



Infrastructure and its role in Brazil's development process



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ABSTRACT

This article considers the relationship between growth and infrastructure spending in the Brazilian context and the nature and causes of infrastructural underinvestment. The paper begins by considering the relationship between infrastructural investment and economic growth on both a national and regional basis. Next, focusing on the critical urban transportation sector, the paper gauges the infrastructural shortfall facing Brazil and the policies designed to overcome it. Given the obvious importance of infrastructure, why has investment not been higher? In the final section we argue that a central reason for this lies in regulatory design and implementation.

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1. Introduction

Well before the emergence of its current political and economic crisis, Brazil's once favorable track record on inclusive growth masked serious structural deficiencies. One of the most important of these centered – and continues to center – on the quality and quantity of its infrastructure. The infrastructural challenges facing Brazil are epitomized in the well documented difficulties that surrounded the construction of facilities for the 2016 Rio Olympics. However, the infrastructural issue runs far deeper than this heavily publicized case, extending across transportation, energy, telecommunications, sanitation and housing.

Infrastructure has moved to the heart of the policy agenda in Brazil. Since 2007, the authorities have been attempting to engineer a step change in the scale and quality of infrastructure across a range of strategic sectors. One major effort in this direction, realized under the Lula and Rousseff administrations, was the Growth Acceleration Program (or PAC, to use the Portuguese acronym). This envisaged significantly raised investments in highways,

railways, energy, air transportation, telecommunications, housing, water and sanitation. However, for reasons that will be made clear, the ambitions embraced by the PAC were far from fully realized. This rendered Brazil subject to significant supply side constraints. In attempt to remedy the issues surrounding PAC, the interim administration of President Michel Temer has launched a revised infrastructure development program under the PPI (Program of Partners and Investment) label. This embraces a significantly elevated role for private sector capital, with a renewed emphasis on public private partnerships.

The ingrained challenges surrounding infrastructure form both the background and stimulus for this paper which adopts the following structure. First, Section 1 briefly considers the relationship between infrastructural investment and economic growth. This relationship is examined on both in relation to the Brazilian experience and more broadly. A highly positive link is established between infrastructural investment and growth. Bearing this in mind and Brazil's long-term growth underperformance vis-à-vis other major emerging market economies, the question then is to what extent and why has Brazil failed to channel more resources in this direction? Section 2 gauges the infrastructural shortfall facing Brazil, with extra focus on the urban transportation sector. The urban transportation focus in our paper stems from the especially high profile of this sector in the Brazilian infrastructure debate. This

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has been driven by the obvious ramifications for social inclusion and quality of life in cities. Attempting to understand why chronic underinvestment has arisen, Section 3 briefly analyses the evolution of recent infrastructural policies (especially the PAC) while Section 4, focusing on regulatory issues, considers why such policies have fallen short of expectations.

2. The importance of infrastructure to economic growth in Brazil

As indicated above, investment in Brazil's infrastructure has become a policy priority. The priority status of infrastructural investment derives in large part from a belief that it is pivotal in boosting growth performance. What is the empirical validity of this view? In the remainder of this section we briefly consider the relationship between growth and infrastructural investment in the Brazilian and broader international context.

The causal link between infrastructure and economic growth is one of the hardest relations to assess in macroeconomics. Economic growth feeds investment in infrastructure, and the resulting infrastructure accumulation impacts economic growth. The evident endogeneity between these two variables due to simultaneity can confound the analysis, to the extent that authors have implemented a significant number of identification strategies to obtain reliable results (Straub, 2008). Examining a broad sample of this empirical literature (64 studies in fact) Straub identifies a reasonably strong link between infrastructural investment and output.

Specifically, this link held (and across countries of different income levels) in three quarters of the studies that employed a physical measure of infrastructural investment. Interestingly, the link was less evident in studies that employed alternative measures (including monetary measures). In one of the most important recent studies (Calderón and Servén, 2011) the authors empirically establish an output elasticity of between 0.07 and 0.1 for infrastructural investment (measured in physical terms) across a range of 88 countries. In a useful literature review (Frischtak, 2013) summarizes the results of a further 6 influential international studies (using both physical and monetary measures) which demonstrate output elasticities ranging between 0.07 and 0.39. In the particular case of Brazil quantitative studies of infrastructural impacts have been very thin on the ground. Perhaps the most notable recent contribution has been based on the estimation of co-integration models between the 1960s and 2000s by Ferreira and Araújo (2007). Here, the authors establish the “significant impacts” on output that can be generated by shocks to infrastructure stocks (Ferreira & Araújo, 2007, p. 21). The authors further argue that past reductions in capital expenditures are likely to have had high costs in terms of foregone output and associated adverse social impacts.

In a more recent Brazil-focused study Brazil, Amann, Baer, Trebat, and Villa Lora (2014) analyze the sub-regional and national impacts of infrastructure spending on output. A novel feature of this study is its use of satellite-derived luminosity data as a proxy for GDP, the objective here being to circumvent the endogeneity issues which surround the econometric evaluation of the output–infrastructure relationship.

The results of the study indicate that spending on infrastructure has a positive effect on growth and per capita growth. Signs for GDP and luminosity data coincide. If the sub-national authorities – the states – increase their spending in one percentage point, then the regional GDP growth rate would increase by 0.11 percentage points per year, while the GDP per capita growth rate would respond with an increase of 0.072 percentage points per year. The effects of infrastructure spending on GDP are halved when economic activity is measured by luminosity data. The study also found that spending

on communication infrastructure yielded the highest gains in terms of eventual output increases.

An important point concerning the infrastructure–growth relationship, and one not always taken into account in available empirical studies, concerns the long term effect of infrastructural investment on demand for infrastructural services. Accepting that infrastructural spending is a strong driver of output, it follows that this in turn is likely to place further demands on the infrastructure stock, necessitating yet further investment (Frischtak, 2013, p. 324). Thus the challenge facing policymakers in Brazil and elsewhere to stimulate infrastructural investment is likely to be an ongoing one.

3. Brazil's infrastructural challenges: a brief snapshot

The previous section lends empirical support to the view that the infrastructural deficit facing Brazil represents one of the key structural obstacles to accelerated growth. Some idea of the scale of the challenge in international comparative terms is provided by the *World Economic Forum* rankings (Global Competitiveness Report 2013–14). In these global rankings of infrastructure quality Brazil's overall standing was at 114th place. The quality of its roads was ranked in 120th place, its railroads at 103rd, its ports at 131st, its air transport at 123rd, and its electricity supply in 76th place. A more thorough grasp of the issues can be gleaned by examining data on a sector by sector basis.

According to a 2012 World Bank study, of 1.75 million kilometers of highways, only 18% were paved.¹ This represents an especially significant deficiency bearing in mind that 60% of Brazil's freight moves by road. Moreover, in relation to optimal levels, the authorities have been spending far too little on highway maintenance. In the budget for 2011–14 less than 1% of GDP per annum has been set aside for such spending when, according to the World Bank, 6% of GDP would be necessary to catch up with advanced industrial countries. It is also important to note that the quality of highway infrastructure is heavily differentiated by region. While the South and South East are comparatively well served with divided multilane paved highways, the same is not true in some of the less developed regions of the country, notably the North, the North East and the Centre West. Even the capital, Brasília remains to be connected to the South's multi-lane “interstate” system. Partly for this reason, transportation costs are notoriously high in Brazil: spending on logistics represents 15.4% of Brazil's GDP. In advanced countries this is typically closer to 8–10%.²

Some of the shortcomings identified regarding Brazil's highway sector would not be so critical were the country's rail infrastructure to be highly developed. However, as is the case in most economies, the extent of the railway network is substantially smaller than that for paved roads in Brazil (five times smaller in fact).³ If one sums the paved and non-paved road network then the rail network is no less than 50 times smaller. Unlike in other key emerging market economies – China and India for example – rail transportation is almost exclusively the preserve of freight, the latter being heavily dominated by iron ore (which accounts for no less than 79% of total rail cargo). Brazil possesses just 3.4 km of rail per 1000 square km compared with 14.7 km in the United States.⁴ Another curious feature of the Brazilian rail network is that it possesses, rather as Australia did, a significant narrow gauge as well as standard gauge element. Such a feature poses a major challenge to network inter-operability.

¹ World Bank (2012).

² World Bank (2012).

³ *Ibid.*, p. 78.

⁴ *Ibid.* p. 79.

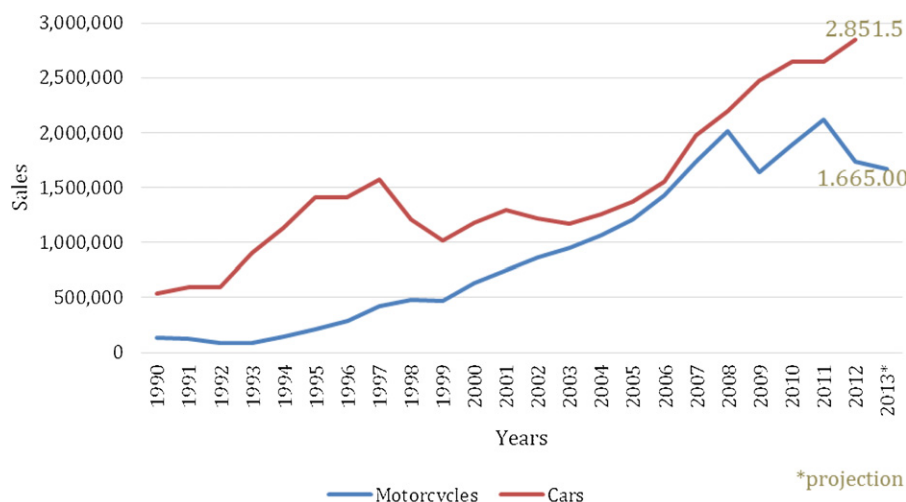


Chart 1. Cars and motorcycles/Sales in Brasil (1990–2013*)

Sources: ANFAVEA Annual Report – Anuário da Indústria Automobilística Brasileira 2013 (<http://www.anfavea.com.br/anuario2013/anfavea2013.zip>). ABRACICLO – Associação Brasileira dos Fabricantes de Motocicletas, Ciclomotores, Motonetas e Similares (http://www.abraciclo.com.br/images/stories/dados_setor/motocicletas/retrospectiva/2013_retrospecto_setor_motociclos1.pdf).

For an economy heavily dependent on exports of natural resources-based products Brazil suffers to a surprising extent from quality and capacity limitations in its port infrastructure. Despite limited privatization and accompanying investment in the sector, at turn of the 20th century inefficiencies remained. According to Micco and Perez (2002) ‘tariffs were three to six times higher than the international average, with long waiting times for ships’.⁵ The authors further establish that in ‘1998 the average cost of handling a 10-foot container in Buenos Aires was US\$ 180 – while in Santos, Brazil, it was US\$ 350. At that time 50 workers were required to handle a cargo ship in Santos, compared to only 14 in Buenos Aires’.⁶ Things did not improve by the second decade of the 21st century. According to one report: ‘while Brazilian ports handle on average 34 containers per hour per ship, ports such as Hamburg handle 66 containers and Singapore 100 containers; and berthing wait times are high and space is insufficient. The fact that Brazilian ports handle 95% of the country’s trade by volume and 85% by value underlines the scale of the problem and its broader ramifications. Important though the ports sector may be, for some authors, at least, they may not be the most pressing priority.

Another critical bottleneck comprises urban transportation. This sector came to global attention following urban unrest across a number of Brazilian cities in mid-2013. Unrest here had been sparked by a rise in bus fares and broader concerns around the cost and quality of urban transportation.

Brazilian cities are among the most car-dependent in the world (Biderman, 2009). Automobile production has grown from less than one million vehicles per year in the early 1990s to about 3.5 million in 2011. Domestic sales of autos have doubled in the 2005–2012 period and motorcycle sales also have shown dynamic growth (Chart 1).

Automobiles are near the intersection of big business and big government in Brazil. The country hosts more than 20 private companies producing vehicles in at least 53 plants; new entrants into this market appear regularly. The industry generates more than 150,000 jobs directly and many more indirectly through networks of suppliers, retailers, and providers of support services. Automobile sales generate significant tax revenues for the government

with something on the order of 30% of the final consumer automobile price comprised of various federal, state, and municipal levies.

Car ownership in Brazil as a whole is still relatively limited by international standards. The ratio of inhabitants per automobile in the United States, for example, is 1.2; this same ratio is 3.5 in Mexico, a middle-income society comparable to Brazil. In Brazil, the ratio is much higher – six residents per vehicle.⁷ Between 2008 and 2012, years of rapid economic growth in Brazil, the percentage of Brazilian homes with either an automobile or motorcycle increased by nine percentage points from 45% to 54% of all households.⁸ In some of the wealthier states in the south of Brazil, these ownership rates can be as high as 75% of households with access to a vehicle (IPEA, 2012b).

While individual motorized transport has expanded relentlessly, Brazil’s system of public transportation – buses, suburban railroads, subways, ferries, and so forth – is, for the most part, a study in decline. In Chart 2, the main ridership trends can be seen using long-term data from Rio. Cars are now the dominant mode of transport, surpassing and competing for urban space with public buses which is the only other important mode of transportation in the city. Streetcars have disappeared and, with only one exception, no light rail systems have been built to replace them.⁹ Commuter rail usage, even including subways, has barely increased. Most public transportation (on the order of 90% of all trips taken on public transportation) occurs on buses and related informal modes of transport, such as private vans. Rio has only 40 km of subway lines.¹⁰ Bus Rapid Transit (BRT) construction, a cheaper alternative to subways, accelerated in advance of the 2014 World Cup and 2016 Olympic Games; 160 km of such dedicated lanes were under construction.¹¹

⁷ Source: ANFAVEA.

⁸ Amplifying this point, the same IPEA (IPEA, 2012b) study showed that only 28% of the poorest households in Brazil in 2012 had an automobile whereas 88% of the richest households owned at least one car.

⁹ Rio inaugurated in 2016 a new light rail system in its downtown area.

¹⁰ By comparison, Mexico City, which started its system at about the same time, has 177 kilometers. Other systems in wealthier countries typically have more than 200 km and, in the case of London, more than 400 km of subways.

¹¹ Ironically, BRT systems were pioneered in a Brazilian city – Curitiba in the 1970s. The irony is that no other Brazilian cities have proven to be good imitators of Curitiba’s widely heralded success.

⁵ Micco and Perez (2002).

⁶ *Ibid.*, p. 28.

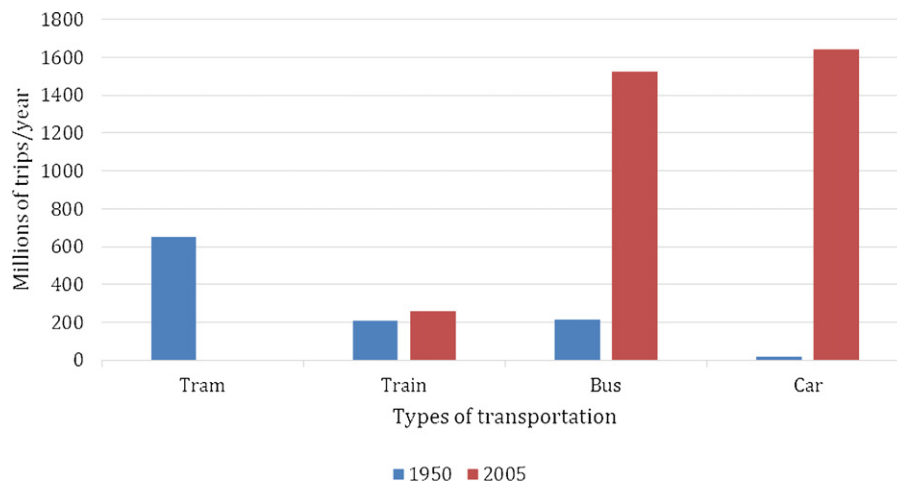


Chart 2. Long-term Trends in Mobility in Rio de Janeiro.

Sources: BNDES 60 anos, p. 316.

São Paulo is emblematic of the types of traffic problems that lie in waiting for other Brazilian cities. Some public investment in transport infrastructure is occurring, but it is relatively small. Following years of delay, São Paulo has a subway extension of 60 km and 120 km of BRT corridors. To put these advances in perspective, São Paulo has 17,000 km of roadways, 15,000 buses, 4300 km of regular bus routes, and 7 million cars with the car fleet growing by 650 new vehicles per day. Traffic backups in São Paulo typically extend to 100 km per day, peaking at between 200 and 300 km (Biderman, 2009).

Transportation modes in Rio and São Paulo are typical of other metropolitan areas. Chart 3 shows the relative importance and recent growth of transport modes. Aside from the fact that most trips taken in cities are by pedestrians on foot, the transportation system in urban Brazil is basically bimodal – private autos and municipal buses with growth of the former rapidly exceeding that of the latter. All other modes – subways, commuter rail, metropolitan region buses, etc. – account for very small percentages of rides taken in cities.

Most automobile owners in Brazil use vehicles primarily as a means to get to their places of employment. As congestion mounts, commute times are increasing. IPEA data show that the time required to commute one-way in Brazilian cities is already among the highest in the world (IPEA SIPS). The average time to commute to work is on the order of 30 min, but this is increasing and higher in the larger urban areas: 20% of urban dwellers

spend one hour or more to commute to work; in the two largest cities of São Paulo and Rio, 25% of commuters use more than one hour to get to work, especially residents of poorer, outlying districts (Biderman, 2009). In addition to the inefficiencies caused by lengthening commute times, other negative externalities are generated by the growing national reliance on cars. Traffic accidents, air pollution, inefficient use of public lands, and a national dependence on fossil fuel are among the additional by-products of dependence on cars.

As Brazilian cities become congested, technical solutions are not at hand. BRT construction may be the most attractive alternative, and it has worked well for the city of Bogotá (whose efficient Trans-Milenio system carries huge passenger volumes with relative speed and safety), but the experience of other Latin American cities (e.g., Santiago which faced great difficulty and public protests following the roll-out of its “Trans-Santiago” BRT system which became immediately overcrowded) shows that BRTs are not a cure-all. Subway expansion helps and is very popular, but the cost per kilometer of subway lines is eight times that of BRTs and constructing subways in the built environment of Brazilian cities adds delays and legal complexities. Other approaches to congestion alleviation do not play well politically in Brazil. Public and businesses do not support restrictions on vehicle use such as congestion charges, street closures, parking fees, circulation restrictions, higher vehicle and gasoline taxes, etc. Left undisturbed, the short-term and long-term trends point to increasing use of the private auto and a relative

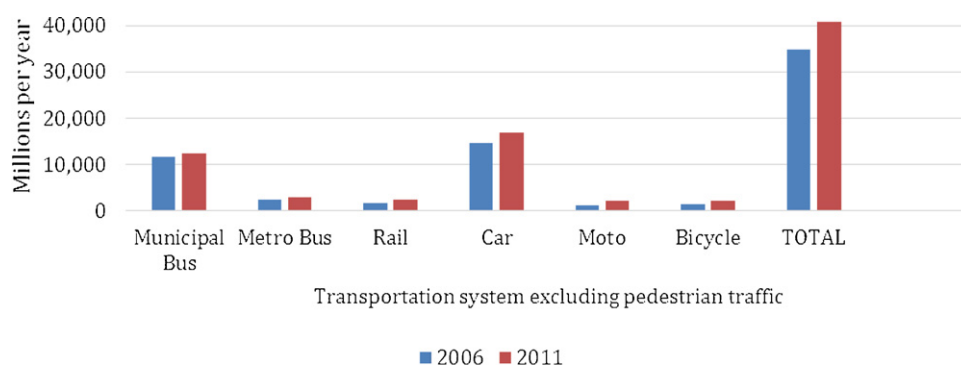


Chart 3. Urban mobility in Brazil: trips taken by mode of transport.

Source: National Association for Public Transportation (ANTP) 2011 and 2006 Annual Report.

decline in municipal buses. Seminars are regularly held in both Rio and São Paulo about what to do when these car-clogged cities eventually “stop”.

As will be seen below, the story of how Brazil came to this impasse in urban transportation as well as other critical sectors, emerges out of a history of neglect of infrastructure investment allied to longstanding regulatory issues.

4. Contemporary policy responses: The Growth Acceleration Program (PAC) and the role of the private sector

The previous two sections highlighted the fact of under provision of infrastructure in Brazil, together with clear evidence that any infrastructural investment that takes place is highly growth promoting. Given that failure to invest sufficiently in infrastructure represents such an obvious development priority, what policy measures have been implemented in response?

By the time of President Lula’s second mandate (2007–2011) a firm national consensus had developed around the necessity to tackle the infrastructural deficiencies and bottlenecks retarding growth and, by extension, the further alleviation of poverty. As in the case of earlier efforts to tackle inflation (see [Amann & Barrientos, 2014](#)) business groupings (such as the National Confederation of Industry), trade unions and civil society were in broad agreement over the need to tackle a serious structural issue, while the government proved more than willing to step forward with a pragmatic solution embracing elements of market liberalization and state-directed investment.

The resulting program, known as the PAC (Programa de Aceleração de Crescimento – Growth Acceleration Program) ([Morgan Stanley, 2010](#), p55) was introduced in 2007 at the beginning of President Lula’s second term. The PAC has divided into two phases, the first (PAC 1) running from 2007 to 2010 and the second (PAC 2), under the administration of Dilma Rousseff, from 2010 to 2014. They consist mainly of projects to increase infrastructure spending in critical, growth-sensitive areas (see [Table 2](#)). In terms of PAC 2, investments fall under six key initiatives: My House, My Life (housing), Water and Light for All (Water, Sanitation and Electricity), Bringing Citizenship to the Community (safety and social inclusion), Better Cities (urban infrastructure), Transportation (railroads, highways and airports) and Energy (renewable, oil and gas).

PAC I envisaged spending of R\$ 503.9 bn over its four year period while the more ambitious PAC 2 proposes spending of R\$ 958.9 bn over its lifespan (around 2.7% of 2010 GDP per year), with a further R\$631.6 bn of investments planned beyond 2014. The PAC, recognizing the limitations of previous spurts in infrastructural spending (notably the Second National Development Plan of the 1970s) also aims to address issues of infrastructural quality and durability by increasing public resources targeted at operation and maintenance.

Both phases of the PAC program have involved a central role for the Federal Government whose key strategic function embraces the selection of projects and the design of incentive mechanisms to encourage private, as well as public investments. However, the program has come under criticism for not delivering on its ambitious targets sufficiently rapidly. A brief review of the data suggests that these concerns may be – in the aggregate – overblown. Between the beginning of 2007 and the end of 2010, 82% of planned PAC 1 projects were completed with public investment rising to 3.2%¹² of GDP compared with around 2% prior to the program’s launch. It will be noted from [Table 1](#) that there was a significant

Table 1
Brazil: PAC investments, percent by sector.

Sectors	2007–10	After 2010	Total
Logistics	14.9	7.2	11.5
Energy	45.7	92.4	66.1
Social and urban	39.5	0.4	22.2
Total	100.0	100.0	100.0

Source: PAC, Morgan Stanley LatAm economics.

concentration of investment in PAC 1 located in social and urban infrastructure (mainly housing): this declined significantly in PAC 2. Furthermore, by the middle of 2016 fiscal pressures and the advent of President Temer’s interim administration had resulted in the number of housing units planned for the 2016–19 period falling by half to 1.5 m (*Globo Online Imóveis* 10.6.16).¹³

Data released in February 2014 show that 82.3% of PAC 2’s projects had been completed by the end of 2013 with accumulated spending reaching R\$773.4 bn, or 76.1% of the program’s total budget.¹⁴ Despite the scale of the program’s achievements in overall terms, it remains true that investment in certain critical sub-sectors – notably urban transportation, ports and sanitation – have met with significant delay. In the area of sanitation, for example, by the end of 2013, out of a total of 4128 sanitation projects scheduled to go ahead as part of PAC 2 only 54% had been granted formal approval and, of these, many have not reached the construction phase.

With the policy decision to tackle Brazil’s legacy of ingrained under spending on infrastructure two things became obvious; first that the state did not have the technical or managerial means to accomplish these projects by itself, and, second, that it did not have the financial wherewithal to see these projects through to completion. It was thus decided to turn to two models; the Public Private Partnership (PPP) and the longer-established model of concession contracts. According to [Spilki \(2012, p. 5\)](#) the PPP concept “is not a precisely defined term and represents a variation of concepts and possible structures”. In the Brazilian context these structures – or modalities of PPP – have included Build Own-Operate, Build Operate Transfer and Build Own Operate Transfer formats.¹⁵

However, their common feature, as established under a 2004 law, is that they envisage an injection of public sector resources to support the private sector’s investment activity ([Mourougane & Pisu, 2011](#), p. 14). Concession contracts, by contrast, under the terms of the law, require no such public funding and should be able to sustain themselves by the levying of (regulated) user charges alone. The PPP approach was pioneered in the highways sector in the 1990s and has continued to be applied in that area with 17,904 km of roads under private sector operation by late 2013, compared with 15,365 km by the end of 2010 (*O Globo*, p. 49 8.12.2013).

During the Rousseff administration – whether through PPPs or concessions – the private sector became increasingly involved not only in the construction and maintenance of highways, but also in the construction, expansion and maintenance of railroads, the modernization of ports, the expansion of power generation, and the modernization of airports. This experience stands in some contrast to the generalized perception that under Lula and Rousseff, the approach to management of the economy became more

¹³ <http://g1.globo.com/especial-publicitario/zap/imoveis/noticia/2016/06/minha-casa-minha-vida-deixa-de-atender-familias-de-baixa-renda.html>.

¹⁴ *Investorideas.com*, 20th February 2014 <http://www.investorideas.com/news/2014/international/02204.asp>.

¹⁵ For a full discussion of these concepts please see the World Bank PPP in Infrastructure Resource Center <http://ppp.worldbank.org/public-private-partnership/agreements/concessions-bots-dbos>.

¹² [Mourougane and Pisu, \(2011, p.10\)](#).

“statist”. Faced with continuing fiscal tightness (see Afonso, Araujo, & Farjado, 2016 in this issue) the major factor driving the progressive introduction of both PPPs and the concessions was the lack of public funds to fully underwrite the infrastructure projects from the public sector, and the perception that the private sector would be able to deliver infrastructure-based services in a more efficient manner than its public sector counterpart (Calderón & Servén, 2012, p. 679–684).

In the face of renewed fiscal pressure and the likely implementation of a measure to freeze federal spending in real terms over a multi-year period, the new interim administration of Michel Temer in mid-2016¹⁶ announced its intention to place further reliance on the PPP model with private banks, rather than their state-owned counterparts (notably the BNDES¹⁷) taking the lead in providing the necessary finance.¹⁸ Aside from the pursuit of fiscal adjustment the renewed focus on PPP-style models reflects the commitment of the new administration to reduce the scope of state intervention. The new program, the Programa de Parcerias e Investimentos (Program of Partners and Investments – PPI), envisages investments of R\$500bn over the 2016–2018 period (O Globo, Economia p. 15, 13.6.16). However, the principal sectoral focus of the PPI will not center on urban transportation, but rather on oil exploration and production, especially in the development of the pre-salt deposits. The total investment envisaged here amounts to some R\$ 408 bn (ibid.). A secondary focus of the PPI is formed by inter-city highways where spending of R\$ 49 bn is planned. Further investment in airports is planned under this program, the plans featuring as their centerpiece additional privatizations. However, at the time of writing, there were no signs of an enhanced commitment to investment in urban transportation, whether through the use of the PPI or other mechanisms. This has to be of concern given the chronic shortfalls in provision we have already identified.

5. Explaining the failure of infrastructural investment to take off: regulatory issues, access to finance and delays in infrastructural investment

A characteristic to date of infrastructure investments in Brazil has been the comparative slowness with which they have been rolled out. The delays in implementation (especially regarding those embodied in the PAC), in particular, have been blamed on the complicated bureaucratic mechanism which has grown over many generations governing the release of public funds and the very cautious approach of the authorities in running bidding competitions, especially in the field of the novel PPP contracts. However, there is a growing consensus (see, for example Amann & Baer, 2006; Cunha & Rodrigo, 2012; De Paula & Avellar, 2008) that it is the nature of regulatory governance in Brazil, and its attendant regulatory uncertainty, that have long been holding back investment.

The theme of regulatory governance has attracted growing attention in the development literature in general, and that dealing with the issue of Latin America infrastructure in particular.¹⁹ This has accompanied the rise of the ‘Regulatory State’ in developing and emerging economies as publically owned infrastructure and network industries were transferred to regulated, private ownership in the 1980s and 1990s (Dubash & Morgan, 2013). In specific terms, the concept of regulatory governance centers on ways in

which concession contracts or other public-private contractual arrangements are managed and established (Correa, 2007). More generally, Veljanovski (2010) considers regulatory governance as comprising those mechanisms through which societies manage the process of regulation. It has particular relevance to the analysis of private sector provision of infrastructure and public utilities. Effective regulatory governance arrangements should serve to reduce regulatory risk which in turn should drive up private sector investment (Correa, 2007, p. 1). Unfortunately, shortcomings in Brazilian regulatory governance have resulted in high regulatory risk in many critical sectors. Some examples here will serve to bear this point out.

A recurrent theme in the literature surrounding the persistence of high regulatory risk in Brazil is that of the sometimes weak autonomy of the regulators, both from governmental political interference and from the influence from the infrastructure providers themselves. Correa (2007, p. 2) in a survey of 21 of Brazil’s 27 infrastructure regulators found that “13 reported that the executive (ministry or governor) had made “highly” or “very highly” effective attempts to intervene” while 8 reported direct interventions. Prado (2013) identifies the electricity regulator, (ANEEL) for reasons of bureaucratic resistance, as having fewer institutional guarantees of independence than ANATEL. De Paula and Avellar (2008, p. 246–7) identify further evidence of strong party political influence at ANTT. The contrast between the experience of the solidly independent ANATEL, on the one hand with the more politically exposed ANEEL/ANTT on the other, seems of special significance when one contrasts the rapid expansion of the telecommunications sector following liberalization in 1998 with the slow progress observed in expanding electricity generation and distribution capacity and accelerating highways construction.

The case of highways construction is especially telling. Under the government of Fernando Henrique Cardoso in the 1990s, road tolls were set at a sufficiently high level to encourage private sector operators to enter what was then a very new market. This policy did lead to a rapid upsurge of private sector investment in the motorway network of the South and South East. However, the high level of tolls provoked popular opposition and the decision of some users to abandon the newly improved infrastructure for more congested – and dilapidated – public sector highways.

Compromising regulatory autonomy, President Lula, appealing to his political support base, suddenly changed the regulatory model for new highway concessions, selecting winning bidders on the basis of those able to offer the lowest tolls rather than on the basis of track record or capacity to deliver. Correspondingly, the pace of private sector-driven upgrading of the highway network has lagged behind schedule while there are curiously high disparities in toll levels between highways governed by Cardoso-era and Lula/Rousseff era contracts. As a result, tolls now vary between R\$1.99 and R\$18.56 per 100 km (O Globo 8.12.13). Similarly, political pressure on ANEEL to rein in tariffs underpins at least in part, the failure of much needed additional power generation and distribution capacity to be put in place in the urbanized South and South East. Stemming from this, power outages are by no means an infrequent occurrence and Brazil remains vulnerable to electricity shortfalls (Mourougane & Piso, 2011, p. 20). Recognizing the retarding effect low tariffs may have had on investment, interim President Temer’s PPI program features a task force which at the time of writing was examining the possibility of upward adjustments in user charges (O Globo, Economia p. 15, 13.6.16).

Another undesirable feature of Brazilian regulatory governance which, again serves to elevate regulatory risk, is identified by Cunha and Rodrigo (2012, p. 13) as weak institutional leadership and, allied to this, poor technical capacity and low efficiency

¹⁶ President Temer came to power as head of an interim administration in May 2016 following the launch of a Senate impeachment trial against President Dilma Rousseff.

¹⁷ Brazilian National Economic and Social Development Bank.

¹⁸ Agência Brasil 25.5.16 <http://agenciabrasil.ebc.com.br/economia/noticia/2016-05/especialistas-pedem-clareza-nas-regras-do-programa-de-parcerias-de>.

¹⁹ See, for example Jacobs and Ladegaard (2010) and Jordana (2012).

Table 2
The BNDES and its participation in infrastructural projects, 2003–2013.

	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013
Total infrastructure investments (US\$ bn)	22	26	29.1	29.6	30.3	36.4	41	40.7	45.9	53.2	54.4
BNDES disbursements to infrastructure (US\$ bn)	6	7.8	7.5	6.8	10.2	12.3	21.3	16.2	16.1	22.6	21.8

Source: Coutinho, 2015.

within some regulators. To try and combat this, financed by an Inter-American Development Bank loan, the PRO-REG program²⁰ was introduced in 2007. The central objective here was to drive up the quality of Brazilian regulators through a deliberate process of the diffusion of international best practice. However the results here have been modest at best and, according to international comparisons of regulatory quality, Brazil continued to fare poorly (OECD, 2011). A particular area of concern, where both quality of procedure and timeliness are issues is the case of IBAMA (Brazilian Environment Institute), the environmental regulator. Cunha and Rodrigo (2012, p. 12) describe this agency as “poorly equipped and institutionally weak”.

In fact, perhaps the most glaring obstacle to accelerated process has centered on the delayed issue of environmental permits by IBAMA and state-level bodies. The delays here have largely concerned the slow operation of dispute resolution procedures and the licensing mechanisms rather than the environmental regulatory provisions themselves (Mourougane & Piso, 2011, p. 17). Brazil's environmental licensing procedure comprises a three stage process involving the issue of Preliminary, Installation and Operating licenses, each of which requires its own procedures and creates separate scope for the generation of disputes and appeals. This stands in marked contrast to the more streamlined processes which are typically found in other emerging and developed economies. According to a World Bank study, no less than 15–20% of the budgets of hydroelectric projects in Brazil are accounted for by environmental licensing costs (World Bank, 2012). Easily the most celebrated case in this regard has been the Belo Monte dam project, which, in the wake of environmental disputes, has met with repeated delays and budget overruns.

Lack of strategic coordination and poor regulatory design are both features which have adversely impacted the urban transportation sector, a focal point of the previous section. Aside from the absence of adequate means to regulate effectively the setting of user charges (notably bus fares), according to Frischtak (2013) there also exists an absence of metropolitan governance mechanisms which would allow projects to optimize the use of available resources (p. 342). Successful integrated urban transportation networks around the world (for example those of Zurich and Paris) rely on strategic direction and planning by dedicated metropolitan authorities which enjoy the necessary financial autonomy and authority to direct and realize long term projects. The existence of such an authority in New York City, under the famed Chairmanship of Robert Moses, empowered by its ability to engage in bond issuance, was instrumental in the construction of the New York/New Jersey's network of bridges and tunnels in the mid Twentieth Century.²¹ This represented one of the greatest construction projects of modern times. In Brazilian cities, the existence of such autonomous, self financing authorities is notably lacking.

The quality of regulatory governance in Brazil, has since the emergence of the Petrobrás contractors' scandal (Operation Car Wash) in 2014, been yet further called into question. This scandal, which is still unfolding, has involved contractors to Petrobrás

(the state-controlled oil firm) paying billions of Dollars' worth of kickbacks to political parties via corrupt intermediaries. Significantly, most of the contractors identified have been among Brazil's largest builders of infrastructure. Aside from its broader political ramifications, the Car Wash affair threatens future infrastructure projects given the indictment of senior executives from Brazil's largest construction and capital goods firms. Given the scale of the legal problems in which leading Brazilian infrastructure firms as Odebrecht and Camargo Corrêa are now embroiled, the Temer administration's PPI program is said to be looking to foreign investors, notably consortia led by US and Australian private equity groups, to fulfill the lead functions once undertaken by these firms (O Globo, Economia p. 15, 13.6.16).

At a fundamental level, the Car Wash scandal once more illustrates shortcomings in the effectiveness and potential independence of Brazil's regulators: despite the enormous scale of the bribery the relevant regulatory agency, ANP, failed to step in to prevent it. The unveiling of huge levels of corruption surrounding the relationship between a state-controlled client and contractors cannot but significantly raise regulatory risk. Unfortunately, the problem may extend beyond the oil sector. A study, by the São Paulo State Industrial Association (FIESP), estimated that, with the money lost to corruption in the first stage of the PAC, between 2007 and 2010, 124 percent more roads and 525 percent more railways could have been built.²²

While public attention has been focused on the role of regulatory obstacles to accelerated infrastructural investment it is important to recognize the role of one more critical factor: access to long term finance. According to Amann and Baer (2006), since the 1980s the capacity of both the federal and sub-national governments to expand the scope of discretionary spending in the field of capital investment has been severely restricted. As a result, and as already made clear, the private sector has been expected to fill the breach. However, at least as far as the domestic private sector is concerned and unlike its counterpart in high-investing, China, its ability to perform this function has been severely constrained by the comparative shallowness and illiquidity of domestic capital markets (see Torres, Macahyba, & Zeidan, 2014). At the same time, and, again in telling contrast to China, base real interest rates have been maintained at among the highest levels in the emerging market world as part of the authorities' counter inflationary strategy.

Consequently, for potential domestic private sector infrastructure operators, the provision of capital has become a binding constraint with the only viable sources being retained earnings, or, more usually, subsidized credit from official sources such as Brazil's BNDES development bank or the International Finance Corporation.

As Table 2 illustrates, in the period leading up to 2013 the BNDES played an increasingly active role in supporting the provision of infrastructural provision through the extension of long term credit. Even during this period, however, it was always clear that the scale of the investment challenges involved would have required additional sources of capital if growth constraints were to be alleviated. By 2016, though, the outlook for accelerated BNDES disbursements had notably clouded with the Bank's board of directors replaced

²⁰ Program for strengthening of institutional capacity in regulation.

²¹ The Triborough Bridge and Tunnel Authority, and its rise with Robert Moses at the helm, is the subject of Robert Caro's acclaimed biography, *The Power Broker*.

²² For details, see: Funmi Ojo and Allison Everhardt, “Brazilian infrastructure and corruption”, in *America's Business Intelligence*, Washington, D.C., October 11, 2013.

with a new, less interventionist-minded team under Maria Silvia Bastos Marques, a former Chief Executive of CSN, a steel company. According to Mansueto Almeida, the new Finance Ministry's Secretary for Economic Monitoring, the Bank's average annual lending is destined to return "to its historical average" (Bloomberg, 2nd June 2016).²³ If the BNDES' lending does indeed decline then it will be doubly important to ensure that private capital is able to meet demand for financing infrastructure projects, not least in the urban transportation sector.

6. Conclusions

Despite the clear growth promoting properties demonstrated by numerous econometric studies, significant under-investment in infrastructure has continued to characterize the Brazilian economy. This article made clear that the problems are not confined to one area but stretch from highways, to urban transportation, from ports to electricity generation and transmission. Given the obvious priority that should be accorded to infrastructure, why has investment in this sector not been higher?

This article has argued that a central reason for this lies in the design and implementation of regulatory mechanisms. In particular it was established that, in general terms Brazil's regulatory governance has proved deficient. As a consequence, regulatory risk has remained elevated, especially in key infrastructural sub-sectors such as highways and urban transportation. Not surprisingly, this has deterred, or at least delayed, investment. At the same time, domestic financing for infrastructural investment has been squeezed by public sector fiscal constraints and the relative thinness of Brazilian capital markets. Looking ahead, acceleration in the pace of infrastructural investment will require fundamental improvements in the quality of regulatory governance, and attendant reduction in regulatory risk. The reforms necessary to achieve this may prove politically contentious. However, a huge ongoing scandal concerning infrastructure provision contracts in the energy sector may provide the impetus to make progress. At the same time, a new interim administration under President Temer, appears committed to overcoming some of the traditional obstacles which have beset private sector involvement in infrastructure projects. Whether this translates into improved results will have a crucial bearing on the degree to which Brazil is able to embark upon a path of more sustainable, growth.

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²³ <http://www.bloomberg.com/news/articles/2016-06-02/brazil-s-bndes-to-sell-assets-seeks-to-lure-private-investment>.