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Explaining infrastructure underperformance in Brazil: cash, political institutions, corruption, and policy *Gestalts*

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ABSTRACT

Brazil's infrastructure underperforms compared to that of peer emerging economies. Why? The political institutions of coalitional presidentialism with strong federalism undermine rational national planning. Politicians' incentives to distribute 'pork' combine with sector-specific oligopoly characteristics, offering fertile ground for corruption. Yet the greatest challenge is low infrastructure investment, a consequence of weak private capital markets and regulatory inconsistency. Recent center-right governments improved infrastructure service delivery without stimulating investment, while center-left governments raised investment, but undermined public finances and efficiency. Greater technocratic consensus across the partisan divide on reforms to stimulate investment is one positive consequence of Brazil's current crisis.

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In international comparative perspective among peer middle-income economies Brazil's recent infrastructure performance has been judged at best fair (McKinsey Global Institute 2013; Schwab 2016; World Bank 2016), an outcome proximately attributed to the 'Brazil cost' imposed by excessive bureaucracy and regulatory and macroeconomic uncertainty (Caldeira 2011). What underlies the Brazil cost in infrastructure? After exploring the contributions of political institutions, corruption, and ideologies, we conclude that inherited political institutions are unhelpful—but low investment remains the core of the matter, and in practical terms the essential bottleneck needing to be addressed.

Following section one's overview of our dependent variable, infrastructure quality, section two summarizes four contending, yet not mutually exclusive, explanatory themes. The third section constructs an analytical policy history (Armijo and Rhodes 2015) of Brazilian infrastructure, first by presidential administration and then in key subsectors. The study includes two administrations in which public policies leaned center-right, those of two-term President Fernando Henrique Cardoso (Brazilian Social Democratic Party, PSDB, January 1995 to December 2002) and Acting President Michel Temer (Brazilian Democratic Movement Party, PMDB, May 2016 to present) and two in which policies tilted center-left, those of two-term Presidents Luiz Inácio Lula da Silva (Workers' Party, PT, January 2003 to December 2010) and Dilma Rousseff (also PT, January 2011 to her suspension from office in May 2016). The fourth section reports our judgments.

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Brazil's infrastructure challenge in comparative perspective

While little in economics is certain, a broad consensus suggests that the quality and quantity of a country's physical infrastructure is crucial for future economic growth (Bhattacharya, Romani, and Stern 2013; Camacho and Rodrigues 2014; Canuto 2014). There is also wide agreement that, as the *Economist* (2015) put it, 'Like the bad food in the old joke, Brazil's infrastructure is poor – and there isn't enough of it' (Amann et al. 2014; Garcia-Escribano, Goes, and Karpowicz 2015; Inter.B Consultoria 2016). The McKinsey Global Institute (2013, 13) judged that infrastructure stock should be 70% of GDP, but estimated Brazil's stock at 53%, lower than China, India, Poland, or South Africa (76%, 58%, 80%, and 87%, respectively). A subsequent McKinsey report (2016, 9) evaluated Brazil's infrastructure investment and quality as low and very low, respectively. The World Economic Forum (Schwab 2016) ranked Brazil's infrastructure a dismal 74th of 140 countries surveyed, although Brazil typically achieves slightly better rankings for telecommunications and electricity than for transportation and urban infrastructure. Overall, these outcomes are inconsistent with Brazil's aspirations as a top ten economy, stable democracy, and increasingly important global leader.

Curiously, the sectors conceptualized as 'infrastructure' vary by country. Everyone includes long-distance transportation: highways, railroads, ports, inland waterways, and airports. Electricity generation, transmission, and sometimes distribution typically are in, as are telephony and now broadband transmission. Urban transportation (roads and public transport), electricity, water, and sewage may be in or out. Brazil is unusual in that exploration, production, refining, and even distribution of petroleum and natural gas also is understood to be 'infrastructure', a legacy of the sector's long history as a state monopoly. Although the comparisons just cited use consistent definitions across countries, our detailed analysis employs Brazil's more inclusive definition.

Alternative explanations: insufficient funds, politicians' incentives, corruption, and contending reform agendas

What accounts for Brazil's poor infrastructure outcomes? Four themes predominate. First, unsatisfactory outcomes may simply result from low levels of infrastructure investment as a share of GDP. Those who stress the lack of money or gross investment may fault the inherited structure of Brazilian public finances, in which the National Bank for Economic and Social Development (BNDES), depending on one's viewpoint, either crowds out or fails to adequately fund long-term private investment (Armijo, forthcoming; Inter.B Consultoria 2016; Silva Filho 2014); enduring inadequacies in Brazilian capital markets; distortions derived from foreign finance (Bresser-Pereira 2016); or a global dearth of investible funds (McKinsey Global Institute 2013).

A second set of explanations argues that democratic Brazil's major political institutions collectively are often dysfunctional for economic policy-making (Abranches 1988; Ames 2001; Amorim Neto 2002; Lamounier 1996: Mainwaring 1997; Power 2010; Stepan 2004). 'Coalitional presidentialism' results from, inter alia, Brazil's system of open-list proportional representation, in which a statewide electoral district has multiple candidates from multiple parties competing for as many as 30 spots as federal deputies. Under

these rules, each candidate runs against all other aspirants, from both other parties and his or her own affiliation, resulting in multiple, weak political parties in Congress and legislators beholden to concentrated special interests. Passing new legislation typically requires those promoting the bill, often on behalf of the president, to build a broad and heterogeneous coalition by offering very specific benefits (political pork) to each federal deputy or senator. Presidents also must distribute cabinet positions among diverse parties. Federalism enhances these already strong fissiparous tendencies by increasing systemic veto points. Under these conditions, strong leadership and presidential willingness to expend political capital is essential to push new legislation through (Figueiredo and Limongi 2000).

Pereira, Bertholini, and Raile (2016) suggest that 'governance cost' is increased by the number of parties in the president's legislative coalition, the ideological distance between them, and the disproportionality of their representation in the executive branch vis-à-vis their share of legislative seats. While their study examines variation across Brazilian presidential administrations, the mean 'governance cost' for Brazil is certainly higher than for most peer countries. Although policy reform is difficult, policy predictability also remains low. High governance costs generate correspondingly high incentives for political clientelism, including politicized public sector appointments and funds allocated on partisan rather than programmatic criteria.

A third theme is cronyism: business–government relations characterized by friendships among small groups of elites, lack of transparency, nepotism, and oligopoly (Schneider 2015; Schneider and Soskice 2009). Cronyism may tip into outright corruption, or direct payments by private actors for preferential treatment by state officials. Brazilian elections, which are very expensive, are almost completely funded by private firms, heavily concentrated in three sectors – finance, construction, and heavy industrial inputs such as petrochemicals and steel (Samuels 2001, 2002). In the 1990s these business interests funded mostly the center-right, but by the 2000s capitalists had moved to a strategy of covering all their bases, including targeting whichever party controlled the executive. The strategy may work: for example, Boas, Hidalgo, and Richardson (2014) find that political donations to the governing Workers' Party (PT) increased firms' chances of federal contracts.

The fourth theme looks to ideologically-driven policy mistakes. Most infrastructure policy discussions within Brazil fit here, and cluster into two broad policy *gestalts*. Economists who lean center-right, more listened to under Presidents Cardoso and Temer, focus on improving competition, macroeconomic stability, neutral and consistent regulatory oversight, and, more generally, the investment environment for private business (Biederman and Galal 2013; Frischtak 2015; Pinheiro (2003) 2015; Pinheiro et al. 2015). Under the center-left administrations of Presidents da Silva and Rousseff economic policymakers instead prioritized escaping commodity dependence and the middle-income trap through a state-led big push to mobilize investment in technological innovation and large-scale infrastructure. Spanning two Workers' Party administrations, Finance Minister Guido Mantega and BNDES President Luciano Coutinho employed activist exchange rates and explicit support for large firms, both public and private, that could become 'national champions' (Almeida, Lima-de-Oliveira, and Schneider 2014; Armijo, forthcoming; Camacho and Rodrigues 2014; Coutinho 2015). Economists from each economic camp have worked together, yet view one another's prescriptions fundamentally as misguided.

Brazil's infrastructure challenge in comparative perspective

The core economic goal of the Cardoso administrations was to recoup macroeconomic credibility and stimulate business investment by maintaining the anti-inflationary disciplines of the wildly popular *Real* Plan, implemented when Cardoso served as finance minister in the previous government. Persistent complaints of poor and erratic telephony, electricity, and other services led policy-makers to expand the privatization program initiated in the early 1990s. Cardoso's personal leadership was necessary to convince legislators to overturn provisions of the democratically negotiated, post-authoritarian 1988 Brazilian Constitution, which had mandated state majority ownership in petroleum, natural gas, and most public utilities (Manzetti 2002, 173). Brazil's industrial development bank, the BNDES, designed and administered privatization, promoting consortia combining local and foreign private partners.

Privatizations through the 1990s raised around $87 billion, the largest amount of any developing country, with 54% of funds originating abroad (Kiheri and Kolo 2006, 2; Musacchio and Lazzarini 2014, 2). The federal government also created new regulatory bodies for each infrastructure subsector. These were to be organizationally subordinate to the relevant ministries, but operationally independent, and funded by a combination of user fees and Treasury transfers (FGV-CERI 2016). Agency heads, nominated by the President, would be confirmed by Brazil's Senate. Under Cardoso, telecommunications were largely transferred to private ownership and management, while electricity and transportation had a mixture of public and private ownership. Most urban infrastructure, with some exceptions in transportation ('urban mobility'), remained with subnational governments, both municipalities and states. The Fiscal Reform Law of 2000, a major Cardoso victory, forbid unfunded mandates, apparently ensuring sounder public finances going forward (Melo, Pereira, and Souza 2014). These reforms, initially castigated as uncaringly neoliberal by Brazil's left, ultimately were widely accepted. Infrastructure service improved, especially where private ownership or greater competition had been introduced. Disappointingly, infrastructure investment remained low.

When labor activist Lula da Silva assumed office, he retained his predecessor's popular and successful macroeconomic framework while expanding social programs for the lower classes. Initially Lula's economic advisors prioritized innovation policy, including tax breaks for research and exports, as their principal growth strategy, but in his second term the president announced ambitious multiyear infrastructure spending: the Growth Acceleration Program (PAC) ultimately with two four year phases, PAC I of 2007–2010 and PAC II of 2011–2014. The PAC was an eclectic mix of mega-projects in oil, gas, and electricity ('energy' represented 65% of the announced totals), urban and social 'infrastructure' (though the majority was low-income housing), and transportation spending, eventually dominated by airport and urban transit renovations related to the 2014 World Cup and 2016 Olympics. PAC II's star projects included the refineries Premium 1 and Abreu e Lima, the petrochemical complex Comperj, and the Belo Monte hydroelectric dam. Dilma Rousseff, President Lula's chief of staff, oversaw the program. In her successful election campaign to succeed her mentor, the president consistently introduced her as 'Dilma, the mother of the PAC'.

In 2011 Brazil grew over 7%, particularly impressive given the global financial crisis, and generating enormous optimism over Brazil's prospects (Montero 2014, 70–100).

Subsequently, growth decelerated. In 2012, President Dilma announced auctions for 'new' transportation concessions intended to raise R$ 155 billion (US$ 66 billion) over five years. Many projects were not new. Worse, several big projects never left the drawing board nor attracted any bidders, including a visionary high speed passenger rail link (the 'bullet train') between Rio de Janeiro and São Paulo. The on-going recession coincided with a sharp drop in the president's popularity and increasingly critical press about infrastructure projects with ballooning budgets, years behind schedule or completely stopped. In early 2014 the Lava Jato (Car Wash) scandal broke, as Paulo Roberto Costa, Petrobras' Director for Refining and Supply (in charge of purchasing and sub-contracting), saved himself from hard time by turning state's witness, laying bare an enormous corruption scheme in which most of Brazil's premiere construction firms – many formerly touted as national champions by the BNDES – were revealed to have paid kickbacks for infrastructure contracts (Burges and Bastos 2016; Taylor 2016).

President Rousseff tried to revive her political fortunes popularity by again turning to infrastructure investment. In mid-2015 she posed for photos with China's Vice-Premier Li Keqiang, who promised strong Chinese participation in US$ 58 billion of new infrastructure projects, including Brazil's portion of an evocative Bioceanic Railway to connect Brazil's Atlantic Coast to Peruvian ports. The BNDES announced a 20% increase in infrastructure investment for 2015–2018 (Coutinho 2015). Nonetheless, journalists pilloried the president, gleefully noting that the transcontinental railway lacked even a preliminary feasibility study. By early 2016, Rousseff's legislative opponents had sufficient votes to charge her with fraudulent public finances for intentionally delaying government payments to creditors ('pedaling'), a practice rife in the infrastructure sector. In May 2016 President Rousseff was suspended, and in August, she was impeached and removed from office. Acting President Michel Temer used his first speech to address problems of public finance and infrastructure management, quickly replacing scores of developmentalist economic officials with more pro-market economists, purging ministers, the central bank president, and the heads of BNDES and Petrobras. These themes played out in each infrastructure subsector.

Telecommunications

The 1998 auction of the Telebrás system was the biggest Latin American privatization to date, raising US$ 21 billion. Thereafter, landlines proliferated, and new investments in a 3G wireless network and data transmission followed. Landline teledensity grew from 10.4 to 29 per 100 inhabitants (1996–2002), and cellular from 4.5 to 53.2 (1998–2006). By 2004, service was completely digital, with cell phones more numerous than land lines (Guimaraes 2007). Private investment slowed in the wake of the global financial crisis in Lula's second term, especially in cellular telephony. Policy-makers responded by shifting back to a 'national champion' model distinguished by fewer worries over oligopoly and greater state financing. In a highly visible 2009 decision, the National Telecommunications Agency (ANATEL), permitted the conglomerate Oi to purchase Brasil Telecom, another private firm with a fixed telephony concession, creating a Brazilian 'supertele', with hopes of competing with foreign operators. The 2010 National Plan for Broadband assigned the public sector holding company, Telebrás, responsibility for the fiber network (Galperin, Mariscal, and Viecens 2013). Renewed investment also came from a new source: Chinese state firms Huawei and ZTE were crucial to the achievement of wireless coverage in 100% of municipalities, celebrated by the president in her April

2011 visit to China (Becard, Ramos, and de Macedo 2014). Yet in June 2016 the 'supertele' Oi filed for Brazil's largest bankruptcy ever, an ignominious end for a national champion (Jelmayer and Magalhaes 2016). Chinese state capital remains crucial, but overall investment has been below expectations.

Electricity

Rapid technological development characterized both electricity and telecommunications. Cardoso's late 1990s electricity sector reform drew on experiences in California and Chile. The objective was to create competition and reduce state participation everywhere, except in Brazil's two nuclear plants and Itaipú, the multinational hydroelectric facility governed by a 1973 agreement with Paraguay. Key changes including opening electricity concessions to private, including foreign, investment, and creation of a regulator, the National Agency for Electric Energy (ANEEL), to protect households from price gouging (Hermes de Araujo, da Costa, and Correia 2008). The reform allowed distribution companies and large consumers to choose their suppliers, bringing competition into generation and wholesale supply. However, during the 1999 devaluation crisis, ANEEL froze consumer prices, damaging private investors. Furthermore, trading arrangements with thermal plants (which hydroplants must rely on in times of low rainfall) exposed the latter to many risks. There were acrimonious disagreements, particularly during the 2001 drought and associated massive blackouts and rationing, blamed on either excessive reliance on markets, or faulty government actions, depending on one's partisan viewpoint (Karacsonyi 2003). From 1998 to 2003, the rate of return on electricity distribution was systematically negative, so much so that some private investors opted to return their concessions to state governments (Rocha, Camacho, and Braganca 2007).

The PT governments shifted from regulatory reform to expanding supply through new hydroelectric dams, by some metrics renewable and thus 'clean' energy. Yet already by the 1990s an anti-dam movement, focused on damage to river systems and local communities, had made their construction politically problematic, and conflicts were on-going and frequent. Key policy-makers resigned in protest, including Environment Minister Marina Silva in 2008 and the head of the Brazilian Institute for the Environment and Natural Resources (IBAMA), in 2011. Civil society campaigners involved the Brazilian courts and multinational organizations. In April 2011 the Inter American Commission on Human Rights granted an injunction on the Amazonian Belo Monte Dam project, alleging adverse consequences for indigenous groups. Rousseff's government angrily rejected external intervention; despite some scaling back, dam construction proceeded, stimulated by further blackouts in 2014–2015. Nonetheless, by 2015 Norte Energia, organizer of the huge Belo Monte consortium, was in litigation with the federal electricity holding company, Electobras – while simultaneously fending off Car Wash scandal bribery allegations. As Brazil's crisis deepened in early 2016, China's Three Gorges company, owner of the world's largest hydroelectric facility, paid US$ 1.48 billion for the Jupiá and Ilha Solteira dams, key parts of the Belo Monte complex (Texeira 2016). Although scaled back, the project has gone forward (see Hochstetler, 2017).

Oil and gas

Brazilian policy-makers long considered petroleum, along with 'subsoil wealth' more generally, as a key sector for state leadership. In 1953 President Getúlio Vargas

nationalized the mostly foreign-owned oil industry, creating Petrobras, awarded a permanent monopoly of fossil fuel exploration, production, refining, and transportation. In the mid-1970s, worries about the strategic vulnerabilities implied by petroleum imports also led Brazil's then military government to promote production of biofuels, primarily sugarcane-derived gasohol. Initial skepticism notwithstanding, the program was a success: effective, if not necessarily efficient. The center-right governments of the 1990s sought to reduce the role of the state in the fuel sector, closing the Sugar and Alcohol Institute, IAA, which had coordinated production and subsidy policies, gradually withdrawing gasohol subsidies, and under Cardoso opening petroleum exploration and production to the private sector, including foreign capital.

The more developmentalist da Silva administration that followed renewed implicit subsidies by mandating in 2004 that all new cars be equipped to run on either gasoline or biofuels, and in 2008 giving Petrobras the job of coordinating biofuels production and distribution. By 2008, 92% of new cars sold were flex-fuel models (Távora 2011, 26). Petrobras also was riding high. New offshore ('pre-salt') petroleum deposits, discovered in 2007 and confirmed in importance by 2009, constituted the largest new finds in Latin America in two decades. World oil prices hit a new high of $147/barrel in mid-2008. Even if prices were to fall, Petrobras (and Brazil) were shielded from large consequences, given rough balance of petroleum imports and exports, plus Brazil's leading position in biofuels. Notably, Petrobras raised much of its own capital budget in global markets. Thus by mid-2009 Petrobras had at its disposal, in addition to $12.5 billion from the BNDES, $2 billion from the U.S. Eximbank, $6.5 billion from international private bank consortia, and $10 billion from the China Development Bank. In 2010 Petrobras' international initial public offering (IPO) raised $70 billion, the largest IPO anywhere to date, briefly elevating Petrobras to the world's fourth largest firm – after Exxon Mobil, Apple, and PetroChina. In July 2011, Petrobras' total market capitalization hit $224 billion, larger than the GDP of many countries. Over the 2000–2014 period, oil and gas constituted 27% of all Brazilian infrastructure investments.

These extraordinary successes under President Lula made Petrobras' subsequent precipitous fall all the more poignant. Petrobras used its ample financing to fund several poorly justified mega-projects, of which the most notable was the petrochemical complex in Rio de Janeiro state, Comperj. BNAmericas (2014) concluded that, in price per barrel, Comperj would be 'the most expensive refinery in the world', and by mid-2015, much of Comperj had simply been abandoned (Segal 2015). In early 2014, the Car Wash scandal exploded. In February 2016 Petrobras' market capitalization touched below $20 billion, less than *one-tenth* of its mid-2011 value. Some of the tumble was due to overall slowing in Brazil, and some to world oil prices, but the Lava Jato fallout turned a slump into a rout. Since approximately 48% of Petrobras shares are held by the government, including the BNDES and most public sector unions' pension funds, these losses have rippled through Brazil's public sector.

Transportation

Both experts and users find Brazilian transportation woefully inadequate. The transportation cost to bring a good to market is 12% in Brazil, 8% in the equally vast United

States, and only 6% in Europe (Biederman and Galal 2013, 4). At the national level, the mix between different transportation modes is inefficiently skewed toward highways: 60% of freight moves by road, but only 18% of roads are paved, making them impassable during the rainy season (Amann et al. 2014, 14). Long-haul trucks are involved in frequent accidents, and robberies of truckers, on their way to South America's busiest port in Santos, are a staple of the nightly news. Cabotage (water freight transport between two ports in the same country) is potentially a solution, but underdeveloped, perhaps because only Brazilian firms are allowed in this sector.

Rail transport would be cheaper for long-distance transport of many bulky goods, but the rail network is small, 3.4 kilometers of rail per 1000 square kilometers, compared to 14.7 kilometers in the U.S. (World Bank 2012, 78). Worse, key rail corridors, especially the long-envisioned North–South and East–West lines, exist only in non-connecting stretches, and two different track gauges remain in wide use in Brazil. The only area where rail freight functions properly is the Northeast: iron ore comprises 79% of all goods carried by train (Amann et al. 2015, 15), mostly traveling from the mining complex Carajás to Northeastern ports. In contrast, Brazilian soybean growers pay 25% of the value of their final product for transportation, compared to 9% for farmers in the United States (*Economist* 2013). Brazil's internationally competitive agro-export sector lobbies furiously, but not yet effectively, for rail transport from the Center-West to ports. Unlike other large countries and regions, including the United States, Western Europe, and India, Brazil shut down all long-distance passenger rail service following World War II.

Ports and airports fare only somewhat better. The port of Santos, South America's largest, needs dredging to accommodate more ships, especially the largest container carriers, more urgent since opening of the enlarged Panama Canal in mid-2016. Meanwhile, huge ships queue offshore, while trucks wait a week to unload. Over many years, the central government's perverse policy response to transportation bottlenecks has been to keep fuel prices low to please the large constituencies of truckers, mayors, and citizen-drivers, thus reinforcing the overall bias for roads. Airports have improved, but mainly due to recent mega-sporting events.

Urban infrastructure

Even as Brazil's military government attempted to promote the settlement of remote parts of the country's vast territory, Brazilians flocked from the interior to the cities, their movement made possible by the expansion of national highways in the 1950s and 1960s. Many of the peripheral urban communities they built were constructed prior to the provision of water, sanitation, transport, and electricity (Martine and McGranahan 2010). Two articles in the 1988 Constitution, followed by the 'city statute' of 2001, focused on the social use of urban land and squatters' rights. In 2003 President Lula created the Ministry of Cities, which required all municipalities to prepare master plans for land use and urban problems.

Since democratization, urban 'peripheries' gradually have been incorporated into cities via infrastructure. In São Paulo, for example, asphalt, water, and electricity are today 'almost universal' (Caldeira 2015, S129). One reason may be the codification of squatters' rights, which allows them a better negotiating position in dealings with municipalities and private construction firms. At the same time, neither the legal reforms of the Cardoso period, nor the renewed attention from the federal government under the PT, has been a panacea. The millions of people who inhabit marginal neighborhoods are vulnerable

to loss of life in landslides, the spread of disease and injury, and countless other indignities resulting from poor urban infrastructure (Martine and McGranahan 2010).

New problems in urban transportation have become especially acute. In the early 2000s car density in Brazil was not nearly that of OECD countries. The urban sprawl problems seen in the latter were not evident, as the slum dwellers responsible for most urban growth seldom owned automobiles. However, during the Lula-Dilma period, there was a shift from one model of urban transport, in which public transit was used by the poor and cars by the rich, to another, in which everyone who possibly can aspires to own a car or motorcycle. Private vehicles became cheaper relative to the price of public transit, and the extremely poor were priced out of transportation altogether (Amann et al. 2014, 33). The wave of social protests that swept a hundred Brazilian cities in 2013 was inspired to by the price of public transportation as well as a more general frustration with the poor quality of urban services, both aggravated by juxtaposition with mega-event planning (Caldeira 2015).

Accounting for poor outcomes: money, politicians' incentives, corruption, and policy reform *gestalts*

How do we account for the relatively poor performance of Brazil's infrastructure as compared to peer countries? We began with four explanatory themes: money, politicians' incentives, corruption, and policy gestalts.

Insufficient investment

Brazil's infrastructure problem may begin and end with low investment. Most of Brazil's more rapidly growing peer countries, but especially those in East Asia, have saved and invested a higher share of their GDPs for decades. In 2014, Brazilian savings and investment were only 16.7% and 21.1% of GDP, respectively–above those of Venezuela, whose economy has been in deep crisis for years, and similar to shares in Argentina, but well below those of Mexico, Colombia, Chile, and Peru (IMF 2016). China has invested 8.8% of its GDP annually since 2008, and sits squarely in McKinsey's (2016, 7–9) high spending, high infrastructure quality box – despite the fact that China's investment efficiency is, like Brazil's, rather low.

During the years of military government, Brazil invested a higher share of its GDP, and growth was faster. As shown in Table 1, from 1971, the earliest year for which subsector figures are available, until the adoption of the 1988 democratic Constitution, infrastructure investment averaged 5%. When the Constitution came into force, a notable feature was the permanent redistribution of a significant portion of federal tax revenues – previously earmarked for highways, electricity, and other infrastructure – to states and municipalities, yet without a corresponding reallocation of obligatory infrastructure responsibility. The

Table 1. Brazilian political periods and mean infrastructure spending (% of GDP).

Political period	Years	Transport	Electricity	Oil and Gas	Telecoms	Water/Sewer	Total
Military and transition	1971–1988	0.76	2.40	0.95	0.60	0.36	5.04
New constitution thru Lula I	1989–2006	0.21	0.82	0.47	0.84	0.22	2.56
Lula II and Dilma I (PAC I/II)	2007–2014	0.83	0.68	1.01	0.51	0.21	3.24

Source: Based on annual data from the Institute for Applied Economic Research.

federal government thus was left with an unfunded mandate (Garcia-Escribano, Goes, and Karpowicz 2015). Contemporary coalitional presidentialism also begins in 1989. From then through the end of President Lula da Silva's first term in 2006, annual infrastructure spending collapsed to 2.6% of GDP. Although the center-right governments of the 1990s achieved improved infrastructure service provision and efficiency, they did not recover earlier levels of investment. With the PACs, the Workers' Party governments pushed infrastructure investment up to 3.2% of GDP, a substantial achievement. Frischtak and Davies (2015, 1) estimate that infrastructure spending of 3% of GDP is sufficient to compensate for depreciation, or the normal obsolescence of Brazil's existing stock, but that at least an additional 1% of GDP would be needed to *improve* infrastructure outcomes.

Observing that infrastructure spending should be higher does not explain why it is low. Ironically, it was the leftist da Silva government that in 2004 shepherded through Congress a new law permitting public–private partnerships (PPPs), intended to inspire greater private investment through transferring some increments of risk and costs to the public sector (Oliveira and Chrysostomo 2013). Many in the president's own party (PT) opposed the PPP law, viewing all 'privatization' as anathema, while the center-right opposition coalition also fought it, fearing a blank check that would undermine hard-won fiscal balance. Subsequently, most specialists embraced the PPP option. Private investment apparently has increased, contributing half of all infrastructure investment, 2007–2014, and 43% of the global total of $51.2 billion of private infrastructure investment in all emerging economies in the first half of 2014 (Inter.B 2016, 7; World Bank 2014).

The reality is more complicated. For complex historical reasons, Brazil has virtually no longer-term commercial bank lending and a tiny long-term capital market (Frischtak and Davies 2015; Pinheiro et al. 2015; Silva Filho 2014). Most long-term business finance actually originates with Brazil's national development bank, the BNDES, which lends at below-market rates (Armijo, forthcoming). To fund the PACs, the BNDES expanded loan disbursements almost 10 times between 1999 (R$20 billion) and 2013 (R$190 billion), increasing its share of total infrastructure financing from 27% to 40%, 2003–2013 (BNDES, 'Annual Reports'; Coutinho 2015, 3). Direct Treasury transfers provided 11% of BNDES resources in 2005, but fully 57% by mid-2015 (BNDES 2015, 43). The infrastructure consulting firm Inter.B (2016, 9) concludes that, if financing to private borrowers with government guarantees of repayment is included, the true public share in infrastructure finance in 2014 was about 83%. This level of public financing is unsustainable, and contributed to Brazil's loss of investment grade credit rating in late 2015. In mid-2016, Acting President Temer announced that government's first domestic economic priority would be reform of public finances, including accelerated repayment of Treasury loans by the BNDES. There is now a substantial consensus, reaching across economic ideology, that private capital markets must provide a larger share of financing in the future. The problem becomes attracting these investments.

Political institutions and politicians' incentives

A second set of explanations looks to the ways in which political institutions structure politicians' incentives. In the language of Haggard and McCubbins (2001), Brazilian infrastructure policymaking is not "decisive," because it is difficult to alter existing laws. But neither is policymaking "resolute," because informal practices have evolved that permit presidents to bypass laws they dislike, at least temporarily, through executive decrees.

Although policy reform is difficult, policy predictability also remains low, as each incoming administration must distribute favors to construct its coalition (see the discussion of electricity above, and [Doctor 2016] on reforms of ports regulation).

Moreover, the history of infrastructure reforms is rife with political clientelism across all levels of Brazilian federalism. For example, when Cardoso wanted to privatize the state mining behemoth, Companhia Vale do Rio Doce (CVRD), with operations based mainly in the poor Northeast, he was opposed by his ostensible allies, including former Presidents-turned-Senators Collor and Franco, who feared job losses. Cardoso got his legislation through by announcing that half of the proceeds from CVRD's sale would go to a new Economic Reconstruction Fund allocated to governors for financing local infrastructure (and therefore subsequently allocated to mayors) (Manzetti 2002, 214–215). This sort of practical politics works, but it is expensive.

Pervasive political clientelism also helps explain Brazil's observable penchant for excess road-building. Infrastructure experts agree there has been an unjustifiable bias for highways, and under-investment in rail and water freight. Moreover, the share of paved in total roads is small. Why? Waterways are relatively fixed, and railroads travel point-to-point, but a highway spur can be built anywhere. Consequently, any democracy, but especially a federal one, is likely to have a politically induced tilt toward road-building, as local politicians love them. Added to this, in Brazil the incumbent president's need to construct a viable legislative coalition at the center leads to particularly strong political incentives to fund (but not maintain) highways in patterns that do not maximize the social benefits from transportation spending. Moreover, those ministries that ought to be thinking about this are among the most likely to be allocated politically (Schneider 2015, 23). Similar arguments pertain to the distribution of urban infrastructure funds, as through the PACs. Policy predictability is low, as each incoming administration must distribute favors to construct its coalition (see the discussions of electricity above, and Doctor 2016 on ports reforms). Brazil's political institutions, although democratic, frequently impede both policy effectiveness (goal achievement) and efficiency (goal achievement at reasonable costs).

Corruption

The institutional environment that pushes toward clientelism may also encourage outright corruption: the direct exchange of bribes, kickbacks, and contributions to public officials by private actors seeking special treatment. Examples from the infrastructure sector are legion. In 1998 critics alleged that several of the new telecommunications concessionaires had made important donations to Cardoso's 1994 presidential campaign (Samuels 2001). In 2011, the transportation minister resigned, accused of skimming money off contracts related to construction for the World Cup and the Olympics. In 2013, Brazil's press accused President Lula of overruling the telecommunications regulator, ANATEL, to favor a friend (Azevedo 2013). Since 2014, virtually every major construction firm has been implicated in the Car Wash scandal, and Petrobras, once regarded as a clean institution, is at its heart. The former CEO of construction firm Andrade Gutierrez told a judge that his firm conceptualized bribes to public officials as an ordinary cost of doing business; bribes were included in the project budget and calculated by a formula like that used for executive bonuses (Carvalho, Dantas, and Herdy 2016). Corrupt allocation of contracts undermines both effectiveness and efficiency – and frightens private investors.

Yet we note that the infrastructure sector anywhere attracts corruption. Inherent characteristics of 'natural monopolies' imply that state regulators have substantial discretion over the distribution of monopoly rents, making these sectors uniquely prone to regulatory capture, opportunistic officials, and corruption (Estache and Martimort 1999). The heavy engineering and construction sector also tends to oligopoly, as complex projects need large firms to manage them. Oligopoly facilitates the use of cozy deals, as in Brazil. Not surprisingly, most middle income emerging economies struggle with corruption, as their governance challenges expand rapidly with industrialization and urbanization. Arguably, Brazil's independent judiciary, contentious and investigative press, and increasingly involved civil society reveal the comparative maturity of Brazilian democracy in uncovering and punishing corruption, which should be lower in future. Corruption does not explain *comparatively* poor infrastructure outcomes vis-à-vis Brazil's peers.

Policy gestalts of the 'left' and 'right'

Finally we turn to policy ideas. There is today considerable consensus across partisan lines on the challenges for infrastructure, including low investment; insufficiently steady long-term planning; inadequate proposal design prior to concession auctions for a given project; and lack of regulatory oversight to see that a concessionaire actually meets the terms of the contract. More recently, the list of standard woes has been expanded to include verification that the government is fulfilling its obligation to pay private sector suppliers and contractors on time. Following two decades of intense experimentation, analysts of both right and left are converging on the problem statement, although they continue to weigh solutions somewhat differently.

The left-leaning or developmentalist response runs through the state. An expanded state role in production, management, and financing was the thrust of the Growth Acceleration Program (PAC I and II). Policy-makers assumed that the federal government was best placed to further the public interest, rather than narrow private interests, and acted accordingly. For example, after the deep water ('pre-salt') petroleum finds, a presidential decree guaranteed a majority share for Petrobras in all future exploration contracts, partially reversing the Cardoso era liberalization of the oil and gas sector. The Rousseff administration also guaranteed a majority share for state holding company Infraero in contracts for airport modernization – at least until worries about readiness for the 2014 World Cup caused that requirement to be lifted abruptly – and gave Brazilian companies a 25% price preference over foreign firms on infrastructure project bids. The Lula and Dilma governments successfully expanded infrastructure investment, yet had enormous problems with wasteful spending, cost overruns, and never-completed mega-projects – not to mention corruption.

The center-right's solution has been to promote private sector competition, as well as improved technocratic performance, including via checks and balances within the state. The Cardoso administration created independent regulators for each infrastructure subsector, and tried to invigorate other oversight organs, such as the Federal Accounting Court. Efficiency arguably improved, although total investment did not, and the regulatory apparatus has not functioned very well. Pinheiro et al. (2015) argue that the state needs to

be more proactive in project design, well in advance of any public auction, and propose that the current practice of allowing firms to do the initial project design for projects on which they then bid be disallowed. Another study observed that an important cause of regulatory failure has been 'pedaling': funds to pay salaries and expenses for independent regulatory agencies were transferred not to them, but rather to the sectoral ministries to which they were nominally connected – who often declined to release these funds (FGV-CERI 2016). Frischtak and Davies (2015) recommend against any new infrastructure financing responsibilities for the state – including providing insurance guarantees for long-term private investments – arguing that the state will end up subsidizing private profits. Reforms promoting enhanced transparency, competition, and higher regulatory predictability are probably essential precursors for the desired higher private infrastructure investment in the future.

Concluding observations

This paper has asked why Brazil, a relatively successful upper middle income country, has had less successful infrastructure outcomes than peer emerging economies. After reviewing the experiences of the past two decades, we conclude that corruption has been endemic, but is not obviously worse than that in similar countries, and anticipate that Brazil's current crisis will stimulate genuine reform. Aspects of Brazil's national political institutions have been, and will continue to be, a drag on infrastructure and other policy-making. Public policy responses have not always improved outcomes, yet Brazil possesses pragmatic politicians and economists on both center-left and center-right, and useful learning and convergence has occurred. Overall, the dominant reason for comparatively poor outcomes may simply be low investment, which is only partially a result of these political and institutional variables. The most useful medium-term reforms would be those that increased state accountability and regulatory capacity, ranging from conceptually straightforward changes like reducing 'pedaling', to tackling complex and long-standing challenges like stimulating long-term private capital markets. Such reforms would improve conditions for private investment. This said, the often lamented 'lack of long-term planning in Brazilian infrastructure' is not a problem administrative reforms can fix. Big shifts in the conditions of infrastructure require a political vision and presidential leadership. These are possible under coalitional presidentialism, even if their implementation is necessarily inefficient.

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