unnecessary and create distortions in the macroeconomic supply of credit.³²

Others argue that the lack of private long-term financing and high short interest rates makes it necessary for BNDES to set an interest rate³³ that is compatible with the maturity structure of the projects and investments it supports. On the other hand, attention is brought by the same approach to importance that BNDES loans play in directing investment as part of broader industrial policy, and the externalities and multiplier effects (on production, employment and competitiveness) that BNDES. One of the consequences of this debate has been an increased pressure on BNDES to adjust its pricing (and reduce the subsidy of their lending), to widen the co-financing of larger projects and to simply downsize. This debate is however not easily settled and would deserve a document of its own.³⁴

For our purpose here, however, it suffices to emphasize that the business model does lead to an increasing dependency on fiscal sources of funding, which in turn creates enormous challenges for both BNDES and its shareholder. Therefore, this model needs to evolve if BNDES is to continue to expand its relevance in addressing the significant challenges faced by Brazil – particularly those related to the improvement of existing infrastructure and logistics. This evolution can indeed build

31 These sources are basically the Workers’ Assistance Fund (FAT), linked to the Ministry of Labor, that finances the Unemployment Insurance Programme, transfers from Treasury; and a multitude of other public funds administered by that institutions. See more http://www.bndes.gov.br/SiteBNDES/bndes/bndes_pt/Institucional/BNDES_Transparente/Fundos/Fat/

32 See Lazarini et al (2015).

33 The so-called TJLP, the acronym for the long-term interest rate which is the benchmark rate created by BNDES, around which it sets the interest rates charged on its loans.

34 For an interesting review of the debate, see Rezende (2015).

on the long-standing experience of BNDES in crowding in private financing resources. This will be the topic of the next two sections. Before we discuss the issue, an analysis of the role of BNDES as a financier of sustainable infrastructure is due.

3.4 BNDES AND SUSTAINABLE INFRASTRUCTURE

If long-term financing is in general restricted in Brazil, domestic sources of sustainable infrastructure financing are extremely scarce.³⁵ Not surprisingly, BNDES is by far the main player and financier of green investments in Brazilian soil. The comparative advantage of BNDES in funding sustainable projects comes from a long history the institution has in dealing with green investments and green economy. Since the early 2000s, produces and monitors indicators of the green economy, formulated to assess efforts to improve its environmental performance and allow comparison with other institutions that finance national and international development.

The Bank also has its own environmental safeguards (which strictly follow Brazilian legislation and environmental licensing) when granting financial support to projects from different sectors. Indeed when assessing direct and indirect non-automatic operations, the Bank not only checks if they comply with its own environmental standards, but also assesses the environmental risks, and promotes environmentally related improvements in investments and company management.³⁶

Additionally, BNDES offers products and support instruments to other sectors, with special financial conditions that vary depending on sustainability standards. It also manages three dedicated “green funds”: Amazon Fund, BNDES’ Atlantic Forest Initiative, and the Climate Fund. And even though the total volumes of green financing constitute a small part of current lending (more below), its expansion shows commitment to a low-carbon growth model and to the preservations of important natural regions and increasing the country’s energy efficiency.

There has been a substantial increase of the overall green investments financed by BNDES, which increased almost six times from 2004 (R\$ 4.7 billions) to 2014 (R\$ 27.8 billions). Most of the pipeline consisted of hydroelectric power plants, renewable energy and energy, and (both freight and public transportation. Despite this very rapid increase, the proportion of green investments never exceeded 15% of total lending, and still a small portion of loans outstanding.

³⁵ The reason for this, in our view, has to do with their normal perceived risks, the lack of developed instruments and markets dedicated to this type of financing, and because they often represent innovations and/or still little competitive with other more tested “brown” types of projects. In section 4 we will return to the theoretical rationale behind this additional challenges.

³⁶ BNDES also produces and disseminates specific socio-environmental knowledge. In 2014, three environmental guidelines were published for the sugar and ethanol sectors, beef cattle as well as water and sewage. These guidelines are designed to direct project analysis in relation to the socio-environmental aspects. In this sense, innovation applied to business strategies. These investments may include innovation in products, processes, marketing, besides improving skills and technical expertise in the company.

Figure 3.8: BNDES: green financing (in R\$)

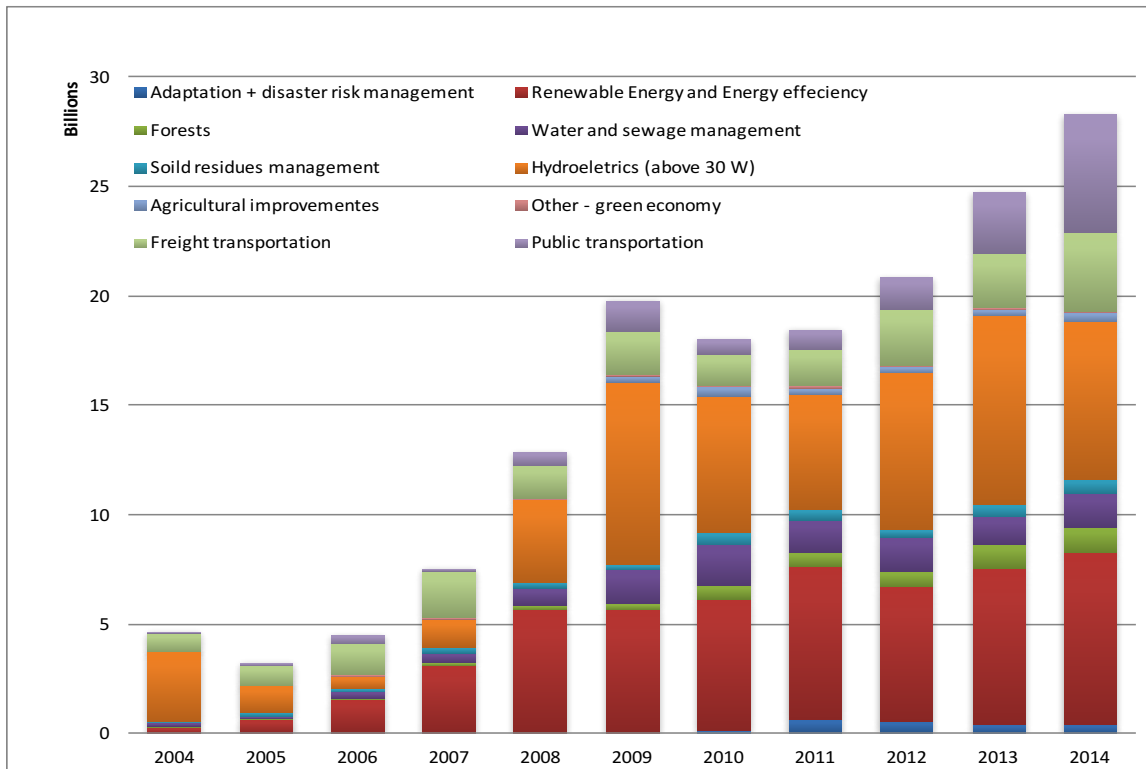
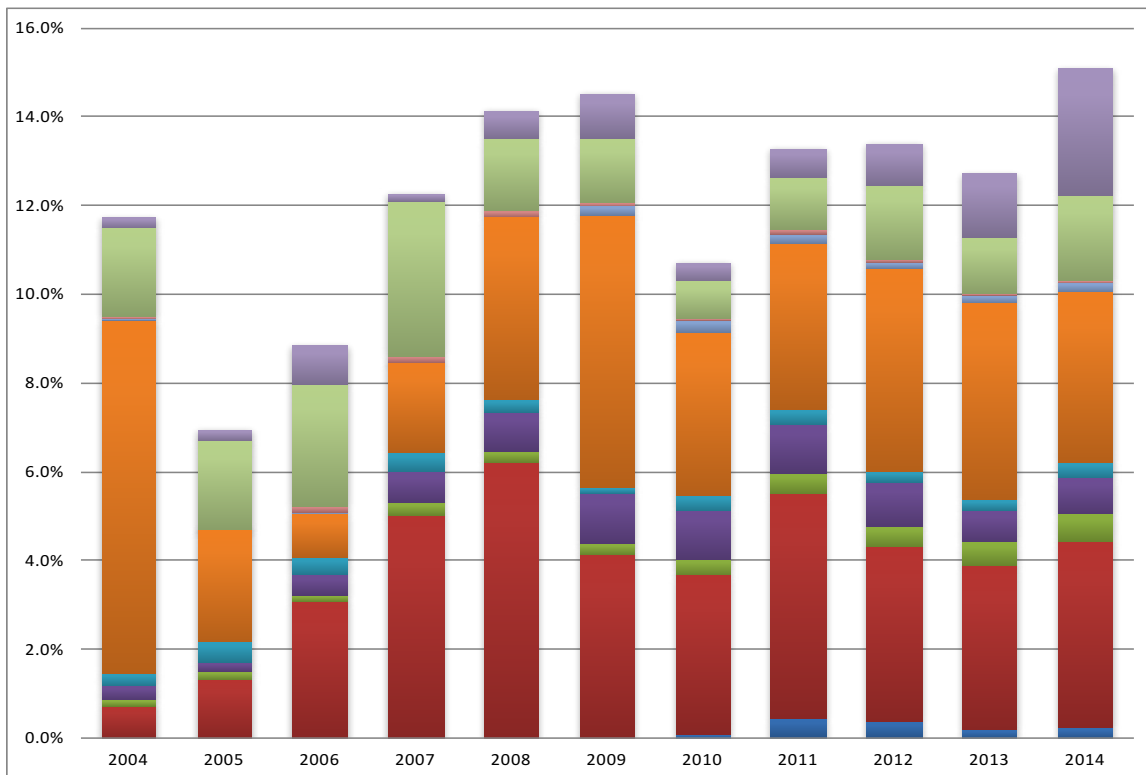


Figure 3-9: BNDES: green financing and as % of total lending



In sum, BNDES continues to be the leading long-term financier in Brazil, a critical player in the overall infrastructure finance and almost the sole source of domestic funding of sustainable infrastructure. Given the funding limitations of the institution, it is unlikely that Brazil can address the investment gaps that needed to be filled so that the country may resume an inclusive development path – let alone the ambition to do it through a low-carbon trajectory. This leads us to the discussion of crowding-in of private capital, and the role BNDES can have in promoting that.

4. LEVERAGING AND CROWDING-IN PRIVATE CAPITAL: AN ANALYTICAL FRAMEWORK

In most market economies, both wealth and financial institutions are privately owned, investment financing can only occur if there is an alignment of the interest of wealth holders and private financial institutions with those that want to invest. This alignment is often difficult to achieve because portfolio allocations of the former are based on what is perceived to be a good balance between return and risk. This alignment is even more difficult when it comes to infrastructure investments, particularly those that are likely to introduced innovations – such as in the case of a number of green investments. For in addition long-term and/or transformational investments are often perceived as very risk undertakings.

Unleashing private capital to help fill the infrastructure gap in a way that is consistent with a low-carbon growth path will require an architecture necessary to reduce the perception of risk (or **de-risking**) while maintaining long-term returns that are acceptable for wealth holders and financial institutions. National developments banks can be part of such an architecture if used as platforms to de-risk green investments or assets backed by green projects. This section aims at understanding this process conceptually.

4.1. RISK AND DE-RISKING OF INFRASTRUCTURE INVESTMENT PROJECT

Risk, which is the basic pillar of modern finance theory, is based on the projection of probability distribution functions obtained from the frequency of past events. In an overwhelming part of economic theory risk and projected return go hand-in-hand in the process of creating the resources needed to transfer resources from surplus economic agents (“savers”) to deficit ones (“investors”).

To a certain extent it makes sense to use this simplification to describe how financial intermediaries and markets work. After all, a reasonable track record of potential clients is essential to evaluate risks in providing credit and negotiating equity positions. But one needs to be cautious of the limitations of such conceptual framework: information tends to be unavailable in too many significant financial and productive investment decision – either because (i) they are too costly to

obtain or (ii) because they simply do not exist. The former applies more easily to problems and consequences of asymmetric information. The latter is the case of uncertainty, which paradoxically is the most common information problem in development context and the seemingly least explored by mainstream literature.

Indeed, uncertainty is not an uncommon problem, neither should it be associated with any stage of development or with transformative undertakings. Take the case of a startup in any market economy. Early stages of firm development are often more associated relatively with high levels of investment and higher events of “uncharted waters”. They are also associated with lack of track records of the owners, and sometimes with businesses represented by the startup. Because of the uncertainty surround such investments, it is not a coincidence then that even in highly developed economies, access of finance to startups and MSMEs often comes from special institutions - such as business angels and venture capitalist. These use completely different parameters to access potential performance of companies.³⁷

In addition to the early stages of the life cycle of a company (i.e. startup) or a project (development and construction of an infrastructure investment), there are at least three cases where uncertainty prevails. First, when there is a significant timespan between the decision to undertake a project and their final operationalization (long term investments). Second, when new products are introduced fundamentally and have not been tested in existing in current markets (innovation). And finally when the project produces substantial sectorial or macro environments (transformational projects).

Uncertainty in the way used here should not be confused with another common information-related problem associated to credit rationing to MSMEs, particularly in informal/unregulated markets: poor quality of information caused by inappropriate accounting or governance systems. These shortcomings make the information provided of very little use of private financial intermediaries or create an imperative search cost for private intermediaries.

Distinguishing these two types of uncertainties are crucial for policy reasons (as we shall see below). Certainly in the cases of asymmetric information, uncertainty and poor quality of information, NDBs may have an important role as intermediaries even in high developed financing markets - as indicated in the table below. As a matter of fact, this role is often highlighted by reports on the financing of MSME, infrastructure and innovation in developed economies.³⁸

37 Business angels and venture capitalists often develop investment strategies based on non-risk individual assessment. The variance (and thus the risk) is so significant, that investments are made in startups with significantly different sectors and activities.

38 For an interesting analysis of special public mechanisms to finance MSME and innovation, see respectively OECD (2013a), and Mazzucato (2013).

Table 4-1: Information problems, financial market development and financing consequences

	Complete information	Asymmetrical information	Uncertainty	Poor quality information
Highly developed financial systems	Markets provide full access to finance	Credit and equity rationing	Access to finance to high risk and/or long-term projects often limited to specialized private arrangements (e.g. angel investors and venture capital)	Rationing is determined by transaction cost in supplying/obtaining information
Partially developed financial systems	Credit rationing affecting mostly smaller and new clientele	Credit and equity rationing, often more acute for smaller and new clientele	Access to finance to "strategic" sectors and activities often provided by specialized public agencies	Overall poor access to finance
Poorly developed financial systems	Very selective access to finance	Credit rationing pervasive, particularly acute for smaller projects	Access to finance nonexistent	Credit rationing pervasive

Source: Studart (2005).

Luckily a significant part of the information problems described in the table above are not states of nature. More likely they can be "resolved" with persistence and by using resources to produce, obtain and even create information.³⁹

But for long-term investments in sustainable infrastructure this conceptual framework raises some difficult policy issues. For these investments are often embed innovative technology and are transformative of social and productive structures. In such case, the past and present can only be a very poor guide to the future, which makes conventional risk analysis ill-suited to provide a guidance for allocation of capital and/or supply of loanable funds.

Unleashing private capital for sustainable infrastructure financing can be facilitated in national development banks can be part of a new architecture design to de-risk green projects, to create new instruments and foster new markets to intermediate funds from institutional investors. This is our next topic.

³⁹ Being scarce almost by definition, public resources can only be a small part of the financing required even for this seemingly small list of actors and activities. That is why, even in most developed economies NDBs have to be selective and often leverage private resources to complement their own (public) funds. In addition, because some information-related constraints to access private funds can be mitigated if enough time and resources are used, NDBs can develop mechanisms to leverage and even crowding-in private resources. This should be an essential part of their financial strategies, but the potential of doing so will depend on the level of development of domestic financial markets. More on this later.

4.2. MARKET IMPROVING AND MARKET-ENHANCING STRATEGIES

How to develop a new financing architecture to finance infrastructure in general, and a sustainable one in particular, seems to be one of the greatest challenges of developing and emerging economies. Good business environment and sustained macroeconomic stability (low inflation and low growth volatility) are indeed important necessary conditions, but they are not sufficient ones: most of the successful cases have involved appropriate regulation and “strong doses” of public policies.

Fostering financial development should not be an attempt to mimic one or other existing financial structures, but to understand what capabilities and other requirements are needed to promote access to finance. These policies are basically of two types:

Business environment improving policies - that create a safe and stable environment for the development of different types of instruments, financial institutions and markets. These policies range from the development of appropriate regulations and oversight mechanisms to sound macroeconomic management.

*Market-enhancing policies*⁴⁰ - that stimulate the emergence of new instruments, institutions and markets specialized in specific types of risks. Since institutional investors are vital for the consolidation of such markets, these policies also have to offer incentives (regulatory and otherwise) that increase the attractiveness of the securities concerned. They also include promoting the negotiation of new types of assets and instruments.

There is a lot written, and there is a lot of advocacy for the need for market improving policies, but market-enhancing policies – which try to overcome different types of “market-failures” - need to be better understood. Government intervention in order to address these failures is of three types: they can absorb risks altogether; they can share risk or they can implement policies to enhance markets.

In practice, many governments adopt market-enhancing policies using public financial institutions (PFI) as institutional platforms, or policy instruments.⁴¹ This is because PFIs often

40 For a discussing of market-enhancing policies in a much wider context than used here see Stiglitz (1994), Aoki, Murdock and Okuno-Fujiwara (1997) and Stiglitz and Uy (1996). Market enhancing policies are in a nutshell meant to create new information and make it possible for agents to organize themselves and plan for the future on the basis of optimizing behavior. More on this below.

41 This has been, for instance, the case of the largest financial assets markets in the planet: that of mortgage-backed securities in the United States. This is not the place for a full description, but it is worth to remember some important features of its development. First of all, the development of the MBS market was strongly enhanced after the establishing three important institutions: Fannie Mae in 1938, Ginnie Mae in 1968, and Freddie Mac in 1970. Even though only Ginnie Mae was partly a public institution, all of them were directly or indirectly created by government initiatives. Second, it was Ginnie Mae that in 1970s issued its first mortgage-backed security, a market which

provide distinct financial instruments that can be articulated to promote the development of new private instruments and markets:⁴²

- Direct lending to ultimate borrowers, guarantees schema or equity finance;
- Intermediated lending – providing credit to private lenders (e.g., commercial banks), earmarked for further intermediation to the designated sectors or firms.
- Public securitization - purchasing existing loan portfolios of private lenders.
- Guaranteed market securitization - guaranteeing private lenders' loan-backed or mortgage-backed securities (LBS, MBS).
- Partial credit guarantees on private loans to, and securities issuance by, ultimate borrowers.
- Market liquidity provision - public portfolio investments aimed at increasing the financial market's depth.

One can even imagine a sequencing of the use of such instruments to promote the de-risking of some investment activities and subsequent development of private instruments and markets to attract private capital to them. Initial interventions could constitute of risk-absorbing instruments - direct lending, guarantees or equity finance, for instance. They can then evolve towards risk-sharing ones such as intermediated lending and public securitization.

Once the private agents become used to operating with borrowers in a specific niche, securities markets for such borrower can emerge. This allows PFIs to move ahead towards the development of private instruments – such as guaranteed market securitization, partial guarantees on private loans to, and securities issuance by, ultimate borrowers.

These lines of policy should be complementary in leveraging and crowding in resources to finance sustainable infrastructure, and national development banks are particularly well suited PFIs for implementing them – for at least two reasons. First, they often navigate through often-uncharted waters, and therefore can have an important role in testing new instruments and exposing new types of risks avoided by existing intermediaries and markets.⁴³ Indeed, they often innovate

has flourished since them, especially in the 1990s, constituting today the biggest securities market in the world. Third, the scheme is highly dependent on securitization and a rating system, which permits specialized institutions to sell mortgage-backed securities to final demanders, and to institutional investors, such as pension funds. In sum, the development of the multi-trillion US-mortgage market was strongly determined by a series of government initiatives (throughout the last six decades), with little use of public funds. These initiatives have been extremely functional in bringing together long-term savers and investors through the years. There is no reason why such initiatives could not be reproduced in less developing countries with a minimum development of institutional investors, and not only for domestic mortgage-backed assets but also for other types of asset-backed assets.

42 Equity finance was not included as financial instruments in this list, but it is clear one often provided by NDBs around the world. See Ratnovski and Narain (2007).

43 An example of this was the development of the mortgage asset markets that now form the basis of the United

by creating credit lines and/or other structures to finance to agents and activities that are often deprived from other sources of finance.

Second because they can develop mechanism to facilitate the acceptance of new securities by institutional investors – such as guarantees for “green bonds”. Once standardized, with known quality and returns, these can be traded in private-sector securities and credit markets. In other words, once these markets have been created and returns on the instruments generated have been assured, the attractiveness of their securities for the private-sector capital market opens up debt rescheduling or conversion opportunities that do not require recourse to public funds.

Once those credit and securities markets begin evolving, NDBs only need to support their further evolution by maintaining liquidity provision schema. The creation and “investment” on latter two types of instruments should constitute market-enhancing policies, aiming at promoting the development of both credit and securities markets. If market-enhancing policies are part of a NDB’ strategies, they may have the capacity to mitigate permanently financing gaps by creating new information and even new market niches that can be absorbed by the private sector. And this makes such policy an extremely powerful instrument to foster the engagement of the private sector and the development of new markets.

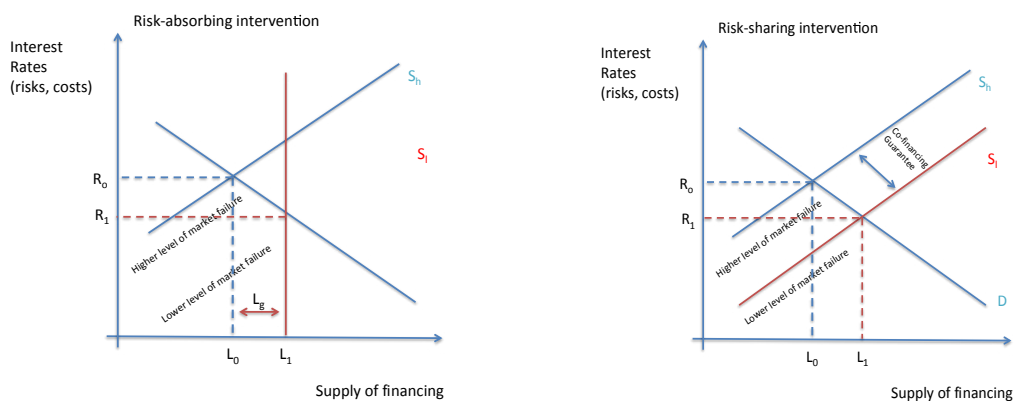
4.3. A ANALYTICAL VISUALIZATION: RISK-SHARING AND DE-RISKING

The concept of risk is the basic pillar of modern finance theory. Based on the projection of probability distribution functions obtained from the frequency of past events, it serves as an educate estimate of future performance. That is why information theory of financial intermediation predict that even perfectly good potential borrowers, with low default risk, can face financing constraints if, because of information asymmetries, banks set their lending rates above equilibrium rates and thus ration supply.

This situation is depicted in the graphic below. Theoretically there are two ways that government intervention can mitigate this market failure: by absorbing it or by sharing. In the first case, a government entity (a NDB for instance) makes the loan in lieu of a private institution. In the second case it offers a guarantee to the private lender. These two cases can be respectively visualized by graphs below:

States property financing system. As Feeney (1995) puts it: “The US securitized market has been greatly influenced by a number of government and quasi government institutions, which have made possible the creation of a liquid secondary market in mortgages... The modern home mortgage in the United States and the securitized mortgage market itself are initially the result of the 1934 National Housing Act. This Act created the Federal Housing Administration (FHA) as a mechanism for attracting private capital into the housing market.” This is one example among many of institution-building and market-enhancing policies that allowed for the development of modern financial structures in developed economies.

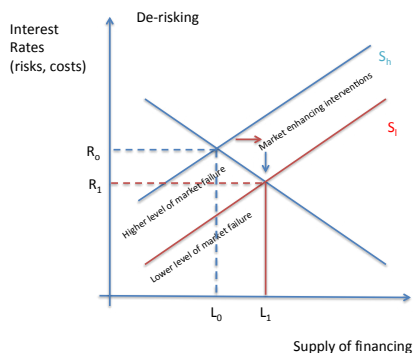
Figure 4-1: Risk absorbing and risk-sharing interventions



In the first case, a credit offered by a public financial institution (L_g) reduces the financing gap created by the market failure. In the second case, a guarantee is offered to the private lender and allows the latter to accept lending more. If these interventions are a one-off situation, they do not correct the market failure because they do not change the risk as perceived by the market, nor do they create a flow of information that allows reducing the problem of informational asymmetry.

A third type of policy requires acting simultaneously on the source of informational asymmetry, de-risking of investment projects and the creation of a new asset class. This can be visualized in graph below:

Figure 4-2: De-risking interventions



For instance, if a public credit guarantee can be made conditional on the improvement of accounting practices by the participating borrowers. This will lead simultaneously in the creation of a track record of some investors and types of investments. In this case, an incentive is created for private lenders to finance these investments, while it opens an opportunity for the NDB to securitize their loans of these specific investors and sectors.

This can be the base of an active crowding-in policy by national development banks for

infrastructure investments. It is interesting now to use this conceptual framework to evaluate the recent efforts by BNDES in that direction. This leads us to our next topic.

5. BNDES: LEVERAGING AND CROWDING-IN OF FINANCING FOR SUSTAINABLE INFRASTRUCTURE

Supply of private long-term financing in the country has been limited for at least five decades⁴⁴, a situation that has worsened with the more recent higher macroeconomic uncertainties (more on this below). The burden of expanding the provision of long-term funding however fell on the shoulders of the Brazil's national development bank, and that put pressure on its own funding structure – as discussed earlier.

Indeed, BNDES is by far the largest provider of financing to infrastructure investment projects in Brazil. This includes fixed and variable-income products with favorable financing conditions (maturities and financial cost), aimed primarily, until 2014, at reducing tariffs charged for public services when becoming operational, in addition to guaranteeing the feasibility of higher risk and more complex projects.⁴⁵

BNDES, through its subsidiary BNDESPAR, also buys stakes in companies that can prospect new business in the sector. In addition, it assists the federal and state governments to structure concessions for the private sector and public-private partnerships (PPP). In 2014, volume of investment in energy and logistics remained high and BNDES target mainly projects in energy (hydro, wind, thermal, nuclear and biomass) and transmission, distribution and rationalization of energy.

Also a significant part of the loans went to projects of logistics, highways, railways, airports, navigation, and ports. Urban mobility projects have also grown in number and volumes, amounting to R\$ 92 billion in 2014.⁴⁶ Investments in high and medium-capacity transport systems financed by BNDES are part of a larger block of investment headed by the federal program PAC (growth acceleration program) dedicated to Mobility in the states.

44 A historical perspective on the lack of private long-term financing in Brazil can be found in Studart (1995). The analysis stops in the early 1990s, but since then this situation persisted until early 2000s and then only worsened after

45 BNDES pricing policy has been changing very rapidly since the beginning of 2015, due to the significant overall government policy focused on fiscal and structural adjustment. Whether this is a trend or just a momentary shift is still unclear. More on this in the conclusion of this paper.

46 According to BNDES (2014), the urban mobility segment will require even greater investments in the coming years due to a large deficit. BNDES estimates for Brazil's 15 largest metropolitan regions indicate a need for investments of approximately 4% of Gross Domestic Product (GDP). It is worth noting that projects for investment in mobility require eight to ten years planning and implementation.

5.1. RISK-SHARING INSTRUMENTS

BNDES has a history of innovative policies and instruments attempting to crowd-in private capital: risk sharing with the private sector through their tier-2 (indirect) lending operations;⁴⁷ project finance; and guarantee funds. Currently, these efforts have been intensified due to the fiscal adjustment agenda, for two reasons. First, at least in the short term, the government can no longer commit to the increased volume of public investment - as it had done in the last twelve years.⁴⁸ Second, by setting the reduction of gross debt as a policy goal, the government decided not to increase the funding for BNDES with Treasury resources.⁴⁹ BNDES has been responding to this new challenge by enhancing its infrastructure bond issuance program by including additional de-risking engineering, and pricing incentives. Here we will describe some of these experiences.

BNDES's indirect operations constitute over 45% of BNDES total lending, and are an example of risk sharing that is very common in many other NDBs. For that, it maintains a network of public and private banking agents to intermediate approximately half of its credit operations.⁵⁰ The partner banks conduct project analyses and take on a significant share of the credit risk behind loans. Their returns come directly from project financing, but also from increasing the customer base, with which they can intensify the business relationship - including management of cash flow, structuring of new operations, absorption of employees' salary accounts and sales of direct services.

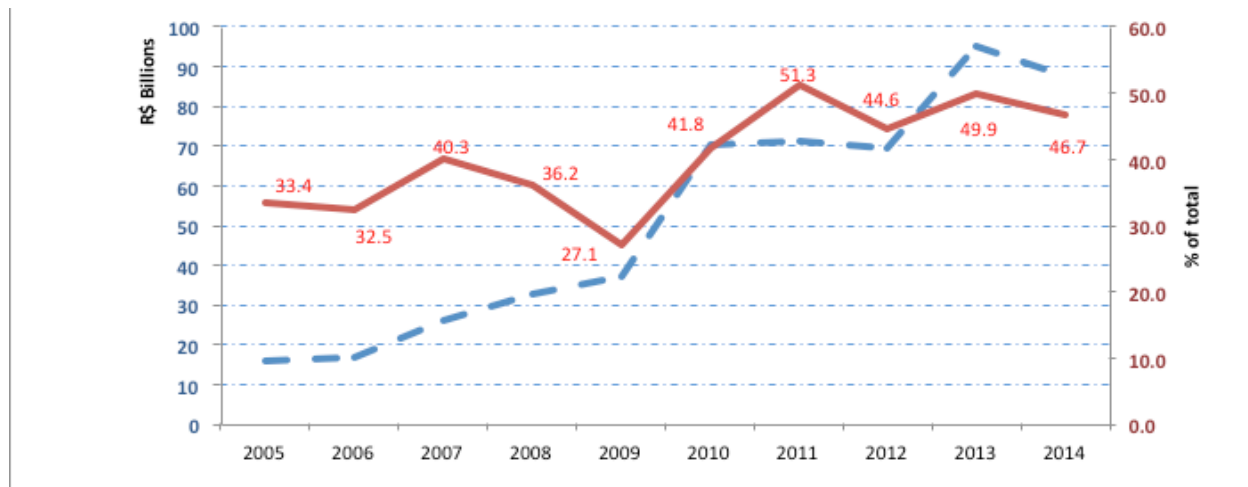
47 The interdependence between state and market, as proposed by Erber (2011), does not necessarily align with development interests. Referring to monetary policy before 2010, "... [There was] a large and powerful constellation of interests, structured over time around the combination of high interest rates and appreciating exchange rate, which established a convention that these elements are essential for the development of the country ... the Central Bank is a necessary member of this coalition..." (Erber, 2011, p.43)

48 According to the decree of contingency spending by the federal government, published in May 2015, spending investment by the Ministry of Transport (logistics infrastructure), and the Ministry of Cities (urban sanitation and mobility), fall in current value, 26% and 33%, respectively, compared to 2014.

49 As mentioned above, from 2009 to 2014, the amount of Treasury funds to BNDES amounted to about US\$ 430 billion. The way to reconcile the growth of investments in infrastructure, which is one of the guidelines to move the Brazilian economy towards a new growth cycle, is to promote private participation, not only as an investor in concession projects, but in long-term financing as well.

50 This partnership also gives capillarity to its financial products, once the network reaches commercial banks; if not all, at least the vast majority of the 5,570 Brazilian municipalities.

Figure 5-1: BNDES: evolution of indirect lending (R\$ billions and % of total)



Source: BNDES

Through indirect operations, as well as other processes and products, BNDES does more than just sharing risks: it has made deliberate efforts to attract private for long-term operations. Once private banks become more acquainted with certain sectors and investment types, they can better analyze the credit risk and finance directly the best clients. In some occasions these has led private banks to take the lead in consortia to finance long-term undertakings.

Yet another example is the evolution of a very “peculiar” type of **project finance** operations carried by BNDES out since 2003. Knowingly project finance is the long-term **financing** of infrastructure and industrial projects based upon the projected cash flows of the **project** rather than the balance sheets of its sponsors. But in the case of those sponsored by BNDES, corporate guarantees are required from the companies participating in a concession consortium.⁵¹

Despite the limitations of these “sponsored” project finance, by introducing this innovation BNDES has induced private players to increase their participation in infrastructure financing. Indeed, other private financial institutions are increasingly widening their participation - with equity, through the provision of advisory service, through the offer of collaterals, guarantees and insurance; and by leading loan consortia for the project.

5.2. DE-RISKING THROUGH GUARANTEE FUNDS AND INFRASTRUCTURE BONDS

The increasing funding constraints on BNDES has led to the creation of a number of guarantee funds and new bond issuance in order to leverage private sector financing in sectors previously only funded by public institutions. Two have been created to support small and microenterprise

⁵¹ According to BNDES officials, this request is driven by regulation on the capital adequacy of BNDES. If guarantees were not requested, they state, BNDES’s capacity to finance infrastructure project would be significantly limited.

in securing credit with financial intermediaries: the Investment Guarantor Fund (IGF) and the Guarantee Fund of Free Investment Credit (FGI - free credit). Another fund (FIDC)⁵² that is still in “trial mode”, aims at facilitating the participation in small issuance of bonds with associated distribution.

Even though BNDES has made an extraordinary effort to innovate its leveraging instruments, the environment characterized by high interest rates and macroeconomic volatility meant that the results have been limited in relation to the needs. For instance, the launch of the New Program for Logistics Investment - with approximately R\$ 200 billion in investments in ports concessions, airports, railways and highways – would require a stretching of BNDES balance-sheet beyond its capital base. This has prompted several attempts to incentives for investors that could acquire long-term bonds.

In 2011, the federal government created several tax benefits for investments in market instruments to channel funds to finance infrastructure investment – and infrastructure bonds were an important part of the strategy. These incentives include zero tax rates on incomes generated by bonds acquired by domestic and foreign investors. These issuances must abide by the following restrictions: all offerings have to be public; bonds must be issued to raise funds for projects or for companies undertaking them; bonds must offer fixed rates, linked to price index or SELIC; weighted maturity of more than four years. In addition, repurchase and anticipated repayments by the issuer are forbidden for the first two years. The idea is to encourage the appropriate use of financial instruments for long-term financing.

In order to increase the safety of bond investors, BNDES included guarantees-sharing clauses in its financing contracts. This mechanism seeks to ensure bond holders that the guarantees of project-financing contracts with BNDES will also apply to bonds under the same level of seniority. Through this measure, they will count with real project guarantees, such as the pledge of company shares and the fiduciary transfer of receivables.

Lastly, in some projects, BNDES has relaxed traditional financial requirements in its credit operations in the case of bond-issuances. The first is to reduce coverage ratio of debt services from 1.3 to 1.2, increasing the maximum leverage of the projects. This provision improves the profitability and reduces the capital requirement of any one project. The second is to change the amortization schedule for the issuance of bond infrastructure, from a constant amortization system (CAS) to the so-called “Price-table” system. While in the CAS system the initial payments are higher, the later provides relief from the cash flow in the first periods during the time when there is greater uncertainty about the project’s ability to make a payment.

⁵² Credit Rights Investment Funds constitute of securities backed by receivables of micro and small enterprises.

Infrastructure bonds only began to be issued after August 2012. Since then until May 2015, despite the incentives, total issuances have reached R\$11 billion in 55 issuances. This may seem to be a significant amount; however, it is small if compared to total investment needs. Only in 2013, according to Brazilian Association of Infrastructure and Basic Industry (ABDIB), infrastructure investments, excluding the oil and gas sector, amounted to R\$ 125 billion. It is also estimated that the new investment plan in logistics infrastructure (PIL), which was announced in June 2015 and contemplates investments of roughly R\$ 200 billion, will require, in 2016, around R\$ 8 billion per year financing backed by the issuance of infrastructure bond.⁵³

5.3. *FOSTERING AN INFRASTRUCTURE-BACKED ASSETS MARKET*

One of the difficulties in issuing infrastructure bonds is the cost of issuance. These costs involve hiring banks, lawyers, rating agencies, auditors and costs related to documentation and offer record-keeping. For this reason, only issuances that exceed a certain critical value manage to reach the market.

In order to stimulate lower issuances of lower value, BNDES participated as a buyer in a number of public offerings, and took part in 11 operations amounting to a total of 33 issuances since 2012. It thus, constituted a portfolio with assets valued approximately at R\$ 1.0 billion, mainly composed of infrastructure bond lower-value issuances, with a “duration” of approximately seven years. This portfolio has subsequently backed the launch of a receivables funds (FDIC - Fundo de Direitos Creditórios). Yields of this FDIC are exempt from taxation if purchased by individuals and foreign investors.

There are several innovative elements in this first fund that may contribute to the strengthening of the capital market, thus stimulating the acquisition of “indirect” infrastructure bond. First, the fund counts with the support of BNDES—an institution with a reputation in the analysis of long-term projects. This brings a greater sense of security regarding the assets that make up the portfolio that backs the FDIC. Secondly, because it is a diversified portfolio, the idiosyncratic risk is mitigated, which represents a safer channel for investors who want to diversify their investments and approach the roles that originate in infrastructure projects. Third, although small issuances have less liquidity because they are generally less frequently traded, hampering their continuous pricing, the FDIC quotas, due to their larger scale, should be traded more often, conferring them greater liquidity.

Yet the main innovation is the fact that BNDES launched the funds with two devices that are

⁵³ It is important to notice that, as indicated by Wajnberg (2014), such poor results are not due to intrinsic characteristics of the financial instrument. Instead that author claims that this poor performance has more to do with the learning curve needed for both potential issuers and potential bond-holders to start operating with such instruments, and the fact that the launching of instrument coincided with the years of greatest economic turmoil.

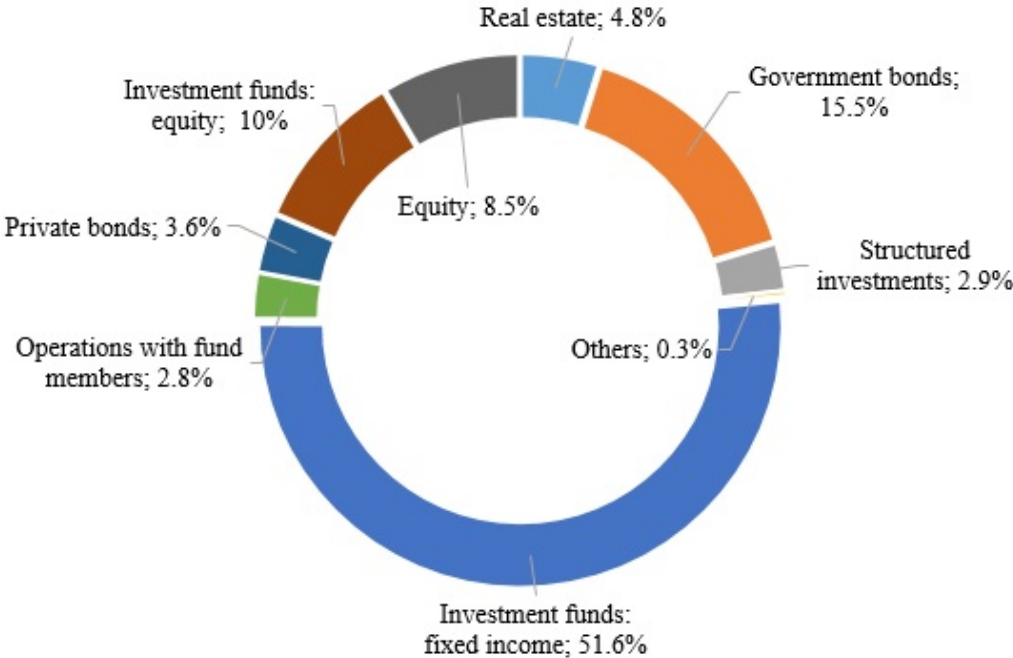
able to strengthen and increase its risk-adjusted return. The first one (Law 12.431) allows them to include in the portfolio up to 15% of other securities not backed by infrastructure projects. This allows BNDES, for example, to include corporate bonds with higher returns that normally do not come with income tax exemption - but that, once they belong to the fund will become exempt from taxation. Thus, this device increases the return on the portfolio, contributing to its attractiveness.

In addition, this fund will be structured with two classes of shares; one senior which has priority regarding interest and amortizations, and the other, subordinate, which can be purchased in full by BNDES. The function of subordinated shares is to reduce the credit risk of the senior quotas, thereby facilitating their placement in the market.

No matter what incentives are created to promote the issuance of infrastructure-backed assets, the development of an infrastructure bond market will definitely depend on the capacity and interest of institutional investors to acquire them. But in Brazil their size and portfolio allocations do make pension funds particularly important potential players in such a new market.

Indeed, the pension fund segment in Brazil is large and growing strongly (R\$630 billion as of June 2013). And there is still plenty of room for further growth of infrastructure bonds in their portfolio – indeed, little more than two percent of Brazilian pension funds’ assets are currently invested in infrastructure (Wagner et al, 2014). What is critical is to sufficiently incentivize funds and other long-term investors to participate in infrastructure projects, as attracting private investment to the sector could substantially reduce the dependency on Treasury’s funding.

Figure 5-2 – Total portfolio allocation of Brazilian Pension funds in 2015



Source: ABRAPP (2015).

However, there are some difficulties in placing infrastructure bonds with pension funds. The first one is the uncertainty about the funded project's ability to generate sufficient resources for the payment of interest, especially in the first years of operation.⁵⁴ Second, infrastructure projects also have a high degree of indivisibility—that is, most of the investment is done prior to cash generation. Thus, it is not possible to adapt it to the growing demand, and if the desired degree of use is not achieved during the planned period, cash flows will be insufficient for the payment of financial obligations. Third pension funds in Brazil are still too accustomed to low risk investment profiles with relatively high returns, and lack incentives and capabilities to diversify their portfolio towards long-term riskier assets.

In sum, increasing the supply of financing of sustainable infrastructure in Brazil will require the creation of a new architecture that can “connect the dots” together. And, we claim, BNDES may have an important role in doing so. This leads us to the conclusion of this paper.

6. CONCLUDING REMARKS

A long history of low investment levels has created a sizable overall infrastructure gap in Latin America and the Caribbean. Even though there is significant evidence that part of the problem of private infrastructure financing has to do with the supply of “bankable” projects and the business environment, lack of interested private investors limited significantly their availability of finance at reasonable costs. This leaves infrastructure investment vulnerable to changes in fiscal and/or external financial conditions. Last but not least, private and public resources to finance sustainable infrastructure investment seem to be even more scarce.

Indeed, only very few LAC nations, like Chile, succeeded in creating a strong private participation in financing any long-term undertakings, particularly infrastructure. A number of them have public banks and funds, that either channel or complement budgetary resources or funds coming from international financial institutions. And because of the fiscal constraints faced by most nations in the region, and the consequent decline of relative public participation in infrastructure investments, the greatest challenge to be faced by the region is how to simultaneously increase the efficiency of public investment, and how to leverage and crowd-in private resources in order to fill the existing infrastructure gaps.

Brazil would not appear to be an exceptional case – but it is a dramatic one. Despite the

⁵⁴ Two risks are especially relevant: the risk of an unforeseen increase of the construction period, which may postpone the date for entry into operation of an infrastructure project and therefore postpone the start of the cash flows; the demand risk, which usually occurs in the early stages of infrastructure equipment operations, except for those that have guaranteed demand.

recent socioeconomic achievements, this G-20 nation faces new daunting challenges related to its outdated, and to a certain degree dysfunctional infrastructure. In addition, the country needs to improve its existing infrastructure, it is of utmost important that it does whilst maintaining an environmentally sustainable path, increasing the efficiency in the use of its natural resources, and building resilience to the already visible consequences of climate change.

Filling these investment gaps will not be an easy task for Brazil, for many reasons. An important one has already been mentioned, and it is related to the capacity of government on different (federal, state and municipal) to expand its own infrastructure investment. Another important constraint has to do, of course, with low levels of private investment, which have been partly determined by the shortcomings of Brazil's domestic private financial landscape. Indeed, for the past two decades, Brazilian financial system has gone significant transformations that increased its sophistication and links with international financial markets. Still, one feature has not changed: private capital continues to be allocated in short to medium term assets, risk aversion prevails and securities markets are relatively small. This has left the financing of long-term and/or riskier undertakings mainly to a public financial institution. If Brazil is to overcome its significant infrastructure gaps, not only public investments have to be substantially increased, but also private capital has also to leverage existing scarce public resources, and to be “crowded-in” towards long-term, riskier and transformational infrastructure projects.

The challenge is even more daunting if we add increasing investment in sustainable infrastructure. Addressing this challenge can only be done through the development of new financial architecture – with specific incentives, appropriate regulatory framework, new players, innovative instruments and markets - that can bridge the gaps between ultimate borrowers and large institutional investors.

The creation of such architecture does need the right macroeconomic and microeconomic environments, incentives (embedded in carbon pricing systems) and policies. In addition, it will require “institutional leadership” in speeding up a process that in many economies took decades to be built. In this paper, we claim that in Brazil, as elsewhere, the national development bank (BNDES) can play this leadership role, for at least three reasons. First, because it already has ample experience in monitoring risks and financing infrastructure projects, being additional the larger financier of sustainable projects. It adopts high standards when it comes to monitoring environmental risks and classifying its projects according to internationally accepted methodologies (including that of IDFC). Second, it is already a leading financier of green infrastructure projects, and therefore has developed capabilities to assess and manage risks related to such projects. Thirdly, it has significant experience in partnering with donors to create climate-related funds. It seems then that with some additional engineering it could tap resources from the rapidly growing global green bonds markets.

Notwithstanding, and interestingly, BNDES seemingly has not at all benefited from its leadership in green financing to foster the development of green bonds markets in Brazil. This seems even more puzzling considering that by helping that market it could theoretically use its own pipeline of green projects to back securities such as “green bonds”. Much more could and should be done. But however big the challenge is, creating a sustainable infrastructure financing architecture may contribute to seizing an incredible opportunity of simultaneously improving the existing dysfunctional infrastructure and paving the way towards a more dynamic, inclusive and environmentally sustainable path.

7. BIBLIOGRAPHICAL REFERENCES

AOKI, M.; MURDOCK, K.; OKUNO-FUJIWARA, M. (1997). Beyond the East Asian miracle: Introducing the market enhancing view, in AOKI, M.; OKUNO-FUJIWARA, M.; KIM, H. (eds.), *The Role of Government in East Asian Economic Development: Comparative Institutional Analysis*, Oxford, Oxford University Press.

BNDES (2014). *Perspectivas do Investimento 2015-2018 e Panoramas Setoriais*. Available at https://web.bndes.gov.br/bib/jspui/bitstream/1408/2842/7/Perspectivas%20do%20investimento%202015-2018%20e%20panoramas%20setoriais_atualizado_BD.pdf

BRAZILIAN ASSOCIATION OF INFRASTRUCTURE AND BASIC INDUSTRY (ABDIB). Available at <http://www.abdib.org.br/index/index.cfm>

BRAZILIAN ENERGY BALANCE (2015). *Empresa de Pesquisa Energética – Rio de Janeiro: EPE*.

BRAZILIAN NATIONAL ASSOCIATION OF PENSION FUNDS (ABRAPP) (2015). *Consolidated Information*. December/2015. São Paulo.

CALDERÓN, C.; SERVÉN, L. (2010). *Infrastructure in Latin America*. World Bank Policy Research Working Paper No. 5317. Washington: World Bank.

CREDIT SUISSE (2013). *The Brazilian Infrastructure: It's "Now or Never"*. July, 2013.

ECONOMIC COMMISSION FOR LATIN AMERICA AND THE CARIBBEAN (ECLAC). (2011). *The economic infrastructure gap in Latin America and the Caribbean*. In *Facilitation of transport and trade in Latin America and the Caribbean*, 1 (293). Santiago, Chile.

ECONOMIST INTELLIGENCE UNIT (EIU- INFRASCOPE). (2014). *Evaluating the environment for public-private partnerships in Latin America and the Caribbean: The 2014 Infrascopes*. EIU, New York, NY.

ENTERPRISE SURVEYS (2010). *Indicator descriptions*. World Bank Group.

ERBER, F. (2011). *As convenções de desenvolvimento no governo Lula: um ensaio de economia política*. In *Revista de Economia Política*, v. 31, n. 1, janeiro-março de 2011.

FRISCHTAK, C. (2013). *Infraestrutura e desenvolvimento no Brasil*, in *Desenvolvimento Econômico: Uma Perspectiva Brasileira*, VELOSO, F. (Eds), Elsevier, Rio de Janeiro, pp. 322–347.

FEENEY, P. (1995). *Securitization: Redefining the Bank*. New York, St. Martin's Press.

- GARCIA-ESCRIBANO, M.; GOES, C.; KARPOWICZ, I. (2015). Filling the Gap: Infrastructure Investment in Brazil, IMF Working paper WP/15/180. Available at <https://goo.gl/UbAIeM>.
- GIAMBIAGI, F.; PINHEIRO, A. (2012). Além da euforia: riscos e lacunas do modelo brasileiro de desenvolvimento. Rio de Janeiro: Elsevier, 2012.
- INTERNATIONAL MONETARY FUND (2010). Macro financial Linkages. Available at <https://goo.gl/6sMvio>.
- INTER-AMERICAN DEVELOPMENT BANK (IDB). (2013). Rethinking Reforms: How Latin America and the Caribbean Can Escape Suppressed World Growth. Latin American and the Caribbean Macroeconomic Report, Washington, DC.
- . (2014). Megacities and Infrastructure in Latin America: What Its People Think. Infrastructure and Environment Department, Washington, DC.
- . (2015). Financing infrastructure in Latin America and the Caribbean: how, how much and by whom? Available at <https://goo.gl/uNADKp>.
- LAZZARINI, S.; MUSACCHIO, A.; BANDEIRA-DE-MELLO, R.; MARCON, R. (2011). What Do Development Banks Do? Evidence from BNDES, 2002-2009. Brasil: Social Science Research Network (SSRN).
- . (2015). What Do State-Owned Development Banks Do? Evidence from BNDES, 2002–09. World Development.
- LORENZEN, C.; BARRIENTOS, M.; BABBAR, S. (2001) Toll road concessions: the Chilean experience. PFG discussion paper series, no. 124. Washington, DC: World Bank.
- De LUNA-MARTÍNEZ, J.; VICENTE, C. (2012). Global Survey of Development Banks. Policy Research Working Paper 5969. Washington, DC: World Bank.
- Available at <http://goo.gl/h9SzLN>.
- MINISTRY OF FINANCE OF BRAZIL. (2015). Informativo Mensal de Infraestrutura. Secretaria de Acompanhamento Economico, June. Available at <http://seae.fazenda.gov.br/>.
- MAZZUCATO, M. (2013). The Entrepreneurial State: Debunking Public vs. Private Sector Myths. Anthem Press: London, UK .
- De OLLOQUI, F.; CHRISNEY, M. ET AL (2013). Public development banks: toward a new paradigm? Inter-American Development Bank.

ORGANIZATION FOR ECONOMIC COOPERATION AND DEVELOPMENT (OECD). (2012). Financing SMEs in Latin America. In Latin American Economic Outlook 2013: SME Policies for Structural Change. Paris.

———. (2013a). Financing business R&D and innovation. Available at <http://goo.gl/ECr1E4>

———. (2013b). Trends in the financing of SMEs in Latin America, available at <http://goo.gl/mNvL4u>.

———. (2014). An overview of development bank and guarantee agency services for infrastructure finance. Available at <http://goo.gl/nmYqob>

RATNOVSKI, L.; NARAIN, A. (2013). Public Financial Institutions in Developed Countries—Organization and Oversight. IMF Working Paper WP/07/227.

REZENDE, F. (2015). Why Does Brazil's Banking Sector Need Public Banks? What Should BNDES Do? Working Paper No. 825, Levy Economics Institute of Bard College. Available at SSRN: <http://ssrn.com/abstract=2544722>

STALLINGS, B.; STUART, R. (2005). Finance for Development Latin America in Comparative Perspective. Brookings Institution Press and the Economic Commission for Latin America and the Caribbean (ECLAC), with Barbara Stallings, 2005.

STIGLITZ, J. (1994). The role of the State in financial markets, Proceedings of the World Bank Annual Conference on Development Economics 1993, Washington, DC: World Bank, pp. 19–52.

STIGLITZ, J.; UY, M. (1996). Financial markets, public policy, and the East Asian miracle. The World Bank Research Observer, vol. 11, No. 2, Washington, D.C., World Bank.

STUART, R. (1995a). The efficiency of the financial system, liberalisation and economic development, in Journal of Post Keynesian Economics, Winter 1995-95, 18(2): 265-289.

———. (1995b). Investment Finance in Economic Development. Routledge, London.

———. (2000). Pension funds and the financing productive investment: an analysis based on Brazil's recent experience. Financiamiento del desarrollo series, No. 102, Chile, Economic Commission for Latin America and the Caribbean (ECLAC). United Nations publication.

———. (2005). The State, the markets and development financing. Cepal Review, n° 85, April 2005. Santiago, Chile. Economic Commission for Latin America and the Caribbean (ECLAC). United Nations publication.

———.; RODRIGUES-CLARE, E.; STEIN, E.; AURBACH, P.; MANDALAOUI, C. (2004). Access to Financing for Small and Medium Enterprises”. In *Unlocking Credit: the quest for deep and stable bank lending*. IADB Report Economic and Social Progress in Latin America, Inter-American Development Bank.

TEIXEIRA, N. (2015). Um papel mais crucial para o BNDES. *Valor Econômico*, p. A11-Opinião, São Paulo, 27/05/2015, available at <http://goo.gl/PpEkKI>.

TUESTA, D. (2015). Infrastructure investment in Latin America Pension funds, capital markets and financial regimes. BBVA Reseach. Presented at Pre Conference Workshop for Capital Markets Regulators. South Africa - November 25, 2015.

UNITED NATIONS. (1999). *World Economic and Social Survey*. New York. United Nations publication.

UNITED NATIONS CONFERENCE ON TRADE AND DEVELOPMENT- (UNCTAD). (2005). *Rethinking the Role of National Development Banks*. Financing for Development Office of UN-DESA, New York.

UNITED STATES TRADE AND DEVELOPMENT AGENCY- (USTDA) (2014). *Major infrastructure projects in Mexico*.The Seneca Group LLC. Washington.

WAGNER, M.; BERTOL, G.; MURPHY, A. (2015). *Enhancing Private Infrastructure Investment In Brazil*. Oliver Wyman Report

WAGNER, M.; HOLLINGSWORTH, T.; OH, J. (2014). *The Brazilian Retail Investment Landscape, Transforming Savers into Investors*. Oliver Wyman Report.

WAJNBERG, D. (2014), Bonds incentivadas: eficácia do instrumento, in *Revista do BNDES*, 41. Available at <http://goo.gl/U8W2BR>.

WORLD BANK. (2010). *Financial Sector Databank*. Washington, DC: World Bank. Available at: <http://data.worldbank.org/topic/financial-sector>.

———. (2012). *Financial development in Latin America and the Caribbean*, available at <http://goo.gl/URmPkM>.

———. (2013a). *Shifting gears to Accelerate shared prosperity in Latin America and the Caribbean*. Available at <http://www.worldbank.org>.

———. (2013b). *World Bank Global Financial Development Report*. Washington, DC: World Bank.

———. Undated. World Development Indicators. Washington, DC: World Bank. Available at: <http://goo.gl/nMKAT9>.

WORLD ECONOMIC FORUM. (2014). Brazil - The Global Competitiveness Report 2014–2015. World Economic Forum.

———. (2015a). How can Latin America close its infrastructure gap? Available at <https://goo.gl/Rj7jeP>.

———. (2015b). The Green Investment Report. Available at <http://goo.gl/Ft3RgM>.

WORLD WILDLIFE FUND (WWF). Undated. Available at: http://wwf.panda.org/about_our_earth/aboutcc/problems/rising_temperatures/hotspot_map/brazil.cfm



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