

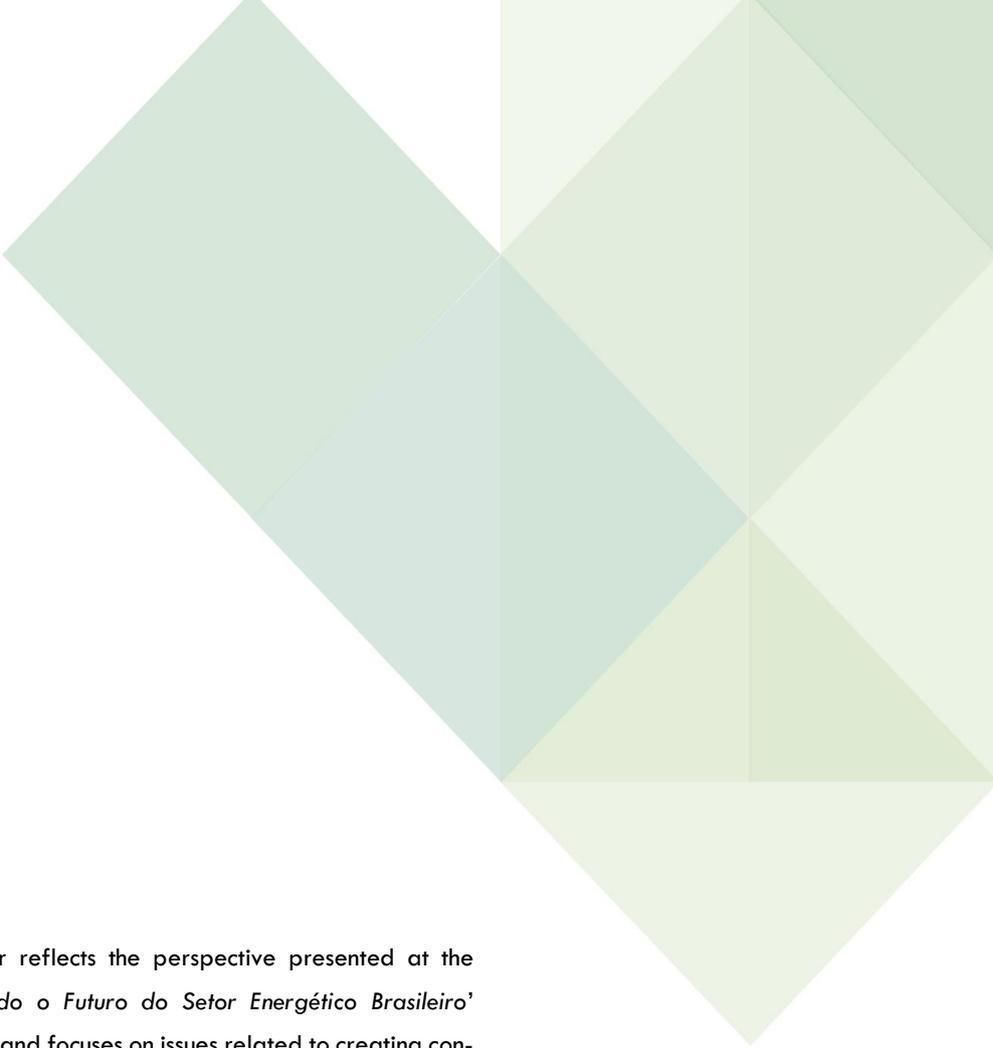
# LONG-TERM FINANCE AND RISK ALLOCATION

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This position paper reflects the perspective presented at the Workshop '*Pensando o Futuro do Setor Energético Brasileiro*' (September 2016) and focuses on issues related to creating conditions for long-term financing and its risks, including

- Discussion of the prerequisites to develop a robust financial market to support the long-term development of the infrastructure sector in Brazil in a post-BNDES era (limited lending role and the possibility of new guarantor role), using the power and gas sectors as pilot cases;
- Analysis of additional financial products and facilities to support long-term financing in the power and gas sectors, such as guarantees and insurance products, provided by BNDES, insurance companies, and multilateral institutions; and
- (Re)assessment of the risk management attitude and mindset in existing project finance practices, identifying current allocation patterns and future trends to attract new capital (for example, financial hedges, contract dollarization, and tracking accounts).

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## 1. Introduction

The main challenge in fostering investments for infrastructure projects nowadays is to engage the private sector. This is a common problem in several countries. The consulting firm McKinsey estimates that infrastructure projects in the world will require investments of US\$57 trillion from 2013 to 2030. Even though the bulk of resources will come from public funds, this number includes private funds—approximately 0.5 percent of global gross domestic product (GDP) in every year of the stated period.

According to the Organisation for Economic Co-operation and Development (OECD), only 1.6 percent of the US\$106 trillion available from institutional capital is currently being directed to infrastructure investments. In turn, the Global Infrastructure Hub (GIH) reports that 69 percent of the institutional investor funds would be willing to increase their allocation in the segment.

These numbers are evidence of the availability of resources that could help closing the infrastructure gap. Therefore, it is worth investigating how the competing opportunities can be successful in attracting such funds.

The challenge of attracting investments for infrastructure is particularly exacerbated in Brazil considering the lack of a developed capital market for long-term finance.

In this paper, we aim at contributing to the debate, by discussing the preconditions to develop a robust financial market to support the long-term development of the infrastructure sector in Brazil. We will use the energy sector, in particular power and gas, as the pilot case.

The topic can be addressed from the perspective of the (underdeveloped and almost missing) market for long-term financing. In such a context, it is important to understand the underlying forces that produce the transactions or products—the financial closing.

Our proposed approach to address the long-term financing challenge is to investigate supply and demand in the market for energy assets. The supply side consists of the sources of capital—funds willing and/or able to be channeled. Coherent with the challenge of turning infrastructure into an asset class, the demand for financing (funds) includes the physical opportunities for investments as well as financial opportunities.

Demand and supply must be understood in a context. The market environment is key to attract capital to infrastructure. Such environment encompasses not only sectoral regulation, but also capital market regulation and competition policy. Lastly, knowledge of the underlying market design is essential to understand the regulatory framework.

The Brazilian power sector legal and regulatory framework foundations were laid down by the reform enacted in 2004 (Law 10,848/2004) that established two contracting environments: (a) in the regulated environment, distribution companies (DISCOs) contract the electric energy required to supply their users' needs; and (b) in turn, in the free market, large consumers may

exercise their right to choose their own suppliers. DISCOs' contracting of bulk energy in the regulated environment take place through a series of auctions of electricity contracts. Potential suppliers compete for long-term contracts—power purchase agreements (PPAs), called *Contratos de Comercialização de Energia no Ambiente Regulado* (CCEARs).

After the 2004 reform, the bulk of the expansion in generation capacity comprised power plants contracted in the regulated environment financed through funds provided by the Brazilian National Bank for Economic and Social National Development (BNDES). The BNDES's dominant position in the financing of infrastructure defined and to a certain extent determined the contracting structures in the power sector. Some trends support this argument, such as (a) increasing the length of CCEARs,<sup>1</sup> (b) few examples of limited-recourse financing of power plants willing to negotiate contracts with free consumers, and (c) few examples of investments financed by the private/commercial banking system.

Even though the model launched in 2004 was successful in financing the construction of several power plants and grid expansion by the private sector, the current needs to address the higher budget deficit constrains the government's ability to transfer a significant amount of funds required to deliver infrastructure investments through the BNDES. This scenario shares some commonalities with the global challenges to expand infrastructure investments.

Considering the difficulties to support investments in infrastructure under the previous model (public funds channeled through the BNDES), this paper investigates alternatives for long-term financing in Brazil. The analysis is based on the experience of the Brazilian electricity industry and structures implemented in other countries around the world. The major challenge is to turn infrastructure investments into an asset class, a topic that is at the top of the agenda in Brazil as well as in other middle-income and developed economies.

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<sup>1</sup> For the sake of illustration, contracts for thermal power plants were auctioned for 15 years, 20 years, and 25 years in 2006, 2011, and 2013, respectively.

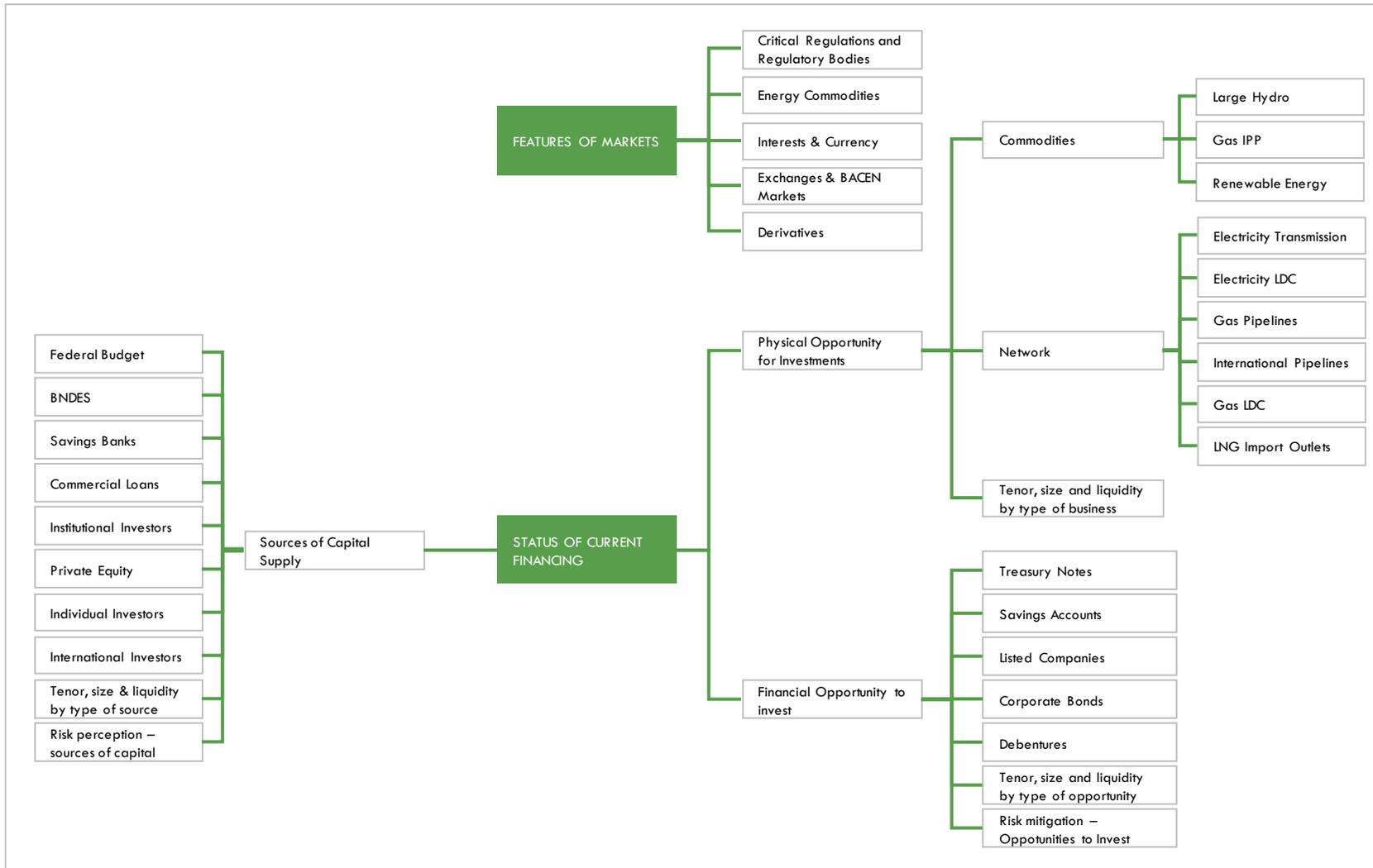
## 2. The Approach

The proposed approach to address the challenge of long-term financing is to investigate the supply and demand of funding sources and the needs in the market for energy assets, given that

- (a) The supply side consists of capital that can be channeled;
- (b) Consistent with the challenge of turning infrastructure into an asset class, the demand for financing includes both physical opportunities for investments as well as financial opportunities; and
- (c) The demand and supply of capital should be understood in a contextualized market. Hence, a proper environment must provide the conditions to attract capital to infrastructure. Such environment comprises not only sectoral regulation, but also capital market regulation, competition policy, and market design.

The following chapters describe this strategy, taking advantage of some good experiences around the world and based on evidence from the financial economics literature.

**FIGURE 1. LONG-TERM FINANCING FRAMEWORK IN BRAZIL**



**Source:** Fundação Getúlio Vargas Centro de Estudos em Regulação e Infraestrutura (FGV CERJ).

**Note:** BACEN = Brazilian Central Bank; IPP = Independent Power Producer; LDC = Local Distribution Company; LNG = Liquefied Natural Gas.

### 3. The Current Brazilian Environment

In Brazil, historical difficulties compound the lack of long-term financing. The analysis of these hurdles can be classified in two categories.

#### 1. MACROECONOMIC AND FISCAL CONSTRAINT CHALLENGES

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**1.1. Term structure of interest rates.** There is no market reference for long-run interest rates with a duration compatible with infrastructure projects. The Brazilian interest rate curve is characterized by a high level of short-term rates and upward sloping format—long-term rates do not have sufficient liquidity and short-term rates are very high, competing with other investments or assets, including infrastructure.

**1.2. High short-term interest rates for Brazilian government debt lead savers to channel resources to these securities.** Banks and pension funds, for example, invest massively in Brazilian Treasuries and have negligible participation in financing long-term assets or infrastructure. Because Brazil has not developed a secondary market for private or corporate bonds, savers have concentrated resources in government debt, which offers a profitable and much more liquid secondary market.

To address these issues, a large fiscal adjustment is necessary, that includes reforms able to decrease and stabilize the growth of government debt in Brazil and, therefore, reduce short-term interest rates. These reforms include a proper assessment of social security funding, current expenses, and privatization of selected state-owned firms. Additionally, it would allow Brazil to raise funds at lower rates and longer terms, channeling resources to assets related to infrastructure, similar to the experience in more developed countries.

#### 2. SECTORAL DIFFICULTIES STEMMING FROM THE RISK ALLOCATION AND/OR COMPETITIVE BIDDING PROCESS, REGULATORY FRAMEWORK, AND THE DURATION OF INFRASTRUCTURE PROJECTS AND CONCESSIONS IN BRAZIL

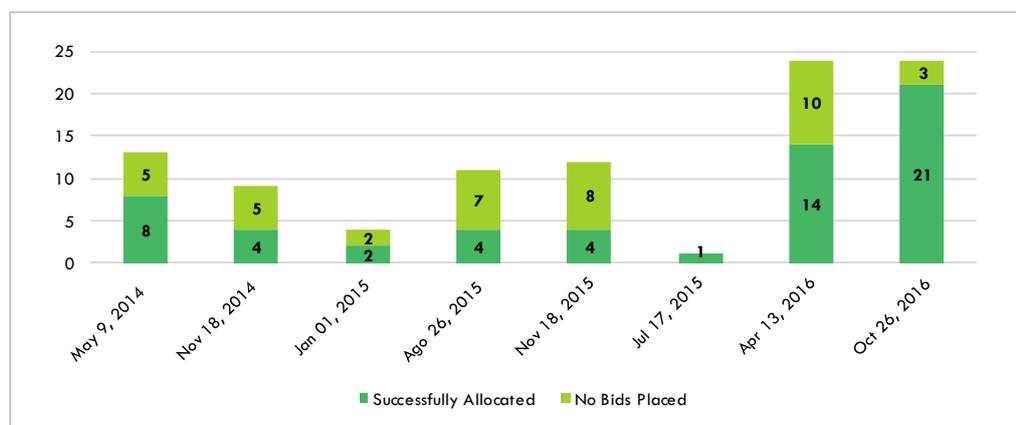
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**2.1. Both the risk allocation design and the attribution process in Brazil need to improve considerably to induce better risk sharing between public and private parties.** Policy makers and private firms could take advantage of risk management tools, including more advanced valuation methods, the use of real options approach, and simulation as well as more robust risk matrices. Recent auctions have not been able to prevent high-risk competitors from winning, often causing delays in projects, dropouts, and renegotiations. For example, the company that managed to contract the highest amount of electric power (to build thermal power plants) in the auction held in September 2008 defaulted on most of these contracts. Additionally, high-risk projects attract less interest and competition.

**2.2. In several competitive bidding processes, the government privileged lower prices and tariffs, compromising the investors' ability to earn returns consistent with the cost of capital of private funding.** For example, several transmission and generation auctions have not been successful in attracting investors willing and able to credibly commit to the

obligations inherent to the concession contracts (Figure 2). As a result, the winners were less-qualified competitors—riskier and in many cases unable to comply with the agreements.

**FIGURE 2. COMPETITION IN RECENT TRANSMISSION AUCTIONS (NUMBER OF ITEMS)**



Source: BM&FBovespa,<sup>2</sup> elaborated by FGV CERI.

**2.3. In general, Brazil's concession contracts extend for 20–30 years.** This extended duration is not compatible with the current term structure of interest rates. Considering the lack of market reference for a long-term risk-free rate, it is worth exploring the shortening of the duration of concessions, at least for projects of restricted social and environmental impact. In addition, there is no mandatory link between the duration of the concession and the duration of the financing.

Alternatives should be explored to tackle these issues, including the use of a duration rolling approach: after a short time (10 years, for example), the concession may be extended or terminated. It is possible to take the duration of the most liquid Brazilian Treasury bond in the domestic market (NTN-B of the National Treasury Notes [NTNs]) as reference or include mechanisms such as concessions with endogenous or flexible extension.<sup>3</sup>

### 3. MAJOR PLAYERS/ACTORS IN INFRASTRUCTURE FINANCING IN BRAZIL

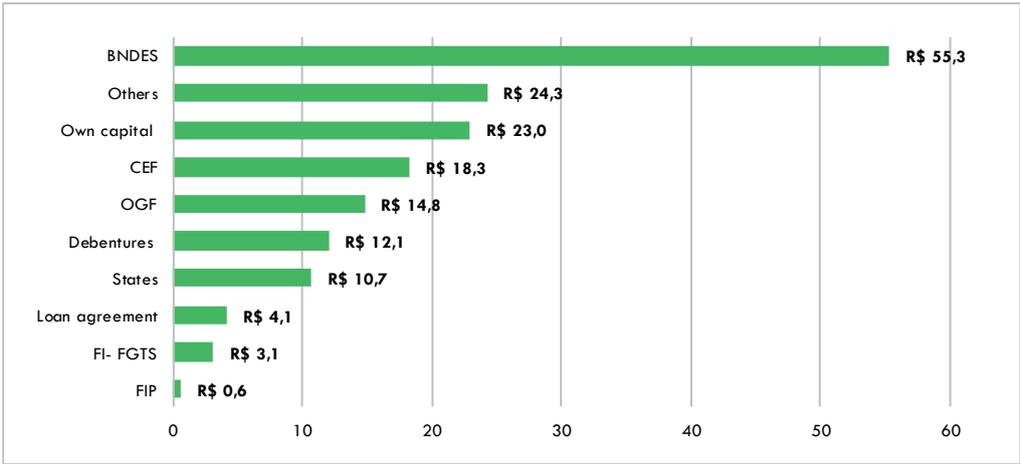
The BNDES has been the most important financier of infrastructure in the country in recent decades (Figure 3). It is the major source of long-term financing, and provides funding indexed to the Long-term Interest Rate (TJLP).<sup>4</sup> This rate is lower than regular rates from commercial banks. The prevalence of public financing of infrastructure in Brazil is not specific to the power sector. The same pattern is observed in sectors like water and transport (Figure 5).

<sup>2</sup> Data available at: [http://www.bmfbovespa.com.br/pt\\_br/servicos/leiloes/acompanhamento/](http://www.bmfbovespa.com.br/pt_br/servicos/leiloes/acompanhamento/)

<sup>3</sup> Recent experiences of this sort are the least present value revenue auction. Such mechanisms have been adopted with relative success in countries like Chile and the United Kingdom.

<sup>4</sup> The TJLP depends on historical inflation, expected inflation, and country risk premium. The methodology is updated every year by the BNDES. For details, see (in Portuguese): [http://www.bndes.gov.br/SiteBNDES/export/sites/default/bndes\\_pt/Galerias/Arquivos/produtos/download/tjlp.pdf](http://www.bndes.gov.br/SiteBNDES/export/sites/default/bndes_pt/Galerias/Arquivos/produtos/download/tjlp.pdf).

**FIGURE 3. SOURCES OF FUNDS FOR INVESTMENTS IN INFRASTRUCTURE (BRL, BILLIONS) – 2014**

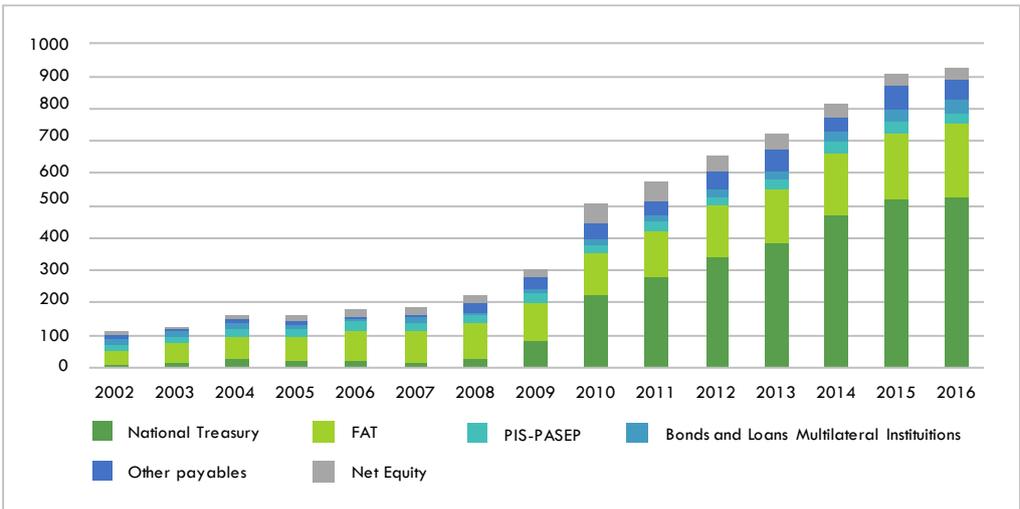


**Source:** Report of National Confederation of Industry (CNI) (2016)

**Note:** CEF = Caixa Econômica Federal; FI-FGTS = Guarantee Fund for Time of Service’s Investment Fund; FIP = Fundo de investimento em participações; OGF = Oil and Gas Facilities.

Currently, the BNDES records a liability in the balance sheet of R\$935 billion (approximately US\$3,000 billion, based on the exchange rate on August 31, 2017, 3.2397 per U.S. dollar). Within the BNDES’s capital structure, the governmental share of sources accounts for 88 percent of the bank’s obligations. Until 2009, the Workers’ Support Fund (FAT) had been the most relevant source of funding for the BNDES, with R\$119 billion (Figure 4). The FAT is linked to the Ministry of Labor and Employment (MTE) whose purpose is to fund the Unemployment Insurance Program and the Salary Bonus Program. Additionally, it plays a role of a development fund, because at least 40 percent of its resources are channeled to finance economic development programs operated by the BNDES. In the absence of a clause that sets a deadline for the principal repayment, the BNDES started to use the compensation funds to release new disbursements. After 2009, the funding situation changed dramatically regarding the bank’s growth, when the National Treasury assumed the role of the BNDES’s main creditor in 2009. The funding amounts held by the Treasury in June 2016 corresponded to R\$525 billion (56 percent of the bonds) with impacts on public debt.

**FIGURE 4. BNDES - REVENUE SOURCES (BRL, BILLIONS)**



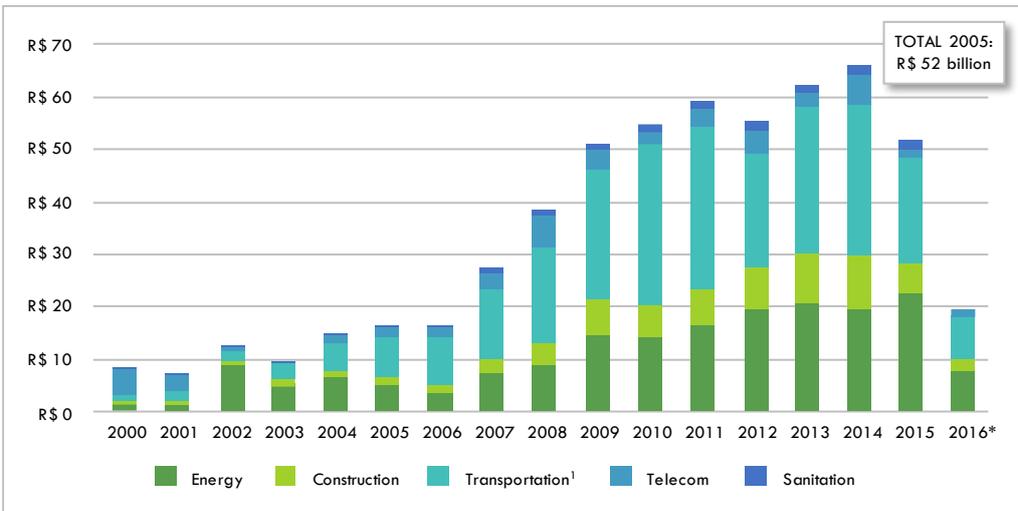
**Source:** BNDES, elaborated by FGV CERJ.

**Note:** Data are reported in June of each year; PIS-PASEP = Programa de Integração Social - Programa de Formação do Patrimônio do Servidor Público.

The bank’s disbursements in infrastructure increased significantly after 2003, going from US\$938 million<sup>5</sup> to US\$11.2 billion<sup>6</sup> in 2014<sup>7</sup> (Figure 5).

The BNDES has channeled resources to finance the bulk of the investments in the power system expansion under the new institutional model (2003–2004). However, the critical fiscal situation of the country requires searching for additional sources of funds or funding the energy sector could be jeopardized.

**FIGURE 5.** BNDES DISBURSEMENTS IN INFRASTRUCTURE (BRL, BILLIONS)



**Source:** BNDES, elaborated by FGV CERJ.

**Note:** \* Until November 2016; <sup>1</sup> Land, waterway, and air.

In addition to the BNDES, *Caixa Econômica Federal* (CEF), a federally owned savings bank, also has a very important role in supporting infrastructure investment in the country. In 2014, it allocated R\$18.3 billion to fund infrastructure projects. The CEF funds were predominantly channeled to transportation (R\$10.2 billion) and sanitation (R\$8.1 billion). Therefore, the BNDES and CEF

<sup>5</sup> It is equivalent to R\$2.71 billion, based on the exchange rate on December 31, 2003 (R\$2.8884 per U.S. dollar) as released by Ipeadata.

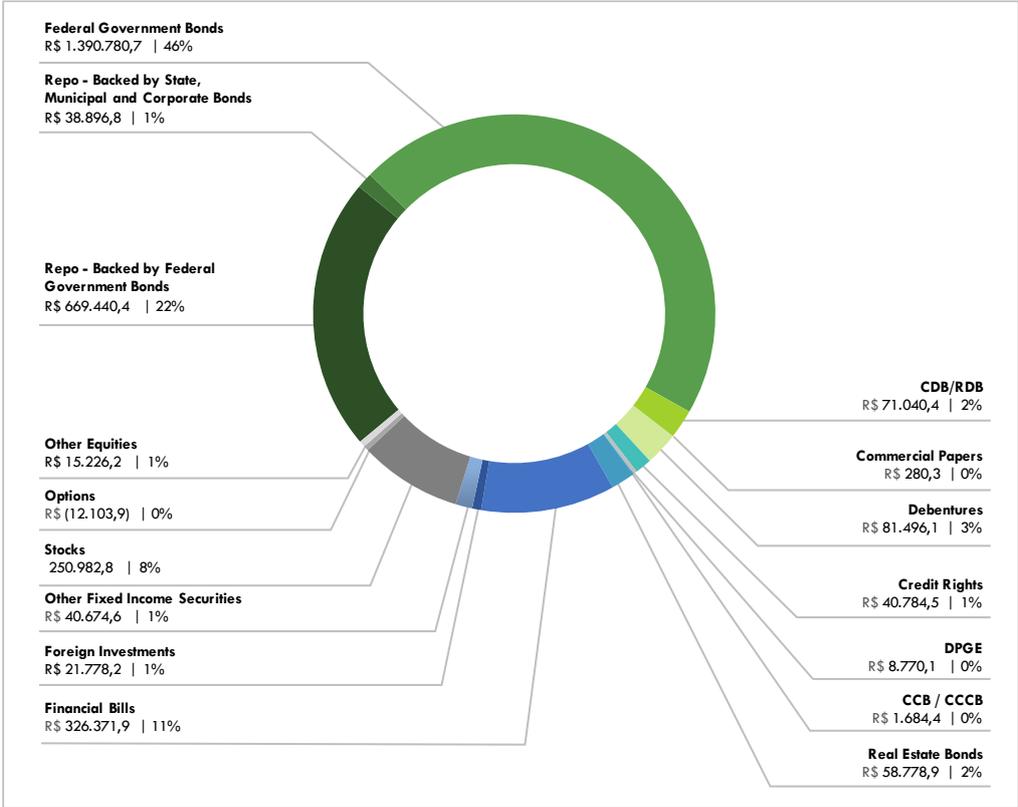
<sup>6</sup> It is equivalent to R\$29.9 billion, based on the exchange rate on December 31, 2014 (R\$2.6556 per U.S. dollar) as released by Ipeadata.

<sup>7</sup> To illustrate the dimension of these disbursements in U.S. dollars, the annual average exchange rates (R\$/US\$) announced by the Central Bank of Brazil were 1.7412 in 2009, 1.6662 in 2010, 1.8758 in 2007, 2.0435 in 2012, and 2.3426 in 2013. However, it is important to keep in mind that, because the disbursements are made in reais, the calculation of the respective values in U.S. dollars does not reflect the original trajectory of disbursements throughout the years. Several reasons, such as the recent economic downturn and corruption scandals involving major construction companies, led to a decrease in the BNDES’s financial transactions. As a result, in 2015, the conditions for long-term funds became more stringent for both existing and new concession contracts.

together account for 62 percent of the total investments in infrastructure (R\$115.5 billion) in Brazil in 2014. The contribution of commercial banks' allocation of resources to investments in infrastructure in Brazil is less significant. Such entities focus on short-term transactions, bridge loans, or those not covered by the BNDES and CEF.<sup>8</sup>

Investment funds are financial intermediaries for a wide range of investors, either individuals or legal entities. In Brazil, pension funds experienced growth in net asset value of approximately 214 percent in the last decade, reaching R\$3 trillion in June 2016. As shown in Figure 6, investment funds concentrate their capital in securities issued by the federal government (46 percent), which offer acceptable rates and increased liquidity. Despite the existence of more profitable investment products in the market, such as bonds/debentures or equities, the allocation of resources in assets is not sufficiently diversified.

**FIGURE 6. INVESTMENT FUNDS: NET ASSET VALUE (JUNE 2016)<sup>1</sup>**



**Source:** Associação Brasileira das Entidades dos Mercados Financeiro e de Capitais (ANBIMA), elaborated by FGV CERI.

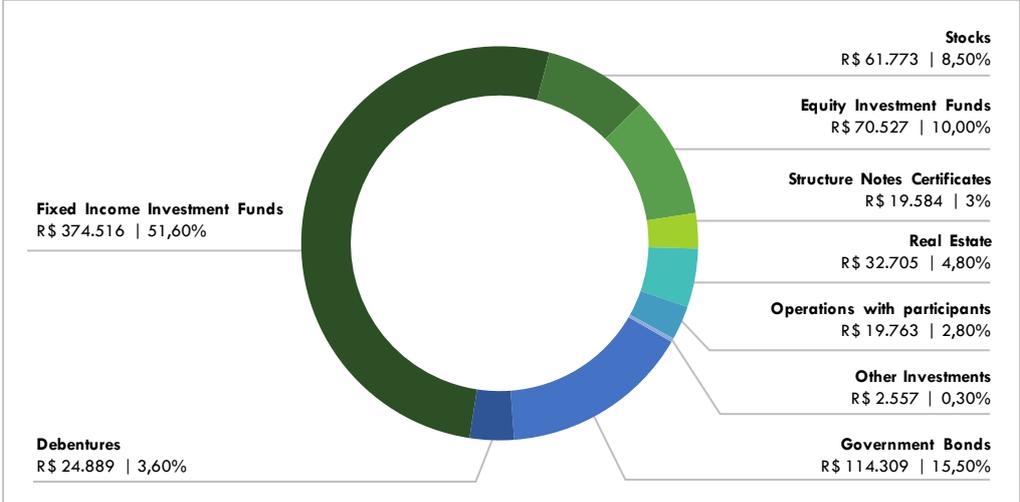
**Note:** <sup>1</sup> Value in BRL, millions; CCB = Cédula de Crédito Bancário; CCCB = Certificado de Cédula de Crédito Bancário; CDB = Bank Certificates of Deposit; DGPE = Depósito a Prazo com Garantia Especial; RDB = Bank Receipts of Deposit.

<sup>8</sup> National Confederation of Industry Report (2016) - See more at: [http://arquivos.portaldaindustria.com.br/app/conteudo\\_18/2016/07/18/11404/1807-EstudoFinanciamentodoInvestimentoemInfraestrutura.pdf](http://arquivos.portaldaindustria.com.br/app/conteudo_18/2016/07/18/11404/1807-EstudoFinanciamentodoInvestimentoemInfraestrutura.pdf)

Brazilian pension funds can also play a valuable role as inducers of infrastructure financing. Figure 7 shows that more than 50 percent of pension fund resources were allocated to fixed-income investment funds (R\$374 billion) in 2015 and 15.5 percent were directly invested in government bonds. It is worth mentioning that the government’s pension funds have different regimes than private pension funds. In contrast to the Brazilian Social Insurance System (the government’s pension fund) in which contemporary workers’ contributions are used to pay for the previous generation’s pensions and benefits conceded, private pension funds collect regular payments from employers and form a fund that needs to be invested to provide retirement income for the contributor.

Similar to pension funds and investment funds, Brazilian insurance companies also concentrate their investments in fixed-income assets. These assets represented 68 percent of insurance companies’ equity, valued at R\$67,961.7 million in 2015.

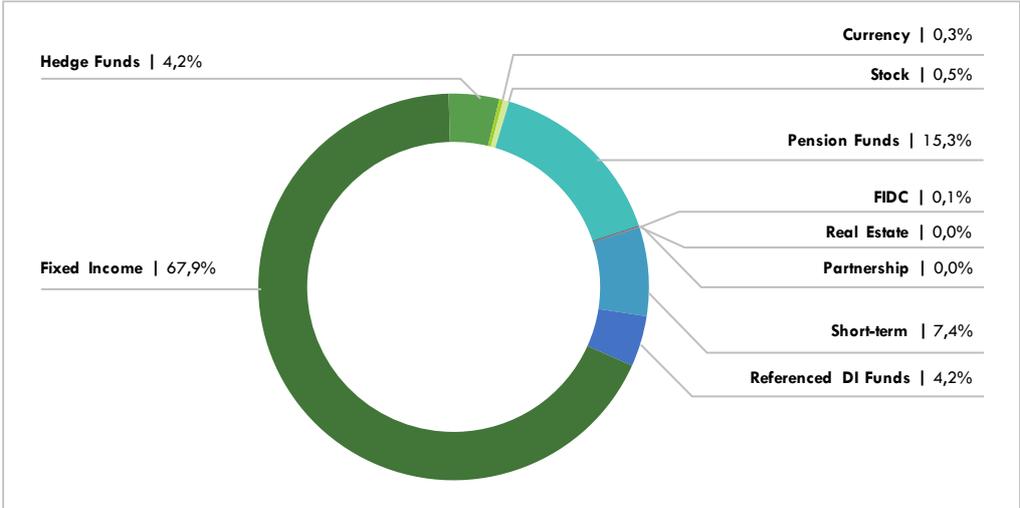
**FIGURE 7. PORTFOLIO ALLOCATION OF PENSION FUNDS (2015)**



**Source:** Brazilian National Association of Pension Funds (ABRAPP), elaborated by FGV CERFI.

**Note:** Values in BRL million.

**FIGURE 8. PORTFOLIO ALLOCATION OF INSURERS (SEPTEMBER 2015)**



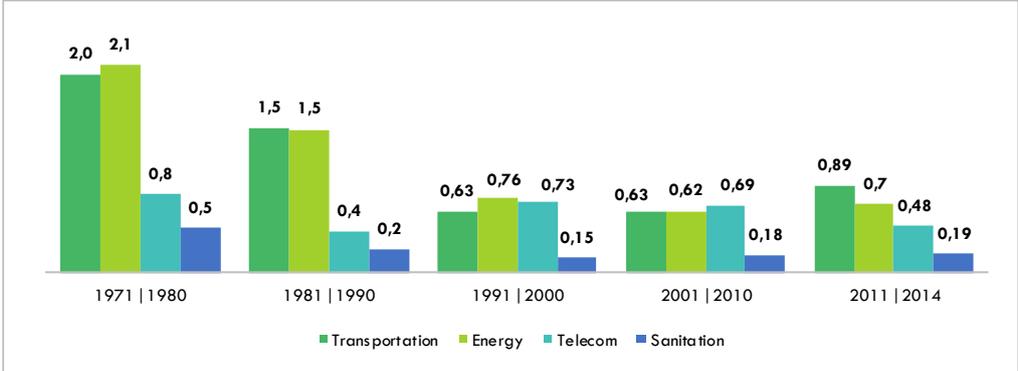
**Source:** ANBIMA, elaborated by FGV CERFI.

**Note:** DI = Interbank Deposit; FIDC = Fundo de Investimento em Direitos Creditórios.

### 4. Sources of Capital (Supply Side)

The level of infrastructure investments in Brazil varied over the last 40 years as a percentage of the GDP. More recently, it is observed that there is room for significant increase in investments, as shown in Figure 9.

**FIGURE 9.** INFRASTRUCTURE INVESTMENTS IN BRAZIL BY SECTOR (AS A PERCENTAGE OF GDP)

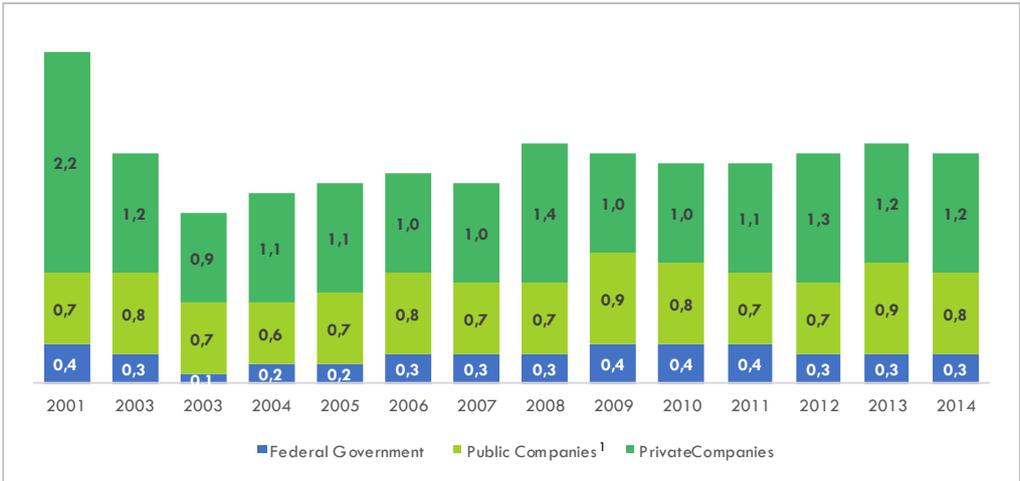


**Source:** Report of CNI (2016).

In the early 1970s, Brazil experienced high economic growth and significant increase in demand for basic services, such as transportation and electricity. In this context, the federal government supported interventions in public institutions to promote the development of infrastructure sectors. This stimulus resulted in more state-owned companies and the predominant engagement of public resources in network industries. In 1973, state-owned companies invested 4.4 percent of GDP in fixed capital. In the 1980s and 1990s, the economy experienced a severe fiscal crisis. The government’s response was to cut spending, lowering investments in state-owned enterprises. In addition, the companies’ own resources lost generation capacity after the promulgation of the 1988 Constitution, which established new rules for the allocation of revenue from the public sector.

Given this situation, private investments were perceived as an alternative to fill the gaps left by the public sector. Thus, in the early 1990s, the government conducted a series of privatization processes resulting in public investments in infrastructure decreasing to 2 percent of GDP. Even after the economic stabilization in 1994, public companies never returned to the level of investments observed during the 1970s.

**FIGURE 10. INFRASTRUCTURE INVESTMENTS IN BRAZIL (AS A PERCENTAGE OF GDP)**



**Source:** Frischtak (2008)<sup>9</sup> and report of CNI (2016).  
**Note:** <sup>1</sup> State-owned enterprises and state and local authorities.

Even though public spending in infrastructure decreased and never returned to the 1970s level, the private sector did not increase its participation. As described in section 2, the participation of private companies decreased by 29 percentage points since 2007. There is a concentration of government funds either directly or allocated through the BNDES (FAT) and CEF (FGTS).<sup>10</sup> In this case, some reallocation of funds could be considered. Some initiatives have already been carried out, allowing part of the FGTS sources to be invested in shares of state-owned companies such as Petrobras and Vale—a similar mechanism could channel these funds to infrastructure assets, according to savers’ decisions. The next topics highlight the main features regarding alternatives to government supply of funds.

**4.1. Bank Financing**

In Brazil, commercial banking resources devoted to infrastructure projects are residual. In spite of efforts that could potentially improve this scenario, due to better perspectives concerning macro-economic constraints, it is important to describe and evaluate the effects that emerge from changes in prudential regulation—the current state of the Basel Accord and Basel III implementation in Brazil and its expectations. Brazil introduced Basel III in 2013. The target is to have the new regulations fully implemented by 2022, according to the Central Bank of Brazil. The National Monetary Council (CMN) and the Central Bank released the first set of regulations implemented under the new agreement in Brazil in March 2013. They established the new structure of regulatory capital and the new standards for capital calculation. In the first quarter of 2015, under the

<sup>9</sup> Frischtak, C. (2008). “O Investimento em Infraestrutura no Brasil: histórico recente e perspectivas”. IPEA, PPE - Pesquisa e Planejamento Econômico, vol.38, No. 2. See more at: [http://horia.com.br/sites/default/files/documentos/ipea\\_historico\\_da\\_infraestrutura\\_no\\_brasil.pdf](http://horia.com.br/sites/default/files/documentos/ipea_historico_da_infraestrutura_no_brasil.pdf).

<sup>10</sup> FGTS is the ‘Guarantee Fund for Time of Service’, a severance indemnity fund for workers. Companies must pay 8 percent of monthly pay into an account held in the name of the employee at CEF. The balance is only available upon dismissal without cause, retirement, and in certain other situations (for example, to finance the purchase of housing).

schedule proposed by Basel III, the Central Bank and CMN introduced provisions related to short-term liquidity and leverage ratio. In general, an increase is expected in capital requirements in a range between 10.5 percent and 13 percent for the Basel Index. These capital requirements should not be mistaken with the mandatory deposits—reserves required by the Central Bank for purposes of monetary policy and for macro financial stability. Mandatory deposits are particularly large in Brazil.

The argument in favor of high requirements for mandatory deposits is to avoid events similar to the bankruptcies that occurred in the country in the 1990s, before the Real Plan in 1994 (which finally managed to tame the rampant inflation of the previous decade). This proved successful in the wake of the 2008 global financial crisis. Even though decreasing to R\$200 billion between September 2008 and March 2010, the current national reserves amount to approximately R\$400 billion.<sup>11</sup>

**TABLE 1. BASEL III CAPITAL REQUIREMENT SCHEDULE**

	2013	2014	2015	2016	2017	2018	2019
Regulatory Capital	8,0%	8,0%	8,0%	8,0%	8,0%	8,0%	8,0%
Tier 1 Capital	4,5%	5,5%	6,0%	6,0%	6,0%	6,0%	6,0%
<b>Principal Capital</b>	<b>3,5%</b>	<b>4,0%</b>	<b>4,5%</b>	<b>4,5%</b>	<b>4,5%</b>	<b>4,5%</b>	<b>4,5%</b>
Capital Buffer	-	0,625%	1,25%	2,5%	3,75%	4,375%	5,0%
<b>Conservation Capital Buffer</b>	<b>-</b>	<b>-</b>	<b>-</b>	<b>0,625%</b>	<b>1,25%</b>	<b>1,875%</b>	<b>2,5%</b>
<b>Countercyclical Capital Buffer</b>	<b>-</b>	<b>0,625%</b>	<b>1,25%</b>	<b>1,875%</b>	<b>2,5%</b>	<b>2,5%</b>	<b>2,5%</b>
Total Regulatory Capital + Conservation Capital Buffer	8,0%	8,0%	8,0%	8,625%	9,25%	9,875%	10,5%
Total Capital + Conservation Capital Buffer + Countercyclical Capital Buffer	8,0%	8,625%	9,25%	10,5%	11,75%	12,375%	13,0%
Capital instruments no longer classified as such	They will no longer be used in ten years period, which starts counting from 2013.						

**Source:** ANBIMA,<sup>12</sup> elaborated by FGV CERI.

The Basel Index already sets a minimum level of 11 percent in Brazil. Larger numbers apply for institutions deemed systemically relevant, either globally or locally. The Central Bank intends to move this level to 9 percent by 2019. However, additional capital will be implemented for which, for some institutions, the total percentage may reach 15 percent.

<sup>11</sup> See more details about compulsory deposits or reserves at <http://www4.bcb.gov.br/pec/gci/port/fo-cus/faq%2012-depósitos%20compulsórios.pdf>.

<sup>12</sup> See references at [http://www.anbima.com.br/data/files/15/04/7B/A1/F32D7510E7FCF875262C16A8/Perspectivas\\_20ANBIMA\\_20Basileia\\_20III\\_1\\_.pdf](http://www.anbima.com.br/data/files/15/04/7B/A1/F32D7510E7FCF875262C16A8/Perspectivas_20ANBIMA_20Basileia_20III_1_.pdf)

**TABLE 2. BASEL III CAPITAL REQUIREMENT SCHEDULE – DETAILED**

	2013	2014	2015	2016	2017	2018	2019
<b>Regulatory Capital</b>	<b>11,0%</b>	<b>11,0%</b>	<b>11,0%</b>	<b>9,875%</b>	<b>9,25%</b>	<b>8,625%</b>	<b>8,0%</b>
Tier 1 Capital	5,5%	5,5%	6,0%	6,0%	6,0%	6,0%	6,0%
Principal Capital	4,5%	4,5%	4,5%	4,5%	4,5%	4,5%	4,5%
<b>Additional Principal Capital (ACP)</b>	-	-	-	<b>[0,625%-1,25%]</b>	<b>[1,25%-3%]</b>	<b>[1,875%-4,75%]</b>	<b>[2,5%-7%]</b>
Conservation ACP	-	-	-	0,625%	1,25%	1,875%	2,5%
Countercyclical ACP	-	-	-	0,625%	1,25%	1,875%	2,5%
Systemic Importance ACP	-	-	-	-	0,5%	1,0%	2,0%
PR + Conservation	11,0%	11,0%	11,0%	10,5%	10,5%	10,5%	10,5%
PR + Conservation + Countercyclical	11,0%	11,0%	11,0%	11,125%	11,75%	12,375%	13,0%
PR + Conservation + Countercyclical + Systemic Importance	11,0%	11,0%	11,0%	11,125%	12,25%	13,375%	15,0%
Principal Capital + Conservation	4,5%	4,5%	4,5%	5,125%	5,75%	6,375%	7%
Principal Capital + Conservation + Countercyclical	4,5%	4,5%	4,5%	5,75%	7%	8,25%	9,5%
Principal Capital + Conservation + Countercyclical + Systemic Importance	4,5%	4,5%	4,5%	5,75%	7,5%	9,25%	11,50%

**Source:** Central Bank of Brazil and ANBIMA,<sup>13</sup> elaborated by FGV CERI.

It has become clear that capital availability (for all types of assets and investments) will be affected—moving not from 11 percent to 9 percent but from 11 percent to 15 percent by 2019. In the standardized approach adopted by most Brazilian banks, the calculation of the portion related to market and operational risks is virtually unchanged by Basel III. The main changes in the calculation of risk-weighted assets introduced by Basel III in Brazil involve credit risk, as can be seen in Table 1 and Table 2. Concerning credit risk, a capital provision is required related to adjustments in the credit quality of counterparties (credit valuation adjustment [CVA]) and exposure to central counterparties. There was also the recalibration of risk weighting factors of some exhibits—exposure to the BNDES began to be treated as sovereign, for example.

In fact, there are no direct changes in the treatment of project finance for capital requirement calculations for banks. The main implications for financing projects come from the need for additional capital due to CVA and constraints on long-term credit (particularly for tenures longer than 10 years) due to the implementation of the Net Stable Funding Ratio (NSFR) and Leverage Ratio (LR).

<sup>13</sup> See [http://www.anbima.com.br/informe\\_legislacao/2013\\_015.asp#tit2\\_5](http://www.anbima.com.br/informe_legislacao/2013_015.asp#tit2_5).

The NSFR, which will be implemented by 2018, measures the amount of long-term and stable resources employed by an institution related to the liquidity profiles of funded assets and the potential margin calls arising from commitments outside the balance sheet and other obligations.<sup>14</sup> LR is the ratio between Tier 1 capital and gross exposure (including off-balance-sheet items). It was introduced to restrict excessive leverage of banks and thus the potential negative effects that a deleveraging process could pose to the financial system and to strengthen traditional capital requirements, based on a weighted risk measure, with a simple, unweighted measure to serve as a threshold for operation of banks.<sup>15</sup>

Following the advances in prudential regulation worldwide, the banking system in Brazil will probably continue to undergo a process of capital adjustments. This movement will significantly limit the availability of long-term funding. This pattern/trend extends to the supply of funding for energy infrastructure.

In fact, in the long run, (commercial) banks will probably diminish longer-term financing of (highly) risky assets. To compensate for this movement, infrastructure assets in Brazil must be 'derisked' to take advantage of an environment in which there will be no (or scarce) credit for long-term investments with high borrower risk. This process is essential to turn energy infrastructure in Brazil into an asset class.

Considering that even state-owned banks will have to adjust their capital requirements, alternative roles can be assessed and assumed by public financial institutions such as the BNDES. In such context, it is advisable to investigate the possibility of such institutions acting as guarantors—similar to the role of other development institutions, including the Multilateral Investment Guarantee Agency (MIGA) of the World Bank Group.<sup>16</sup>

## 4.2. Non-bank Financing

Alternatives to financing through traditional banking markets could focus on the attraction of funds from institutional investors. Institutional investors include insurance companies, pension funds, and sovereign funds. To boost investment in infrastructure or energy assets from these firms, some regulatory changes or alternative/new market designs are needed. These aspects will be discussed in chapter 7. It is important to consider some vehicles or financial products that can be implemented in Brazil to increase the attractiveness of infrastructure-related assets. The following sections describe attempts successfully adopted in other countries and the challenges involved.

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<sup>14</sup> See <http://www.bis.org/publ/bcbs271.pdf>.

<sup>15</sup> See <http://www.bis.org/publ/bcbs270.pdf> and [http://portal.anbima.com.br/informacoes-tecnicas/estudos/radar/Documents/201307\\_radar\\_anexo03.pdf](http://portal.anbima.com.br/informacoes-tecnicas/estudos/radar/Documents/201307_radar_anexo03.pdf).

<sup>16</sup> See more details about MIGA at <https://www.miga.org/>.

### 4.3. Alternative Sources of Supply

#### 4.3.1. Project Bonds

Project bonds markets were created in the 1990s as a source of capital for long-term infrastructure projects in North America and involved institutional investors like pension funds and insurance companies. Canada constitutes the best example, considering that domestic banks in that country did not lend for projects longer than seven years and that credit for projects was based on resources from European banks. Due to the effects of the subprime crisis and considering the amount needed to finance public-private partnership (PPP) projects in procurement, bond markets became an alternative.

Nowadays, infrastructure bonds are also common in Australia, with recent issuances in airports (Perth) and roads (ConnectEast); the United Kingdom; the United States; and some emerging markets. In Brazil, the government attempted a similar structure under Federal Law 12,431/2011—by which it regulated the issuance of infrastructure debentures in the country, mainly being used by special purpose vehicles (SPVs) involved in project management.<sup>17</sup> This law also established tax benefits for investors—interest payable is subject to withholding tax of 15 percent for resident legal entities, no withholding tax is payable by individual residents, and interest payable to foreign investors is free of withholding tax and Tax on Financial Operations (IOF).<sup>18</sup>

Data from the Brazilian Treasury show that since its beginning, the total volume of bonds issuance reached R\$18,593 million. In turn, the amount of resources required by infrastructure projects corresponds to 13 times this amount.

There are two structures so far in Brazil, comprising securities issued with and without collateral. Securities with collateral are issued by firms that own projects in the construction phase, which are riskier than projects under operation. Securities without collateral are related to operational projects that present a cash flow history and, therefore, less risk for investors (according to the BNDES, this type corresponds to 75 percent of the total amount issued).

This collateralization/credit support concerning the construction phase is relevant not only for the Brazilian case—it is considered a general improvement to all project/infrastructure bond/debenture markets and crucial to attract investors like pensions funds, which are not able to give up cash flows for such a long time (two years in some cases). So, typically, the projects are financed with bank debt (or the BNDES debt in the Brazilian case) during the construction phase. Access to the capital markets, or project or infrastructure bonds, would take place during the operational phase. This is a problem because infrastructure projects are capital-intensive during the early stages, and it is possible to identify a clear refinancing risk in this situation.

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<sup>17</sup> This product is also used by firms. On August 15, for example, *Companhia de Transmissão de Energia Elétrica Paulista* (CTEEP) issued R\$148 million in infrastructure bonds (*debêntures de infraestrutura*).

<sup>18</sup> IOF is a tax on financial transactions.

Therefore, there are no significant differences between the structure created for Brazilian infrastructure debentures and the project bonds that exist in other countries, in spite of the typical textbook concepts that define debentures as debt instruments that are not secured by physical assets or any kind of collateral. 'Textbook' debentures also have a more specific purpose than bonds and can be classified as 'revenue bonds' according to the situation. In this case, a situation that is common for municipalities (see next subsection), debentures or bonds are supported by the revenues of a specific project such as a highway or a stadium.

#### 4.3.2. Municipal Governments

In the United States, local governments have issued municipal bonds to finance infrastructure for nearly two centuries. Such products are free of federal income tax. This tax-advantaged debt instrument, together with equity in the form of government grants and state and local expenditures, contributes to a lower cost of capital compared with private debt and equity. This market in the United States is the most developed in the world, reaching US\$3.7 trillion, dispersed among 44,000 issuers. Apart from the effects of the financial crisis and the increasing fiscal pressures at all levels, such instruments have contributed to increase debt ratios<sup>19</sup> in infrastructure projects. Typically, this product has annual principal repayments, and the amortization schedules are structured with equal annual principal and interest payments<sup>20</sup> over the useful life of the asset financed. The common structure also considers municipal and state requirements, rating agency credit standards, and tax exemptions to boost demand. We can compare this 'asset structure' with the typical arrangement performed at the municipal level, composed of taxes, fees, or charges to provide repayment for infrastructure projects.

The structure involving municipal bonds is similar to limited-recourse financing, because bond payments are related to the projects' cash flows; so, they are also 'revenue' bonds. The typical arrangement is a 'balance sheet' approach closer to common banking debt. In the Brazilian case, municipal bonds could be an alternative for funding projects whose ownership belongs to the cities, like sanitation, water services, and those related to energy efficiency. Regarding this situation, there are many good examples abroad.<sup>21</sup> However, municipalities in Brazil must comply with federal regulations (mainly the rules of the Fiscal Responsibility Law<sup>22</sup>) that make arrangements similar to those existing in the United States impractical. Issuing debt is allowed to municipal governments subject to the National Treasury authorization. The Rio de Janeiro municipal government, even considering the needs related to the Olympic Games, did not get this permission.

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<sup>19</sup> Debt ratio = Debt / equity considering projects' capital structure.

<sup>20</sup> Corporate bonds typically have single principal payment.

<sup>21</sup> See for example [https://www.esmap.org/sites/esmap.org/files/DocumentLibrary/FINAL\\_MGN1-Municipal%20Financing\\_KS18-14\\_web.pdf](https://www.esmap.org/sites/esmap.org/files/DocumentLibrary/FINAL_MGN1-Municipal%20Financing_KS18-14_web.pdf).

<sup>22</sup> For more details, see [http://www.rio.rj.gov.br/c/document\\_library/get\\_file?uuid=b65b6264-4452-43b1-b117-3cde85cca0be&groupId=91253](http://www.rio.rj.gov.br/c/document_library/get_file?uuid=b65b6264-4452-43b1-b117-3cde85cca0be&groupId=91253).

### 4.3.3. Others

Some alternative options involve the structuring of specific investment funds for infrastructure. An existing vehicle in Brazil is the equity investment fund (*fundo de investimento em participações*, FIP), established in 2003 through Resolution 391 from the Brazilian Securities Commission (CVM). In 2007, Federal Law 11,478<sup>23</sup> specifically created the infrastructure investment fund vehicle (FIP-IE), aimed at financing projects in the energy, transportation, water, sanitation, and irrigation sectors. Investments can be used in the expansion and renovation of existing assets or projects that are under implementation. In general, the composition of existing portfolios in the market includes small hydroelectric plants, biomass plants, wind farms, and infrastructure equipment, as well as securities such as stocks and debentures of companies operating in the mentioned sectors.

According to the latest statistics, there are 576 equity investment funds of all types registered with the CVM. The operation of each depends on prior registration with the entity, which also restricts who can invest and the amount of money that can be applied. These products sound attractive to investors. The pension funds of government-controlled companies have invested massively; for example,<sup>24</sup> the allocation of pension funds in mono-asset FIPs, funds that concentrate resources in the acquisition, construction, and operation of a single asset, represent about 39 percent of the total allocation devoted to private equity within this industry, with the largest five pension funds, including Petros (Petrobras), Funcef (CEF), Postalís (Post Office), and Previ (Banco do Brasil) representing 32 percent of the total volume. This concentration has proved problematic. Due to possible political pressure in recent years, funds have invested in infrastructure FIPs that allocated resources to projects that never left the drawing board or were abandoned, requiring sizeable contributions of additional capital.<sup>25</sup>

## 5. Opportunities to Invest

Potential investors look for opportunities to invest in the financial products available (Treasuries, savings accounts, listed companies' stocks, corporate bonds, or debentures), considering all the risks (and returns) involved, size and liquidity by type of opportunity, and risk mitigation mechanisms.

The ability to attract additional funds for investments in network assets and commodities in the power sector depends on the returns relative to financial assets' earnings. Hence, it is important to develop or promote alternatives for investors, beyond Treasuries and saving accounts in Brazil.

Considering the current fiscal difficulties and a probable new role of state-owned banks (BNDES, Banco do Brasil, and CEF), attracting private investors is critical to boost investments in the power

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<sup>23</sup> See [http://www.planalto.gov.br/ccivil\\_03/\\_ato2007-2010/2007/Lei/L11478.htm](http://www.planalto.gov.br/ccivil_03/_ato2007-2010/2007/Lei/L11478.htm).

<sup>24</sup> See [http://www.spectrainvest.com/Estudo\\_Alocacao\\_Fundos\\_de\\_Pensao.pdf](http://www.spectrainvest.com/Estudo_Alocacao_Fundos_de_Pensao.pdf).

<sup>25</sup> See <http://www1.folha.uol.com.br/mercado/2016/03/1751940-pressao-politica-agrava-perdas-de-fundos-de-pensao.shtml>.

sector. Hence, the challenge is to create conditions for demand growth in which investors will naturally channel money to capital markets—in this case, in corporate and project bonds.

Creation of good products (such as infrastructure debentures) will not suffice. Market agents and governments can jointly develop an effective strategy to create new markets. This requires robust treatment regarding the demand side.

Successful examples of markets include the development of a secondary market for Treasuries in Brazil, as well as the ‘*Tesouro Direto*’,<sup>26</sup> which targets retail investors. Other cases of success are the development of a market for project bonds in Canada and Australia. Below, we present a brief assessment of both financial and physical opportunities available to investors.

## **5.1. Financial Opportunities to Invest**

### **5.1.1. Treasury Notes**

The internal public debt comprises bonds issued by the Brazilian National Treasury, available to all types of investors—institutional, asset managers, banks, or even ordinary people. Such assets belong to the fixed-income allocation class and have the most developed and liquid secondary market in Brazil, attracting not only long-term investors but also those that have alternative investment strategies.

As established in Decree 3,859 of July 4, 2001, the National Treasury has a variety of instruments to meet the financing needs of the federal public debt. These instruments differ in some aspects, such as issue process (auction or direct issuance), indexation clauses, issuance terms, redemption forms, and interest rates, among others. Considering the securities issued in public offerings (auctions), the National Treasury issues two types of bonds according to the nature of cash flows that will be paid to/received by investors: fixed and floating. In the first case, the investor knows the cash flows that will be received at maturity or on coupon payment dates. However, in the second case, the remuneration of securities consists of two components: the interest rate agreed at the time of purchase of the security and the variation of some index or economic parameter like inflation, foreign exchange rate, or others.

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<sup>26</sup> ‘*Tesouro Direto*’ is the Brazilian National Treasury’s online platform for public bonds negotiation with retail investors.

**TABLE 3. FEATURES OF GOVERNMENT SECURITIES**

	INDEX	INCOME	MATURITY (MAXIMUM)	YIELD	PRINCIPAL PAID ON MATURITY
<b>PREFIXED</b>					
Treasury fixed and bullet (LTN)	Fixed-rate securities	Contracted interest rates	4 years	Only on the maturity date	R\$1,000.00 <sup>2</sup>
Treasury fixed with semiannual interest coupon (NTN-series F)	Fixed-rate securities	Contracted interest rates	10 years	Biannual and on the maturity date	R\$1,000.00 <sup>2</sup>
<b>POSTFIXED</b>					
Treasury IPCA (NTN-series B Principal)	IPCA	IPCA + contracted interest rates	40 years	Only on the maturity date	R\$1,000.00 (adjusted by the index)
Treasury IPCA with semiannual interest (NTN-series B)	IPCA	IPCA + contracted interest rates	40 years	Biannual and on the maturity date	R\$1,000.00 (adjusted by the index)
NTN-series C <sup>1</sup>	IGP-DI	IGP-DI + contracted interest rates	No longer issued		R\$1,000.00 (adjusted by the index)
Treasury SELIC (LFT)	SELIC	SELIC + contracted interest rates	5 years	Only on the maturity date	R\$1,000.00 (adjusted by the index)

**Source:** National Treasury Secretariat of Brazil, elaborated by FGV CERFI.

**Note:** IGP-DI = General Price Index - Internal Availability; IPCA = Extended Consumer Price Index; LFT = Letra Financeira do Tesouro; LTN = Letra do Tesouro Nacional; SELIC = Special System for Settlement and Custody.

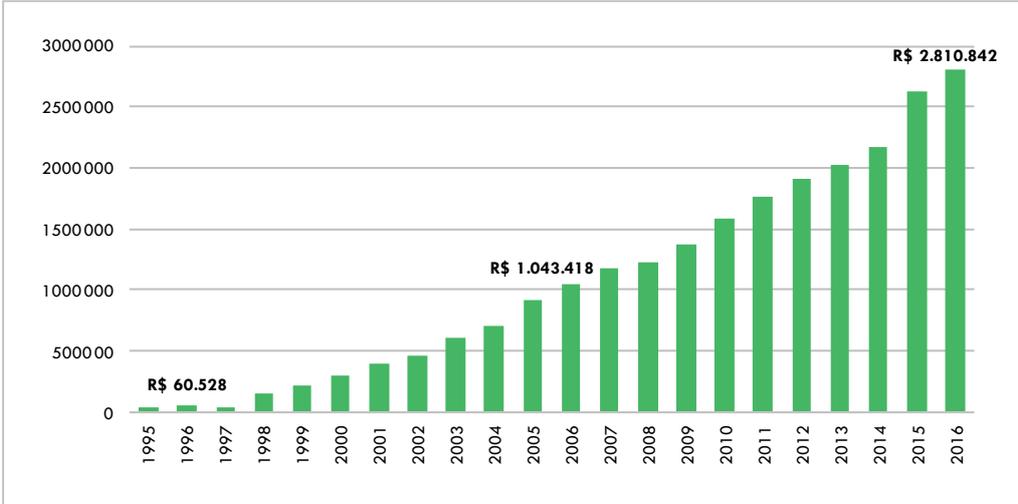
<sup>1</sup> They are no longer issued in auctions, but some maturities still exist on the secondary market.

<sup>2</sup> Income is nominal, so inflation needs to be discounted to get real income. The SELIC rate is the benchmark rate, IPCA is the consumer price index, and IGP-DI is the general price index.

Table 3 shows the characteristics of the bonds offered at auctions. Brazil has two types of fixed bonds (LTN: National Treasury Bills and NTN-F: National Treasury Notes-Series F) and three types of floating-rate securities (NTN-B: National Treasury Notes-Series B, LFT: Treasury Bills indexed to the SELIC rate, and NTN-C: National Treasury Notes-Series C). In all cases, LTNs do not pay coupon interest and instead are redeemed in full on the maturity date. NTN-Fs are bonds with semiannual interest coupon payments and have a single principal flow of R\$1,000 on maturity. NTN-Bs and NTN-Cs are floating-rate securities that pay semiannual coupons indexed to inflation. These bonds also carry a single principal flow of R\$1,000.00 on maturity, indexed to inflation as well (IPCA for NTN-Bs and General Market Price Index [IGP-M] for NTN-Cs). LFTs pay no interest coupon and have only a principal payment on maturity indexed by the SELIC rate.

As mentioned, the government securities market in Brazil is widely developed and highly attractive to domestic and foreign investors. In addition to the aspects described above, one of the most attractive factors for these assets is related to the fact that their gains are benchmarked by the basic interest rate in Brazil (SELIC), which exceeds similar rates prevailing in the rest of the world. Thus, the amount of domestic federal debt was R\$2,627,067 million, representing 48 percent of GDP in 2015. Before 20 years, this amount represented only 1 percent of GDP.

**FIGURE 11. FEDERAL DOMESTIC PUBLIC DEBT (BRL, MILLIONS)**

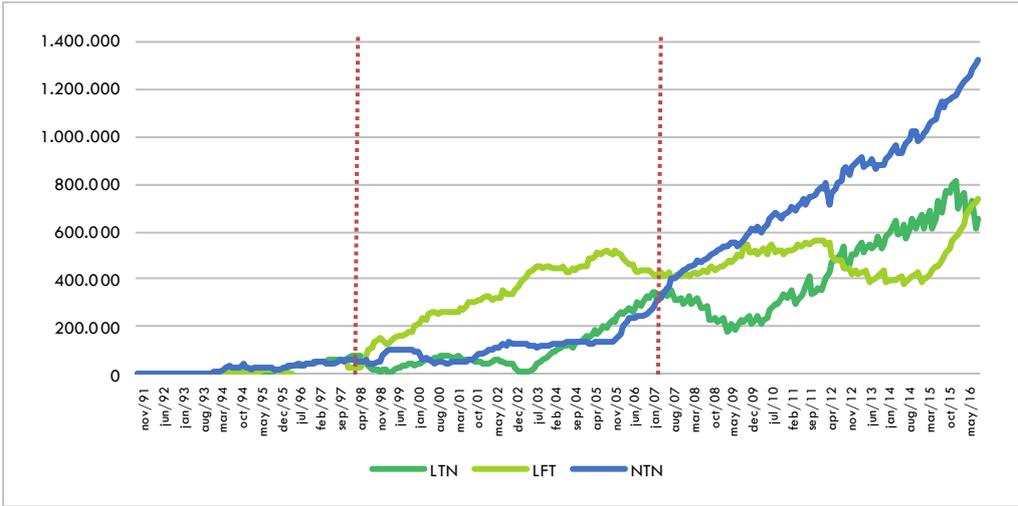


Source: National Treasury Secretariat of Brazil, elaborated by FGV CERI.

Note: LTN, LFT, and NTN-series C, B, F, and D. Position in December of each year; for 2016 June position (latest available information).

From the perspective of federal securities, the composition of public debt reveals increasing participation of NTNs in the market since 2007. This trend was reversed in a scenario that persisted for more than 10 years, during which shorter maturity securities were predominant (LTNs and LFTs), as shown in Figure 12. Before 1998, the government bond market had low penetration, reflecting a period in which the Brazilian economy experienced inflation as high as 2,000 percent a year (up to the middle of 1994).

**FIGURE 12. BRAZILIAN TREASURY SECURITIES (BRL, MILLIONS)**

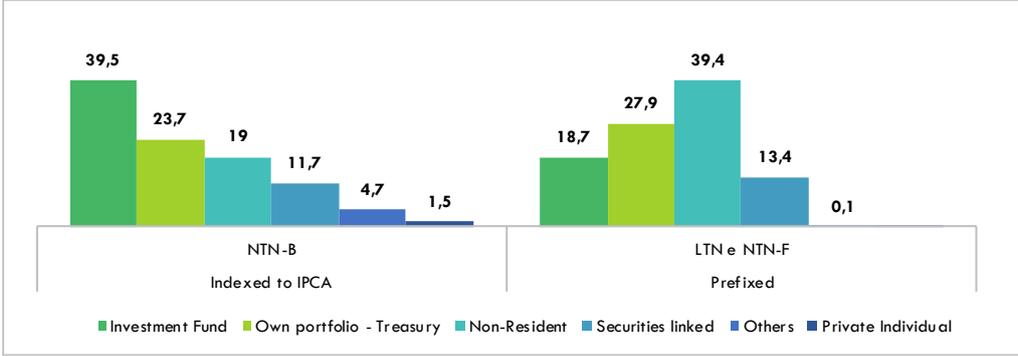


Source: Ipeadata, elaborated by FGV CERI.

NTN-Bs are real-income bonds with semiannual coupon payments—assets that allow reinvestments. However, the price of the securities varies according to inflation expectations. Therefore, if the investor is not willing to wait until maturity, it can earn higher or lower yields than expected in the underlying operations.

Despite the attractiveness of longer-term securities, agents are still more interested in shorter-term fixed-income bonds—LNTs and NTN-Fs correspond to 41.6 percent of the amount of government debt in the market (R\$1.09 trillion). NTN-Bs account for 30 percent of the government securities market (R\$0.81 trillion), with 40 percent of these bonds being acquired by investment funds, probably because they have greater incentive to maintain long-term assets with higher risk; in the case of LNTs and NTN-Fs, 39.4 percent of the bonds were bought by foreign investors (Figure 13).

**FIGURE 13. BRAZILIAN TREASURY SECURITIES (BRL, MILLIONS) - DECEMBER 2015**



Source: ANBIMA, elaborated by FGV CERI.

Hence, among the Brazilian Treasury bonds, NTN-Bs are opportunities for long-term investment, being widely used by institutional investors like pension funds and insurance companies.

**5.1.2. Listed Companies**

The capital market plays a relevant role in a country’s economic development because it constitutes an efficient mechanism for allocating resources and gives another option for financing companies involved in infrastructure projects. Unfortunately, Brazil had a very underdeveloped stock market until recent years. The long period during which the economy faced high inflation rates and there was general economic instability exerted serious negative effects on the Brazilian stock market until the Real Plan (*Plano Real*) in 1994. Stimulated by economic and political stability, the Brazilian stock market initiated a general pattern of growth in 2003.

In spite of the growing stock market, the share of utility companies listed on the BM&FBovespa is not significant, the exception being in the electricity sector. Of the 584 currently listed companies, 71 are classified as public utilities, of which 62 are electric utilities, 7 are water supply and sanitation utilities, and only 2 are gas utilities. Hence, the public utilities sector represents no more than 13 percent of all listed companies traded on the BM&FBovespa.

It is also important to highlight some features related to the indices compiled by BM&FBovespa. The most relevant one is the Bovespa Index (Ibovespa), a broad index that is designed to track the stock market’s average performance through a hypothetical portfolio of the most actively traded and most representative stocks. Alternatively, the BM&FBovespa UTIL and the BM&FBovespa IEE are sector indices with the same purpose as the Ibovespa, respectively for companies in the public utilities sector in general (electric utilities, water supply and sanitation

utilities, and gas utilities) and the electricity sector in particular. As might be expected, these two indexes have a large overlap of eligible stocks that can be used to build each portfolio. In fact, the most recent list of stocks eligible for BM&FBovespa UTIL and BM&FBovespa IEE shows that the former has 17 eligible stocks while the latter has 15, and all the companies are included in the BM&FBovespa UTIL list. In particular, only 8 out of these 17 stocks are eligible for the Ibovespa.

Furthermore, only 23 listed companies in the public utilities sector are listed in the special corporate governance segments of the BM&FBovespa. Known as Level 1, Level 2, and Novo Mercado, these special segments certify that the company follows specific rules related to board of directors structure, internal controls, transparency, delisting, and free float, among other aspects. From the investor's perspective, companies complying with enhanced governance practices are more likely to obtain investments at a lower cost and a higher return.

### 5.1.3. Debt Instruments

Debentures and bonds are debt instruments that companies issue to raise capital beyond their normal cash flows. In theory, there are differences in how each of these instruments uses collateral, the circumstances under which each is issued, and other characteristics. However, in some economies, there is only one of these instruments and the terms 'debentures' and 'bonds' are used to refer to this single instrument interchangeably.

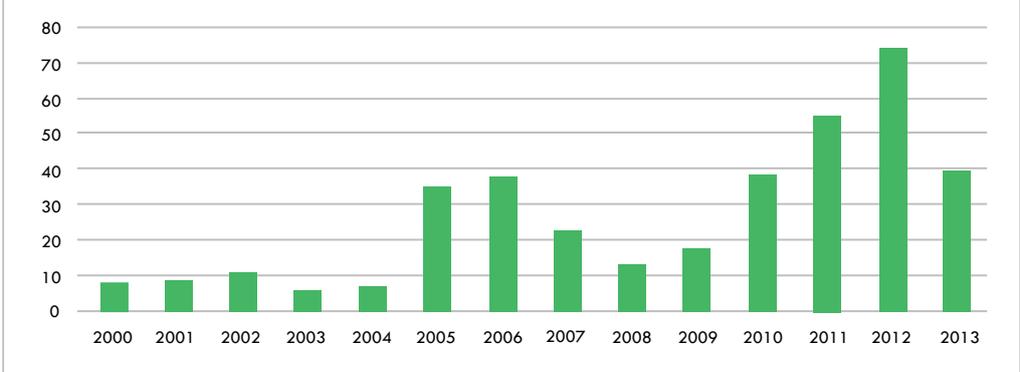
Corporate bonds are financial instruments issued for a fixed period and pay interest during this period, known as 'coupons'. The interest is paid at regular intervals so it will not accrue over time, while the principal amount is paid in the future on the maturity date. In general, bonds are secured by collateral; so, the bondholders can obtain at least partial satisfaction by seizing and selling the asset secured if the company fails to pay the debt. Bonds are not only issued by private companies, but also by governments and their firms. Those issued by private companies are known as corporate bonds.

A debenture is a debt instrument used for supplementing capital by the company. As happens with bonds, debentures also bear interest, which is paid at periodic intervals over the duration. Usually, debentures have a more specific purpose than bonds. Even though both are used to raise capital, debentures are typically issued to raise short-term capital for upcoming expenses or to pay for new expansions. Debentures are not asset-backed, because they are not secured by any collateral. Instead, they are only secured by the credit of the issuing company. In case of liquidation, bondholders are paid with priority over debenture holders. Sometimes, debentures or bonds are convertible into equity. In a sense, all debentures are bonds, but not all bonds are debentures. Whenever a bond is unsecured, it can be referred to as a debenture. In some markets, as in Brazil and India, for instance, the two terms are interchangeable, but in other economies like the United States, they refer to two distinct kinds of debt instruments.

In Brazil, debentures are the only securities classified as corporate bonds, and the debenture market is the market with the most significant growth rate within other financial securities available in the Brazilian market. The debenture market grew more than 400 percent from 2000 to 2013.

As illustrated in Figure 14, it reached a peak of more than R\$70 billion in debentures offered in 2012. A reason for this high volume of offers in 2012 was Federal Law 12,431/2011, which created the infrastructure debentures mentioned in section 4.

**FIGURE 14.** TOTAL AMOUNT ISSUED IN DEBENTURES (BRL, BILLIONS)

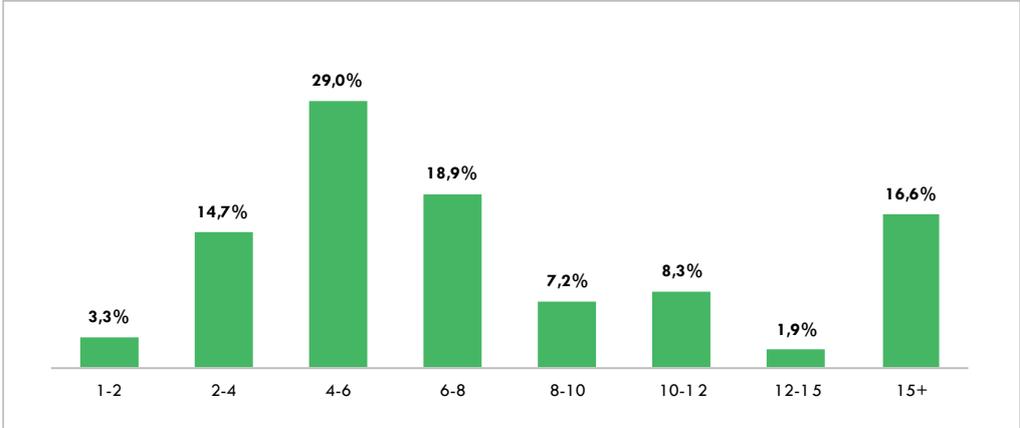


**Source:** National Debenture System (SND), elaborated by FGV CERFI.

Between 2000 and 2013, the largest buyers of debentures in Brazil were the financial institutions related to the issuing companies and investment funds, which acquired nearly 70 percent of the debentures issued during the period. Pension funds, foreign investors, and especially financial institutions with no connections with the issuing companies accounted for less than 10 percent. These numbers reflect the demand composition at the time of subscription. Because Brazil does not have a well-developed secondary market for debentures, it is reasonable to assume that such configuration will not undergo significant changes until maturity.

Another issue is the market’s ability to accept long-term bonds. Despite the need for adequate financing of investments with long maturation period, debentures issued since 2000 have maturities under six years on average. After the 2008 economic crisis, the average maturity fell even more, from six years to four years in 2009. Figure 15 illustrates the high concentration in securities with maturity shorter than five years.

**FIGURE 15.** DEBENTURES ISSUED BY MATURITY



**Source:** SND, elaborated by FGV CERFI.

## 5.2. Physical Opportunities to Invest

### 5.2.1. Networks as Investments and EVA Analysis

Assets in network industries like electricity transmission, electricity distribution, and gas pipelines have characteristics of natural monopolies, often subject to economic regulation. According to the economic literature,<sup>27</sup> these features have financial implications, especially considering the decisions that can be made by long-term investors. Such network assets are considered ‘cash cows’<sup>28</sup>—investments that have a low growth in comparison with other sectors, but a higher market share (in this case the total).

These assets are able to grant or deliver a good and flat expected rate of return coupled with low risk, mainly as a result of regulation by independent agencies. In Brazil, however, these assets have not been able to attract long-term investors, as can be seen by recent results in transmission auctions, as well as the scarce competitiveness. The privatization auction of *Celg Distribuição S.A.* (CELG), the distribution company in the state of Goiás, illustrates the challenges of investing in such assets. The first attempt to sell the control of CELG was not successful.<sup>29</sup>

Government interference in the sector (discussed in an accompanying paper) coupled with a fragile and adverse macroeconomic situation add to the perception of regulatory risk. Therefore, solving the regulatory risk question is crucial to make these assets attractive again.

A typical network asset (and generation, once completed and served by the networks) is valued as a perpetual growth investment, which provides a well-known revenue stream during its lifetime—in this case, the ‘Dividend Discounted Model’ or ‘Gordon Model’ is used for valuation:

$$P_0 = \frac{DPS_0(1 + g)}{k - g},$$

where:

$P_0$  is the estimated price per share;

$DPS_0$  is the last dividend per share available and reported;

$g$  is the perpetual growth rate; and

$k$  is the cost of capital for equity holders.

<sup>27</sup> Further references can be found in corporate finance and investment valuation textbooks such as *Investment Valuation* by Aswat Damodaran.

<sup>28</sup> This expression was created by the Boston Consulting Group in 1970.

<sup>29</sup> It is worth noting that recent results are more auspicious: the transmission auction and the privatization of CELG in the second semester of 2016 are positive signs of increased attractiveness of power assets. However, both cases exhibit different underlying conditions relative to the former auctions.

Why is the Gordon Model good for utilities? Network (or generation) projects, once constructed, demand less capital expenditures (capex) with respect to other types of businesses. In fact, on average, capex will offset depreciation because there is no need of additional capital for a higher growth path—the size of the market and the prices are defined by regulation. Thus, most of the firm's results are distributed to shareholders (dividends)—the capital retention rate is usually low—and a flat cash flow can be expected over the concession's lifetime. Unfortunately, this 'textbook' case, as mentioned, is not applicable considering the current situation of energy firms and assets in Brazil. A wide range of financial indicators related to the firms are far short of the required and desired numbers. The regulator (*Agência Nacional de Energia Elétrica, ANEEL*) has researched the topic, combined with the practice of corporate finance applied to utilities.<sup>30</sup> Further good evidence can be extracted from a simple economic value added (EVA) analysis. For a period of time and considering the amount of capital invested (K), we have

$$EVA = (ROIC - WACC) \times K,$$

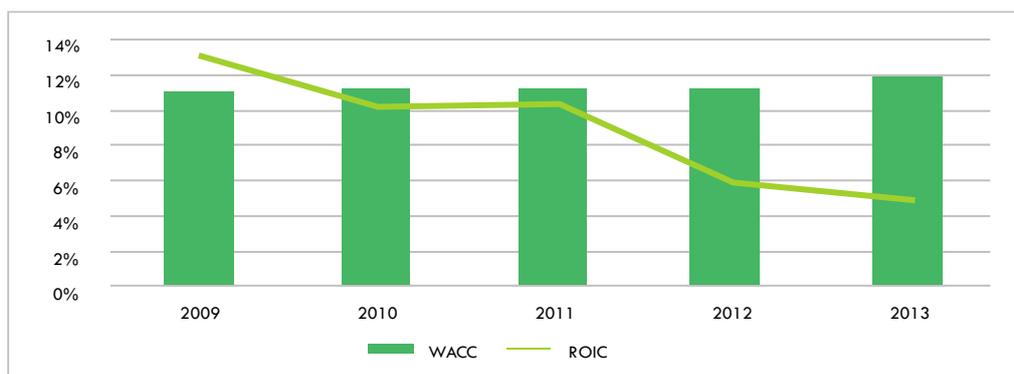
where

ROIC is the return on invested capital (net profits/invested capital) and

WACC is the weighted average cost of capital (effective).

Therefore, the difference between ROIC and WACC is only a measure of value creation for a firm, a sector, a project, or a business line. Below, we show the recent evolution of ROIC and WACC for electric energy distribution firms in Brazil. It is possible to see a gap, meaning 'value destruction', for assets that would otherwise be 'cash cows'.

**FIGURE 16.** ROIC X WACC FOR DISTRIBUTION COMPANIES IN BRAZIL



**Source:** Economatica, elaborated by FGV CERJ.

It is important to distinguish the WACC—the real cost of capital for firms on average—from the regulatory WACC set by ANEEL in the rate-making process. The evolution of this number is illustrated in Table 4.

<sup>30</sup> ANEEL has been implementing a corporate governance and financial monitoring program for energy firms in Brazil. See [http://www2.aneel.gov.br/aplicacoes/consulta\\_publica/documentos/Nota%20Técnica%202016%20067.pdf](http://www2.aneel.gov.br/aplicacoes/consulta_publica/documentos/Nota%20Técnica%202016%20067.pdf).

**TABLE 4. WACC EVOLUTION**

COMPONENTS		1ST RT CICLE	2ND RT CICLE	3RD RT CICLE	4TH RT CICLE
<b>Cost of Equity</b>	$(r_{CAPM}) = r_f + \beta*(ERP) + r_b + r_r + r_x$				
Risk Free Rate	$(r_f)$	6,01%	5,32%	4,87%	5,64%
Beta	$(\beta)$	0,26	0,55	0,74	0,70
Regulatory Risk Premium	$(r_r) = \Delta\beta*(ERP)$	3,33%	1,33%	-	-
Market Risk Premium	$ERP = (r_m - r_f)$	7,76%	6,09%	5,82%	7,56%
Brazil Risk Premium	$(r_b) = r_s - r_c^b$	4,08%	4,91%	4,25%	2,62%
Currency Risk Premium	$(r_x)$	2,00%	1,78%	-	-
<b>Nominal Cost of Equity (in US\$)</b>		<b>17,47%</b>	<b>16,71%</b>	<b>13,43%</b>	<b>13,55%</b>
US Consumer Price Index		2,40%	2,60%	2,45%	2,41%
<b>Real Cost of Equity</b>		<b>14,72%</b>	<b>13,75%</b>	<b>10,72%</b>	<b>10,89%</b>
<b>Cost of Debt</b>	$(r_D) = r_f + r_c + r_b + r_x$				
Risk Free Rate	$(r_f)$	6,01%	5,32%	4,87%	5,64%
Credit Risk Premium	$(r_c)$	3,67%	2,96%	2,14%	3,37%
Brazil Risk Premium	$(r_b)$	4,08%	4,91%	4,25%	2,62%
Currency Risk Premium	$(r_x)$	2,00%	1,78%	-	-
<b>Nominal Cost of Debt (em US\$)</b>		<b>15,76%</b>	<b>14,97%</b>	<b>11,26%</b>	<b>11,63%</b>
US Consumer Price Index		2,40%	2,60%	2,45%	2,41%
<b>Real Cost of Debt</b>		<b>13,05%</b>	<b>12,06%</b>	<b>8,60%</b>	<b>9,01%</b>
<b>WACC</b>					
Equity		50,00%	42,84%	45,00%	51,24%
Debt		50,00%	57,16%	55,00%	48,76%
Tax	$(t)$	34,00%	34,00%	34,00%	34,00%
<b>Nominal WACC (in US\$)</b>		<b>13,93%</b>	<b>12,81%</b>	<b>10,13%</b>	<b>10,69%</b>
US Consumer Price Index		2,40%	2,60%	2,45%	2,41%
<b>Real WACC post-tax</b>		<b>11,26%</b>	<b>9,95%</b>	<b>7,50%</b>	<b>8,09%</b>

Sources: ANEEL, elaborated by FGV CERI.

### 5.2.2. Benchmarking and Risk Assessment

This section presents an (re)assessment of risk management attitudes and mindsets in existing project finance practices, identifying current allocation patterns and future trends to attract new capital, such as financial hedges, contract dollarization, and tracking accounts.

In this sense, a good benchmark is provided by the GIH initiative.<sup>31</sup> The GIH maps risk allocation for a set of relevant infrastructure projects, including those in the energy sector. Their approach proposes an allocation of the most relevant risks, identifying a proper risk allocation between public and private parties.

It is worth assessing to what extent the current practice in financing of projects in the Brazilian energy sector follows the identified risk allocation mapped by the GIH, keeping in mind that this initiative does not make recommendations—it only identifies best practices.

<sup>31</sup> <http://globalinfrastructurehub.org/>

As argued in section 4, on the demand side of the market for long-term financing of our proposed framework, real assets/infrastructure compete for funds with a wide range of alternatives, mainly financial assets. Concerning the Brazilian case, the biggest competitor is government bonds, which pay a high real interest rate.

From the perspective of the profile of return or earnings (generation) in the energy sector, these real assets can be classified into two categories: network assets and commodities. The network assets include power transmission lines and natural gas pipelines. On the commodity side are power plants and the natural gas commodity.

In Table 5, we present a description of the most relevant risks for a selected group of energy projects.

**TABLE 5. ENERGY PROJECT RISKS**

STAGE RISK/RISK	DESCRIPTION
<b>Design</b>	
Environmental and Social	The risk of damage to the environment or adverse impact on local communities
Land Purchase and Site	The risk of acquiring title to the land to be used for a project, the selection of that site and the geophysical conditions of that site.
Design	The project has not been designed adequately for the purpose required
<b>Build</b>	
Resource or Input	Interruption or cost overrun in the supply of the required resources.
Construction	Labour disputes, commissioning damages, quality assurance standards, defective materials, subcontractor disputes/insolvency, cost overruns where no compensation/relief event applies.
Performance/price	Risk that the asset is able to achieve the output specification metrics and the price of doing so.
Completion	Risk of commissioning the asset on time and on budget and the consequences of meeting either criteria.
<b>Operation</b>	
Force Majeure	Unexpected events beyond the parties' control; delays or prohibit performance.
Strategic	Change or conflict in shareholding of private partner.
Inflation	Unexpected increase in the project costs.
Disruptive Technology	Displacement by a new technology.
Regulatory/change in law	Law changes that affect the ability of the project to perform, including price to comply with the new law and changes in taxation.
Political	Government intervention, discrimination, asset seizure or expropriation. Public sector budgeting.
Insurance	Unavailability in insurance for a particular risk.
Exchange and Interest rate	Fluctuations in currency and interest rates over the life of a project.
Maintenance	Maintaining the asset complying with appropriate and regulatory standards.
Demand	Availability by both volume and quality of the resource as well as the demand for the product or service.

**Source:** FGV CERFI from GIH (2016).

In tables 9 to 12 (in the appendix), we present evidence of the risk management practices observed for a selected group of energy projects implemented since 2003. The analysis allows a comparison between the risk allocation proposed at the moment the concession contract was signed with the practice observed since then.

The purpose of focusing on deviations between the contracted risk allocation and the observed one is that the larger the difference is, the lower the ability to attract funds to the sector will be, due to an increase in the perception of regulatory risk. The selected case studies show significant

deviations, both regarding the references proposed by the GIH and with respect to the parameters initially established in the contracts. Hence, we have evidence that a more robust process for definition of risk matrices and their allocation is necessary, with the potential to improve the attractiveness of the projects to private capital.

## 6. Market Environment

The assessment of the environment depends on the stage of development and how some structures of the energy and financial markets in Brazil, with support from a specific or sectoral regulation, may evolve for financing energy projects, including securities exchanges, interest rates, exchange rates, and energy commodity prices.

Some issues relate directly to the availability of capital—banks and other financial institutions. Recent advances in prudential regulation have important implications, such as the Basel III regulation, which establishes specific determinations on investments in infrastructure projects, with a potential effect on the ability to finance these asset classes. This makes it important to develop a well-specified risk matrix. Another important question is the lack of market mechanisms for the formation of energy prices. The creation of a new mechanism, or the evolution of the Brazilian Energy Trading Chamber (CCEE) energy spot market, in partnership with BMF&Bovespa, besides giving more transparency to the process, can boost investments in related infrastructure assets because investors will have a ‘fair’ price reference to make their decisions.

### 6.1. Market Features

#### 6.1.1. Pension Funds

CMN Resolution 3,792 of 2009<sup>32</sup> provides the applicable regulation of investments by pension funds in Brazil. It increased the asset classes available, created new classes, and sought to simplify the existing framework. Limits for investment in equities changed from 50 percent to 70 percent, and investments in structured products and foreign assets became possible. Briefly stated, the resolution sets the following limits for portfolio allocation into distinct asset classes:

- **Fixed income: Federal government bonds** - 100 percent of the investments
- **Private credit** - 80 percent (including debentures)

Private credit exposure is limited to 20 percent of the following instruments:

- (a) CCB, CCCB,<sup>33</sup> and promissory notes

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<sup>32</sup> [http://www.bcb.gov.br/pre/normativos/busca/downloadNormativo.asp?arquivo=/Lists/Normativos/Attachments/47507/Res\\_3792\\_v5\\_P.pdf](http://www.bcb.gov.br/pre/normativos/busca/downloadNormativo.asp?arquivo=/Lists/Normativos/Attachments/47507/Res_3792_v5_P.pdf).

<sup>33</sup> CCB and CCCB are common credit products in Brazil between firms and banks.

- (b) *Nota de Crédito a Exportação* (NCE) and *Cédula de Crédito a Exportação* (CCE), which are securities issued by public companies in Brazil and related to exports/international trade financing
- (c) FIDC and *Fundos de Investimento em Fundos de Investimento em Direitos Creditórios* (FICFIDC), funds and funds of funds, respectively, focused on private debt
- (d) *Certificado de Recebível Imobiliário* (CRI)
- (e) *Cédula de Crédito Imobiliário* (CCI)
- (f) *Cédula de Produto Rural* (CPR), *Certificado de Direitos Creditórios do Agronegócio* (CDCA), *Certificado de Recebíveis do Agronegócio* (CRA), and *Warrant Agropecuário* (WA)
- (g) Group of other securities issued by listed companies, except debentures, or by securitization companies:
  - **Equities:** 70 percent - This segment includes investments in SPVs.
  - **Structured investments:** 20 percent - As mentioned, FIPs are in this category.
  - **Investments abroad:** 10 percent.
  - **Real estate:** 8 percent.
  - **Transactions with participants:** 15 percent.

There are also concentration limits and credit quality parameters established for issuers. The main rules were modified in November 2015 by CMN Resolution 4,449. This ruling allowed certain players to invest in infrastructure debentures (Brazilian project bonds).<sup>34</sup>The resolution applies to pension funds (both open and closed), insurers, reinsurers, ‘capitalization’ companies,<sup>35</sup> and ‘Individual Programmed Retirement Funds’ (FAPIs). The changes related to investments in project bonds are described below:

- **Asset classes** - Project bonds were inserted in the fixed-income class as defined by Law 12,431 (2011), being issued by corporations (private sector or public

<sup>34</sup> [http://www.bcb.gov.br/pre/normativos/busca/downloadNormativo.asp?arquivo=/Lists/Normativos/Attachments/50108/Res\\_4449\\_v1\\_O.pdf](http://www.bcb.gov.br/pre/normativos/busca/downloadNormativo.asp?arquivo=/Lists/Normativos/Attachments/50108/Res_4449_v1_O.pdf).

<sup>35</sup> These are companies offering raffle-linked savings plans. They have been present in Brazil since 1929. Under these plans, savers are eligible for prizes in products or cash, distributed according to periodic drawings, in return for a lower yield on their savings. There is also generally a penalty for redemption of the amount deposited before the maturity date (date of each drawing). The deposit is made by the purchase of ‘savings tickets’ (*títulos de capitalização*), typically with automatic rollover of the investment with each drawing unless the customer opts out. Virtually all commercial banks offer this savings product, through subsidiary ‘capitalization’ companies.

sector) and having as guarantees federal government securities representing at least 30 percent of the principal on the maturity date.

- **Concentration limits by issuer** - Maximum of 15 percent in project bonds.

From the rules outlined, some inferences can be drawn as follows:

- (a) Apparently, there are no severe restrictions on pension funds' investments in infrastructure, through the newly created project bonds, FIPs, SPVs, corporate bonds, or stocks. The exposure of funds to infrastructure assets can be increased.
- (b) The high real interest rate<sup>36</sup> combined with the possibility of applying 100 percent of the capital in Brazilian government bonds may explain the low demand for products such as infrastructure assets.

Another important question concerns the possible differences between Brazilian rules and those in other countries. Apart from specifics between the Brazilian case and the United States (in the United States, for example, it is possible to allocate 100 percent of capital in equities), we were not able to identify significant differences when comparing the rules and limits practiced in Brazil with respect to other relevant jurisdictions.<sup>37</sup>

### 6.1.2. Insurance Companies

CMN Resolution 4,444/2015 recently regulated investments made by insurance companies in Brazil.<sup>38</sup> The asset classes available follow common standards adopted by financial markets. The concept includes fixed income, variable income, real estate, investments subject to exchange rate variation, and others.

There are similarities between the limits imposed on pension funds and some flexibilities. For fixed-income instruments, 100 percent of the capital can be allocated in government bonds or related assets and up to 75 percent in securities issued by public sector companies. Up to 25 percent is allowed in a class of other assets, including securities issued by SPVs—if the funds are raised to implement infrastructure projects. According to Law 12,431/2011, the limit is 30 percent.<sup>39</sup> Investment in equities, real estate, and others also can be 100 percent of the capital, highlighting a rule that potentially has an impact on the funding available for infrastructure. In this case, there

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<sup>36</sup> On August 17, 2016, the yield to maturity of the NTN-B 2014 was 5.82 percent. See [http://www.anbima.com.br/merc\\_sec/resultados/msec\\_17ago2016\\_ntn-b.asp](http://www.anbima.com.br/merc_sec/resultados/msec_17ago2016_ntn-b.asp).

<sup>37</sup> The OECD releases every year a survey about pension fund rules around the world. See <https://www.oecd.org/daf/fin/private-pensions/2015-Survey-Investment-Regulation-Pension-Funds.pdf> and <http://www.oecd.org/pensions/private-pensions/annualsurveyofinvestmentregulationofpensionfunds.htm>.

<sup>38</sup> <http://www.bcb.gov.br/htms/normativ/Resolucao4444.pdf?r=1>.

<sup>39</sup> The same rules for pension funds with relationship to project bonds (*debêntures de infraestrutura*) must be followed by insurance companies according to CMN Resolution 4,449/2009.

are limits of 75 percent for FIPs (included in 'others' category as 'structured products'). Once again, the rules adopted in Brazil do not seem to be as strict compared to those in other jurisdictions.<sup>40</sup> Hence, insurance companies would have some room to invest in other asset classes, including infrastructure.

### 6.1.3. Energy Trading in Organized Markets - Energy Exchange

Similar to other markets, the creation of an organized environment for energy trading based on free market environment, an energy exchange, could potentially increase efficiency in the sector in Brazil.

Stock exchanges or derivatives exchanges help create markets. Through the provision of services related to custody, clearing, settlement, and risk management, such trading platforms can add transparency, improving the price formation process. Also, transparency of price formation leads to increases in efficiency and better decisions by investors interested in energy assets. Exchanges also have to comply with minimum corporate governance principles, according to local jurisdictions and securities commissions (like the CVM in Brazil).

Discussions concerning the development of a power exchange in Brazil are recurrent. Since 2011, for example, at least two electronic platforms were launched, Brix and *Balcão Brasileiro de Comercialização de Energia* (BBCE). These created an agile system for energy trading of contracts with physical settlement. Brix and BBCE also intended to trade contracts that have only financial settlement—a pure financial product associated with energy prices, like traditional commodity derivatives.

Recently, Compass, a trading company that is a partner of Brix, registered the first financial agreement involving energy for trading on the BM&FBovespa. The firm had already closed the first financial agreement for energy of the country's power market in December 2015, registered with Cetip.<sup>41</sup> The difference now is that the BM&FBovespa, in addition to registering the contracts, is also considering carrying out the financial settlement of transactions. Additionally, Brix signed a protocol with BM&FBovespa to use continuous registration and settlement services provided by the exchange. Thus, the energy market would operate as a de facto exchange.

At least for now, these events will not affect the CCEE, which will continue recording and clearing energy contracts for physical delivery. However, considering that physical energy contracts (or

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<sup>40</sup> <https://www.oecd.org/g20/summits/antalya/Regulation-of-Insurance-Company-and-Pension-Fund-Investment.pdf>.

<sup>41</sup> Cetip operates under CVM and the Central Bank's authorization and is Brazil's central depository for private fixed-income securities and over-the-counter derivatives, as well as Brazil's largest private asset clearinghouse. As a central securities depository, Cetip processes the registration, custody, and settlement of securities, as well as, when applicable, the payment of interest and other events related to them.

'deliverable' contracts) already are traded on institutions like Chicago Mercantile Exchange<sup>42</sup> (CME Group) and considering the technological changes related to distributed generation, mechanisms of demand response, and energy storage (batteries), it is important to think about the role to be played by the CCEE, a nonprofit entity subject to interference from the Brazilian government by design.<sup>43</sup>

## 6.2. Foreign Exchange Risk

The pronounced imbalances in the Brazilian public accounts combined with the scarcity of resources of the traditional infrastructure financing institutions that used to finance infrastructure enterprises require/recommend the creation of new financial instruments and a different risk allocation approach. Brazil needs to address important risk issues, to attract foreign investments that will finance the maintenance and expansion of its infrastructure network.

One of the main challenges to attract foreign investments arises from the fluctuations of the foreign currency in relation to the domestic currency, defined as the currency risk. In the Brazilian case, this is usually represented as the variation of the U.S. dollar against the real. Several factors make the management of the currency risk an important issue for long-term investments in Brazil, such as the need for external financing, the long payback horizon, the operational costs linked to relatively stronger currencies, the difficulty in renegotiating infrastructure assets, the non-commercialization of most the products involved in the infrastructure sector, and the tariff regulation system.

Basically, there are three stakeholders' groups that bear risks in an infrastructure project: investors, consumers, and government. In such a context, it is possible to analyze the advantages and disadvantages of allocating risks to each of these stakeholders' groups.

There are two main arguments that justify the allocation of the currency risks to investors. The first one is that developed financial markets provide the investor with a myriad of financial instruments aimed to hedge its investments. The second one is that investors are able to diversify risks investing in assets in different currencies. However, it must be taken into account that not every currency is covered by (sufficient) hedge instruments and that, empirically, there are not many multinationals in the infrastructure sectors with diversified investments.

The allocation of the currency risk to consumers is supported by two other arguments. First, it is argued that consumers are in great number and disperse. Hence, the risk is spread among all of them and no one would bear a significant portion of it. Second, it is argued that price is a good mechanism to generate an efficient demand response, because consumers are usually able to substitute the consumption of one good for another. However, it must be taken into account that

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<sup>42</sup> See for example [http://www.cmegroup.com/trading/energy/electricity/nepool-internal-hub-5-mw-peak-calendar-month-day-ahead-swap-futures\\_contractSpecs\\_futures.html](http://www.cmegroup.com/trading/energy/electricity/nepool-internal-hub-5-mw-peak-calendar-month-day-ahead-swap-futures_contractSpecs_futures.html).

<sup>43</sup> This topic is discussed in an accompanying Position Paper on Governance.

electricity and water expenditures may impose a relatively higher burden on low-income people—as high as 20 percent. Furthermore, the demand for such services is relatively inelastic.

Finally, the (partial) allocation of the currency risk to the government can be rationalized, because it is argued that the government has advantages in accessing information. For instance, the government has a better ability to anticipate future monetary policies and hold in some magnitude the power to influence the currency rate. Despite the fact that this allocation brings credibility to the country and elevates investors safety, a possible external political shock and uncertainty over the decisions taken by future governments may harm this stability. Furthermore, although it can be argued that the risk is going to be diversified among a great number of tax payers, the difficulty of allocating the currency risk to the government is that, by nature, the government carries a large currency risk, and in a currency crisis, the duties related to infrastructure sectors may be overlooked. Hence, the creditors are very skeptical and often doubt whether the government's guarantees will actually be honored. In addition, it is argued that the government must assume this risk simply because other stakeholders are not willing to bear it, and at the same time, allocating this risk to consumers might impose a high social cost.

Recently, the government has been proposing innovative instruments in concessions and privatization contracts, creating intrinsic hedging mechanisms to manage the exchange risk.

It is possible to trace back to 2001 the proposition of a currency risk protection instrument to cope with this risk for investments in the natural gas sector. The construction of the Bolivia-Brazil gas pipeline (GasBol) increased the availability of natural gas paving the way to investments in thermal power plants fueled by the resource. To increase the country's power supply, the Priority Thermoelectric Program was established in 2000, aiming to create conditions to attract investments to natural gas thermoelectric plants. The three main features implemented at the program were the guarantee of a special price of natural gas for the thermals of the program (adjusted annually), guaranteed purchase of electricity by distributors (PPAs), and favored conditions to credit from the BNDES.

The currency risk was perceived at that moment as an undermining factor of the effectiveness of the program. Because 80 percent of the gas used by the natural gas plants was imported from Bolivia and purchased in U.S. dollars while sold in Brazil in local currency, the currency risk was an intrinsic feature of this scheme. It was feared that a devaluation of the Brazilian real would make the loans taken for the power plants' construction unfeasible. To solve this problem and encourage investments, the government proposed a currency risk hedge instrument to the program.

The mechanism consisted of fixing the gas price paid by the thermoelectric plants in Brazilian real for 12 months, regardless of the exchange variation. The difference between the price paid for the gas abroad and the amount disbursed by the power generator is initially charged to Petrobras within the year. In the following year, the accumulated difference is corrected by SELIC, the Brazilian basic interest rate, and is passed through to electricity tariffs.

**6.2.1. The Case Study of the Airports Sector**

The most recent innovative hedging instrument created by the government was adopted in the last airport’s auction on March 16, 2017. The auction’s results were auspicious, granting a total amount of R\$3.72 billion for the airports of four state capitals in the country, namely Porto Alegre, Florianópolis, Salvador, and Fortaleza.

The Brazilian effort to develop and design mechanisms to attract foreign investors was effective, allowing the entry of three experienced international airport operators —Vinci Airports, Zurich Airport International AG, and Fraport AG Frankfurt Airport Services. Therefore, it is worth noting that the profile of investors attracted by the new financial model established at this last auction significantly differ from the group of investors attracted by the previous airports auction model, in which the consortia composed of contractors and/or related parties were awarded winners. Table 6 summarizes the auction results:

**TABLE 6. RESULT OF THE AUCTION OF AIRPORT CONCESSIONS - MARCH 2017**

AIRPORT	WINNER COMPANY	ACCEPTED BID (BRL)	MINIMUM BID (BRL, MILLIONS)	NUMBER OF COMPETITORS	TOTAL NUMBER OF BIDS
<b>Fortaleza</b>	Fraport AG Frankfurt Airport Services	425,000,000.00	360	2	6
<b>Salvador</b>	Vinci Airports	660,943,107.00	310	1	1
<b>Florianópolis</b>	Zurich International Airport AG	83,333,333.33	53	2	11
<b>Porto Alegre</b>	Fraport AG Frankfurt Airport Services	290,512,229.00	31	2	8

Source: Elaborated by FGV CERI.

**6.2.2. Evaluating the Inclusion of Market Solutions**

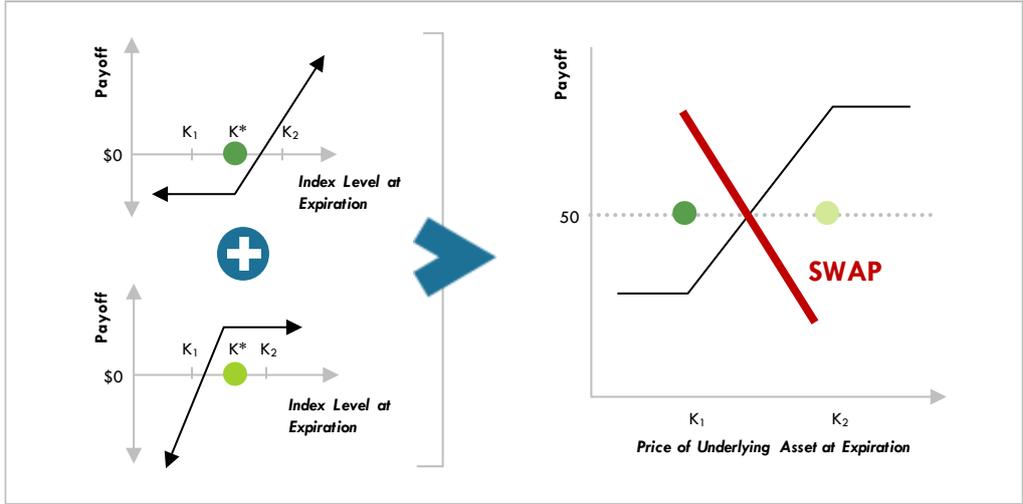
One of the innovations of this auction was the introduction of a currency risk mitigation mechanism, with optional adhesion. This mechanism enables that changes in the exchange rate in one year that exceed a reference component (variation in the inflation rate and country risk component) be offset by a reduction or increase in the amount to be collected as grant.

The mechanism establishes two ways to vary the concession fees to compensate for currency rate changes. On one hand, in the event of devaluation of the Brazilian real, the due concessions fees can be lowered. This reduction can be as high as the total amount due in a given year. Whenever the compensation exceeds this amount, they may lead to compensations in the following year. In turn, in the case of Brazilian currency appreciation, the grant value increases. However, in this last scenario, the increase in the license fee is limited to 10 percent of its reference value.

The National Aviation Fund – (*Fundo Nacional de Aviação Civil*, FNAC) – plays an important role in this process, providing resources to sustain this mechanism. Managed by the Civil Aviation Secretary (*Secretaria Nacional de Aviação Civil*), the FNAC is a fund that collects the license fees in the civil aviation sector, acting as a backstop guarantee de facto.

The mechanism adopted works as a hedge, which can be determined as a two-option combination offered by the government – a Margrabe option, in which one asset is exchanged for another (in this case the currency rate change is exchanged for the Benchmark Value), and a Cash-or-Nothing option, in which the cash flow is some amount of money or zero. In practice, the mechanism created by the Federal Government can be assessed as a derivatives box, intended to deal with the currency risk. Furthermore, according to this mechanism, the government completely absorbs the total currency risk.<sup>44</sup>

**FIGURE 17.** A ZERO-COST COLLAR AND A CURRENCY SWAP



Source: Elaborated by FGV CERl.

The analysis of the mechanism as a derivatives box allows the comparison of the financial instrument offered by the government to financial derivatives normally used by the companies to mitigate the risks inherent to currency value changes in other scenarios. In this case, through the introduction of a zero-cost collar<sup>45</sup> and a currency swap (see Figure 17), it is possible to significantly reduce the compensation amount to be discounted from the grant value or even reduce the contribution amount to the FNAC beyond the reference value in case of appreciation of the Brazilian currency. Table 7 reports the results of the mechanism proposed by the government.

We claim that by resorting to solutions available in the financial markets, it would be possible to achieve better results. For the values considered in the example presented by the government, it would be possible to reduce hedging costs. The adoption of currency financial derivatives is a safe path for the introduction of a technology already known by investors and foreign banks.

<sup>44</sup> An important concern is regarding the sudden exhaustion of the resources destined to the FNAC in the occurrence of an adverse and high-level foreign exchange fluctuation. In a scenario of high demand for projects, the available resources could also be depleted.

<sup>45</sup> The zero-cost collar is a structure that combines two options such that the total cost is zero and the cash flow is limited to a maximum value and a minimum value, corresponding to the options' strikes.

**TABLE 7. THE PROPOSED MODEL BY THE GOVERNMENT**

SCENARIO	$M_t$ MARGRABE OPTION (+)	$CN_t$ CASH-OR-NOTHING OPTION (-)	TOTAL RESULT	PRACTICAL EFFECT
$S_t > B_t$	$S_t - B_t$	0	$S_t - B_t$	'Grant' at moment t is reduced by the total result
$S_t < B_t$	0	$X_t = \min \{ B_t - S_t; 10\% CP \}$	$-X_t$	'Grant' at moment t is increased by the total result

**Note:**  $B_t$  = Benchmark Value ; CP = Grant's Reference Value ;  $S_t$  = Currency Rate;  $X_t$  = Cash Flow .

**TABLE 8. THE COLLAR AS A HEDGE OF A DEBT IN A FOREIGNER CURRENCY**

SCENARIO ( $S$ REPRESENTS THE CURRENCY RATE)	Long Put $t_t$ (+)	Short Call $t_t$ (-)	Debt $t_t$ (+)	TOTAL RESULT
$S_t > K_2$	0	$S_t - K_2$	$S_t$	$K_2$
$S_t < K_1$	$K_1 < S_t$	0	$S_t$	$K_1$
$K_1 < S_t < K_2$	0	0	$S_t$	$S_t$

**Note:** Rolling Zero-cost collar: The limits  $K_1$  and  $K_2$  are obtained for each year horizon and in a way that the combination costs 'zero'. Then, the effect of extreme exchange rate variations is limited by the instrument. Smaller variations can be protected with a traditional swap (see Figure 1).

### 6.2.3. The Government's New Challenge: Scaling FX Hedging

The merit of the government's solution is to combine two fundamental features: a mechanism intended to deal with the currency risk (derivatives box) and the use of the FNAC's cash flow as collateral, a de facto financial guarantee. The most relevant question to be answered is whether the proposed mechanism can be replicated and/or extended to other sectors. In this sense, it is important to assess the availability of funds and resources that could be used as guarantee, such as the FNAC. The power sector (electricity and gas) can be considered as a natural candidate to this kind of mechanism followed by others such as the transport and sanitation sectors.

## 7. Concluding Remarks

One of the main challenges to foster the growth and development of the Brazilian power sector is the challenge of long-term financing. Even though the topic is broad in scope, our analysis focuses on the interaction between the supply and demand for financing, taking the power sector as a reference. Additionally, it is important to investigate the environment in which the trading (financial closure) takes place. This environment is the result of interaction between several regulators: antitrust authority, sectoral regulator, and capital market regulator, among others.

Our initial contribution starts with a diagnosis of the problem (the lack or scarcity of funds allocated to investments in the power sector) and then covers the policy of long-term lending from

public banks, aiming to identify structures and mechanisms that can contribute to the development of long-term financing in Brazil.

Below, we present a preliminary set of key issues and policy recommendations:

- (a) The unfavorable macroeconomic environment clearly distorts the relative rates of return. Despite the rules for institutional investors, including pension funds and insurance companies, it is important not to restrict the classes of available assets, which today are highly concentrated in Brazilian government securities.
- (b) Brazilian private banks have low participation in infrastructure financing or long-term assets. This situation can become even worse with the implementation of Basel III, negatively affecting the state-owned banks such as CEF, BNDES, and Banco do Brasil.
- (c) Considering financial instruments and products, we did not identify major deficiencies in comparison with international standards. Recent initiatives like the creation of infrastructure debentures are similar to those implemented in other countries, including tax features—project bonds. Local financial markets also already have attractive structures that can be used in a more efficient way—good examples are the infrastructure FIPs.
- (d) The role of the BNDES should be reassessed, including investigating alternative roles such as market making or guaranteeing loans from private banks or even bond issues, leaving more room for the private sector to act. The development bank can act as a facilitator for the placement of long-term bonds in the market and act as an advisor to companies and projects and to public sector entities at various levels. Conditional on the rules of the Fiscal Responsibility Law, the bank could help, for example, in the issuance of municipal bonds to fund sanitation and water projects (services typically provided at the municipal level).
- (e) Fostering discussions, including through the media news, about how to improve the trading environment in the free market to create a power exchange is also welcome. This process probably will induce improved governance, adding transparency in price formation, with positive impacts on investment decisions within the sector.
- (f) In addition to the inevitable adjustments in macroeconomics, the process of modeling and risk allocation in attribution processes—concessions, privatizations, and PPPs—should be improved to reach better relative profitability (risk adjusted) for the projects in comparison to the competitors (government bonds and other financial assets). The evidence presented, together with case studies about risk matrices of selected recent Brazilian projects, indicates that there is room for significant improvement. Successful experiences in other countries about methods and alternative designs—Canada, Australia, and Chile—are good examples on how to achieve this.

- (g) Finally, with the goal of turning energy infrastructure projects into an asset class, the Brazilian government should help mitigate regulatory risks. Recent interventions in the sector have undermined the expected returns on assets that would typically be attractive for long-term investors. Power distribution provides some evidence, with assets changing from 'cash cows' to 'dogs'.<sup>46</sup>

Therefore, despite the essential adjustments and reforms that must take place in the macroeconomic environment, there are a number of points that deserve attention with regard to better functioning of the markets involved—financial markets and energy assets (commodities and networks), both from demand and supply sides. Addressing such issues is of essence to attracting private participation in infrastructure as a whole from a larger group of investors. Our analysis aims at contributing to this discussion, starting with the power sector experience.

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<sup>46</sup> The reference is already mentioned in 'BCG Matrix' where 'cash cows' are investments with stable cash flow profile and 'dogs' should be avoided.

## 8. Appendix

TABLE 9. WIND POWER PROJECT RISKS

WIND POWER PLANT			
RISKS CATEGORY	DEVELOPED	EMERGING	BRAZIL
Land purchase and site risk	Private	Private	Private
Environmental and social risk	Private	Private	Private
Design risk	Private	Private	Private
Construction risk	Private	Private	Private
Completion (including delay and cost overrun) risk	Private	Private	Private <sup>5</sup>
Performance/ price risk	Private	Private	Shared <sup>6</sup>
Resource or input risk	Private	Private	Private
Demand risk <sup>1</sup>	Shared	Public	Shared <sup>4</sup>
Maintenance risk	Private	Private	Private
Force majeure risk	Shared	Shared	Shared <sup>7</sup>
Exchange and interest rate risk	Private	Private	Private
Insurance risk	Private	Shared	Private
Political risk <sup>2</sup>	Shared	Shared	Shared
Regulatory/change in law risk	Shared	Shared	Shared
Inflation risk	Private <sup>3</sup>	Private	Public
Strategic risk	Private	Private	Private
Disruptive technology risk	Shared	Shared	Private
Early termination (including any compensation) risk	Shared	Shared	Shared <sup>8</sup>

**Notes:**

1. It is private when the PPA does not contain a Take-or-Pay Obligation.
2. Included ad force majeure.
3. In developed countries the inflation risk is typically borne by Private Partners.
4. The energy contracted in the regulated market contains a take-or-pay obligation. Moreover, when facing a rationing due to a high increase in demand, all will be impacted.
5. Some former contracts present exemption from completion risk for plants able to generate energy, but facing transmission constraints. Currently, this is a private risk.
6. If issues that impact cash flow are considered as performance risk, it can be said that for projects enabled within the regulated environment, the risk is shared with the consumer through the bands of annual and quadrennial attenuation.
7. Force majeure events are planned in the Brazilian Civil Code (Law 10.406 / 2002) and are mentioned in the contracts for both free and regulated environments. Its occurrence, duly proven, exempt the buyer and/or the seller from contractual obligations.
8. There are contracts signed in the regulated environment auctions which provide that if the entrepreneur completes its project before the established deadline, the contract takes effect at the beginning of commercial operation.

**TABLE 10. LARGE HYDROPOWER PROJECT RISKS**

HYDRO POWER PLANT - BOOT			
RISKS	DEVELOPED	EMERGING	BRAZIL
CATEGORY			
Land purchase and site risk	Private	Public	Public
Environmental and social risk	Private	Private	
Design risk	Private	Private	Private
Construction risk	Private	Private	Private
Completion (including delay and cost overrun) risk	Private	Private	Private
Performance / price risk	Private	Private	
Resource or input risk	Private	Public	Private <sup>1</sup>
Demand risk	Shared	Public	Shared
Maintenance risk	Private	Private	
Force majeure risk	Shared	Shared	
Exchange and interest rate risk	Private	Shared	
Insurance risk	Private	Shared	
Political risk	Private	Shared	
Regulatory/change in law risk	Shared	Shared	
Inflation risk	Public	Public	Public
Strategic risk	Private	Private	Private
Disruptive technology risk	Private	Public	
Early termination (including any compensation) risk <sup>2</sup>	Shared	Shared	

**Notes:**

1. Consequences: GSF and the Judicialization
2. Where termination arise from a party's default, the defaulting party may be obliged to pay damages based on a mark to market assessment of losses.

**TABLE 11. POWER TRANSMISSION PROJECT RISKS**

POWER TRANSMISSION - BOOT			
RISKS	DEVELOPED	EMERGING	BRAZIL
CATEGORY			
Land purchase and site risk	Shared	Shared	Shared
Environmental and social risk	Private	Private	Private
Design risk	Private	Private	Private
Construction risk	Private	Private	Private
Completion (including delay and cost overrun) risk	Private	Private	Private
Performance/ price risk	Private	Private	Private
Resource or input risk	Private	Shared	Private <sup>1</sup>
Demand risk	Public	Public	Public
Maintenance risk	Private	Private	Private
Force majeure risk	Shared	Shared	Shared
Exchange and interest rate risk	Private	Private	Private
Insurance risk	Shared	Shared	Shared
Political risk	Public <sup>2</sup>	Public	Public
Regulatory/change in law risk	Shared	Shared	Shared
Inflation risk	Public	Public	Public
Strategic risk	Private	Private	Private
Disruptive technology risk	Public	Public	
Early termination (including any compensation) risk	Shared	Shared	

**Notes:**

1. Why shared? Because there may be specific instances in which the Private Partner may need to share this risk with the CA, such as reliance on local source materials where these may be affected by labour disputes, embargos and other political risks.
2. Maybe it is possible to find examples that violate this rule. Quality regulation and the Variable Parcel.
3. Contracting Authority bears the risk of obsolescence.
4. The Abengoa case. How is it treated under the Bankruptcy Law.

**TABLE 12. NATURAL GAS DISTRIBUTION PROJECT RISKS**

NATURAL GAS DISTRIBUTION - ROT <sup>4</sup>			
RISKS CATEGORY	DEVELOPED	EMERGING	BRAZIL
Land purchase and site risk	Shared	Public	Public
Environmental and social risk	Private	Shared	Private
Design risk	Private	Private	Private
Construction risk	Private	Private	Private
Completion (including delay and cost overrun) risk	Private	Private	Private
Performance/ price risk	Private	Private	Private
Resource or input risk	Shared	Shared	Shared (or Private) <sup>1</sup>
Demand risk	Public	Public	Each Concession Contract <sup>2</sup>
Maintenance risk	Private	Private	Private
Force majeure risk	Shared	Shared	Shared
Exchange and interest rate risk	Private	Shared <sup>3</sup>	
Insurance risk	Shared	Shared	(?)
Political risk	Public	Public	Public
Regulatory/change in law risk	Shared	Public	Public
Inflation risk	Shared	Public	Public
Strategic risk	Private	Private	Private
Disruptive technology risk	Public	Public	Public
Early termination (including any compensation) risk	Shared	Share	

**Notes:**

1. The Contracting Authority is usually responsible for ensuring there is sufficient quantity of on-line pack gas within the system.
2. Further analysis to be discussed/presented are ES and SP. There is a guaranteed ROR.
3. (...) in particular it is common practice to index a portion of operating costs to movements in foreign currencies, hedging whenever possible.
4. ROT: Rehabilitate-Operate-Transfer
5. It may be argued there is a Private risk allocation. COMGAS-BG

**TABLE 13. EXCHANGE RATE AND INTEREST RATE RISK**

EXCHANGE AND INTEREST RISK			
PROJECT	DEVELOPED	EMERGING	BRAZIL
Hydro Power Plant - BOOT	Private	Shared	
Wind Power Plant	Private	Private	Private
Power Transmission - BOOT	Private	Private	Private
Natural Gas Distribution - ROT	Private	Shared <sup>1</sup>	

**Notes:**

1. (...) in particular it is common practice to index a portion of operating costs to movements in foreign currencies, hedging whenever possible.



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