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COMPETITIVENESS AND GROWTH IN BRAZIL

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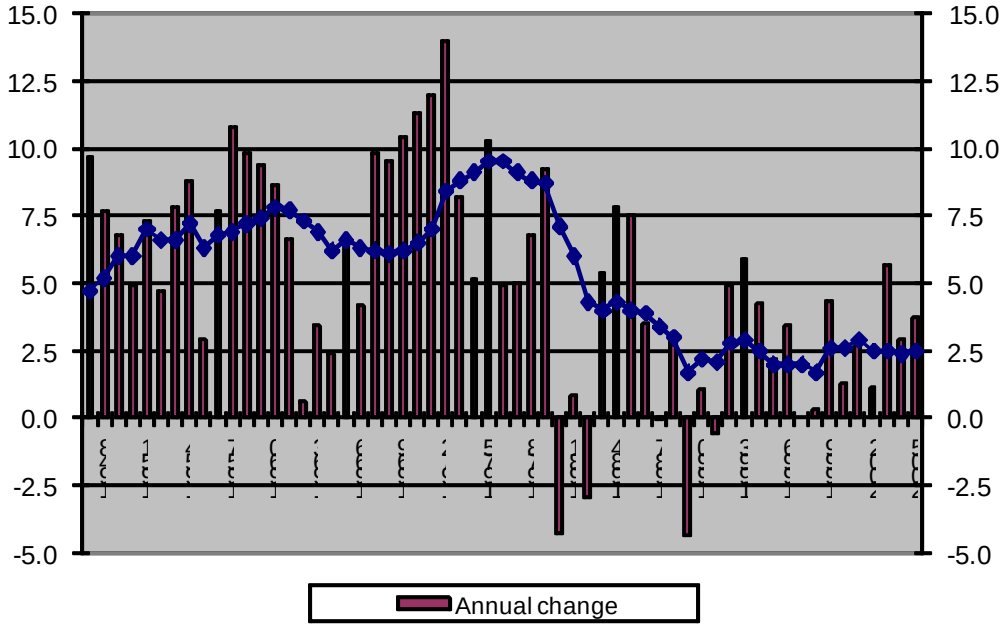
1. Introduction

In the first eight decades of the XX century, Brazil ranked among the countries with highest growth rates in the world. During the period 1930-80, in particular, it managed to reduce its per capita income gap vis-à-vis industrialized economies and seemed poised to escape underdevelopment early in this century. However, this dream never materialized; Brazil's growth performance deteriorated sharply over the following quarter century, never fully recovering from the second oil shock and the foreign debt crisis (Figure 1.1). In this period Brazil experienced much lower and more volatile growth, with its long-term annual growth rate (ten-year moving average) fluctuating in the 2% to 3% range, well below the 6% to 10% range that prevailed in 1950-80. Brazil reacted by embarking on reforms, from trade liberalization to changes in fiscal and social policies. Policies improved, especially after price stabilization, in 1994, and, if anything, have been better than through most the high growth period, but apparently to no avail. Something happened in this later period that prevented Brazil from regaining the rapid growth that it had exhibited previously. What might it have been?

Figure 1.1. Real GDP growth 1950-2005
In per cent



Source: IBGE

As shown in Table 1.1, the original slowdown of the Brazilian economy took place in a period in which other countries were also forced to lower their growth rates, in adjusting to the second oil shock, the tightening of the US's monetary policy and the ensuing debt crisis. Although not all countries were equally hurt by these shocks, with Chile and Korea being notable exceptions, world GDP growth declined quite considerably in 1981-94, dropping by a third from its 1951-80 level. Latin America suffered even more, with growth rates falling to less than half their previous average level. And Brazil was even more intensely affected, with GDP growth declining by 5.4 percentage points, almost twice as much as the Latin America average and more than thrice the drop in world growth.

Table 1.1: Average growth rates in selected countries and periods (% per year)

	1951-80	1981-94	1995-2002	2003-06
Argentina	3.4	1.4	-0.8	8.9
Chile	3.4	4.5	4.6	5.2
South Korea	7.5	8.4	5.2	4.2
USA	3.6	3.0	3.2	3.2
Japan	7.9	3.0	0.9	2.1
México	6.4	2.3	2.7	3.3
Brazil	7.4	2.0	2.3	3.4
Memo				
Latin America and Caribbean	5.2	2.2	2.2	4.8
World	4.5	3.0	3.6	4.9

Sources: IMF, CEPAL and IBGE.

The timing of Brazil's slowdown seemed to confirm that it stemmed largely from a high sensitivity to the performance of the world economy, exacerbated by its dependence on import substitution industrialization, oil imports and foreign savings. This view was reinforced, with somewhat different undertones, by the failure to accelerate growth in 1995-2002, when Brazil

suffered several shocks in financial markets, including Mexico's forced devaluation in December 1994, the difficult political transition in Brazil, the Asian crisis, Russia's default and Argentina's complicated abandonment of the convertibility regime. In particular, this sensitivity to shocks in international financial markets seemed to confirm that growth in Brazil, as well as in most of Latin America, was hindered by its low domestic savings, that put it at the mercy of the foreign savers' willingness to bank the country's large external financing needs.

However, given the performance of the economy in 2003-06, it is doubtful whether these externally based explanations can account for Brazil's failure to recover its past dynamism. Brazil, as well as the rest of the region, has especially benefited from the upswing in the world economy, which boosted the demand and prices of commodities. However, its GDP growth accelerated only slightly, and less than in the rest of the region and the world as a whole (Table 1.1). Moreover, this period has witnessed a large expansion in international liquidity and in the appetite for emerging market risk. But Brazil, although it has been able to tap international financial markets at a declining cost, became a net foreign saver, with an average current account surplus of 1.5% of GDP in 2003-06, in contrast to a deficit more than twice as large experienced in 1996-2002. This suggests that Brazil's poor economic performance stems from more than just a reaction to adverse external shocks, and that whatever was lost in the early 1980s had probably not been recovered by 2003-06.[1] In particular, this suggests that, currently, the binding constraints to growth are more likely to be in the domestic side of the economy than in its interactions with the rest of the world.

These constraints should be able to specifically account for Brazil's low rate of capital accumulation, which is responsible for a large share of the observed contraction in GDP growth (Table 1.2). Four-fifths of this contraction came from the sharp drop in labor productivity growth and the other fifth stemmed from lower employment growth. Using a Solow-type growth accounting decomposition, we estimate that the slowdown in labor productivity from the 1961-80 to 1981-94, that is the slowdown in the expansion of GDP per worker in the more recent period, resulted in roughly equal parts from slower growth of capital per worker and the

[1] Incidentally, note the likeness between Brazilian and Mexican growth rates, which suggests that despite relatively divergent paths in the last decade, there might be similar impediments to growth in the two countries. In particular, their experiences coincide in suggesting that price stability, sound external accounts and trade openness were not sufficient to bring growth back to the previous levels.

reduction in the growth rate total factor productivity (TFP). In turn, the partial recovery in 1995-2006 resulted entirely from the acceleration in TFP growth. This indicates that growth is primarily been constrained by a low rate of capital accumulation, which has failed to resume its pre-foreign-debt-crisis pace after price stabilization, structural reforms and expanded access to foreign financing.

Table 1.2: Decomposition of growth in GDP per worker
(average annual change in variables)

Variables	1947-60	1961-80	1981-94	1995-2006
GDP/worker	4.5%	4.0%	-0.2%	0.5%
Capital/worker	7.4%	5.0%	0.7%	-0.7%
TFP	1.0%	1.7%	-0.5%	0.9%
Memo				
Labor	2.5%	3.1%	2.1%	2.1%

Note: Uses a Solow decomposition with labor and capital shares of respectively 0.531 and 0.469, estimated from average shares in value added in 2000-04.

The slowdown in capital accumulation reflected, in turn, the decline in the rate of investment (Table 1.3). In current prices, the rate of investment plunged form 21% of GDP in 1968-78, the period of fastest GDP growth, to 16% of GDP in 2003-05 (16.8% of GDP in 2006). Three stylized facts are worth noting about this contraction in the investment rate: [2]

- Because the relative price of investment goods vis-à-vis the price of consumption goods and services increased between these two periods,, the real drop in investment was even more significant than suggested by the current price figures. When measured in

[2] Data for the relative price of investment goods in 1987-89 and, to a lesser extent, 1990-94 are apparently distorted, possibly due to measurement problems stemming from the very high inflation observed in this period. Due to the way investment and savings were estimated in that period – from investment at constant prices to investment in current prices, then equated to total savings, from which foreign savings were subtracted – we abstain from analyzing these variables in these two periods.

"constant" 1980 prices, the rate of investment fell from 22.8% of GDP in 1968-78 to 13.3% of GDP in 2003-05. Half of this decline resulted from the rise in relative prices, with the other half stemming from the contraction in the investment effort, that is the rate measured at current prices. In section 3 we delve into the factors that may explain this rise in relative prices.

- The decline in the rate of investment resulted essentially from a major contraction in public investment. The rate of investment of public administration fell by 2.3% of GDP between 1967-78 and 2003-05, while that of federal state-owned enterprises (SOEs) dropped by 2.9% of GDP in the same comparison.[3] By these accounts, the public effort to support investment faltered by more than 5 points of GDP and would fully explain the decline. Although part of the decline in SOE investment stems from changes in classification, as a result of privatization, the bulk of it had already happened by 1990-94, before the peak of privatization in 1996-98. Indeed, the decline in public investment is underestimated, for it does not take into account the contraction in investment by state and municipal SOEs. The main consequence of this fall in public investment has been the deterioration in the quantity and quality of infrastructure, an issue discussed in section 3.[4]

[3] Gobetti (2006, apud Afonso, Biasoto and Freire, 2007) notes that the decline in public investment has been even more significant than captured in the official statistics, for part of the capital expenditures counted in one year are only disbursed in the following years. For the federal public administration alone, this meant that the actual investment in 2004-05 was 0.14% of GDP lower than shown in the national accounts statistics.
[4] Indeed, the bulk of federal SOE investment in recent years has been in the oil sector, not infrastructure.

Table 1.3: Investment and Savings (percent of GDP)

	1947-67	1968-78	1979-86	1987-89	1990-94	1995-2002[5]	2003-05[5]
Investment[1]							
Total	15.0	20.8	21.4	24.8	19.4	16.9	15.9
Public administration	3.7	4.0	2.5	3.3	3.4	2.0	1.7
Federal SOEs[2]	1.0	3.9	3.8	2.4	1.8	1.1	1.1
Petrobras[3]			1.2	0.6	0.5	0.5	0.9
Savings							
Domestic	15.4	19.3	18.0	25.2	19.8	13.8	17.2
Public administration	2.0	4.9	0.3	-1.1	3.6	-0.3	-0.3
Memo							
Total investment in constant "1980 prices"[4]	18.2	22.8	19.6	17.2	14.6	15.1	13.3
Ratio of investment and GDP deflators	83.0	91.1	109.8	144.6	133.4	112.0	119.8

Sources: IBGE, IPEADATA, Giambiagi (2006) and Ministry of Finance. See text.

1/ Does not include changes in inventories. 2/ In last column, average for 2003-04. 3/ In third column, average for 1980-86. 4/ Calculated based on 1980 investment rate and chained indices for investment and GDP. 5/ Use revised National Accounts, which raised the level of GDP by an average 8.8% in 1995-2003.

- There was a major contraction in domestic savings from 1967-78 to 1995-2002, largely explained by the decline in public savings. In 2003-05 there was a substantial rise in private savings, which compensated for the fall in foreign savings, which in this recent period turned negative. Thus, while the rate of investment declined by 4.9% of GDP between 1967-78 and 2003-05, public savings dropped by 5.2% of GDP, foreign savings fell by 2.8% of GDP and private savings went up by 3.1% of GDP. These figures suggest that there is a reasonable scope to finance an increase in the rate of capital accumulation by

raising public and foreign savings, as long as they do not crowd out private savings. We return to this topic in section 4.

Recent papers have linked the decline in public investment to the effort to generate large primary surpluses. Fay and Morrison (2005), for instance, argue that in "most Latin American countries, public investment, particularly in infrastructure, bore the brunt of fiscal adjustment". Easterly and Servén (2003) make a similar argument and ask whether the strategy to sustain large primary surpluses is not self-defeating, since by compressing public investment, notably in infrastructure, growth decelerates and makes fiscal discipline more difficult to sustain. In this sense, the effort to cut down the fiscal deficit in the early 1980s may have prompted governments to lower public investment, including that of SOEs, a more politically palatable policy than cutting salaries, especially while the country was returning to a democratic regime; however it is much harder to use the same argument to explain more recent cuts and, indeed, why public investment has not returned to previous levels. Table 1.4 shows that between 1995 and 2003 current government revenues increased by 7.2% of GDP, whereas the primary surplus went up 2.7% of GDP and investment came down 0.8% of GDP. That is, the increase in revenues went well beyond what was needed to increase the primary surplus, and yet public investment continued to fall. This pattern continued in the following years, with the tax burden reaching an estimated 35.3% of GDP in 2006 and the primary surplus 3.9% of GDP.

Table 1.4: Public current revenues and expenditures - 1995 and 2003 (% of GDP)[1]

	1995	2003
Current revenues	31.53	38.77
Taxes [2]	26.04	31.13
Other current revenues[3]	5.49	7.63
Expenditures	0.00	0.00
Current	0.00	0.00
Consumption of goods and services	17.95	18.05
Nominal interest payments	5.77	8.34
Social security and social assistance benefits	12.04	14.55
Other income transfers to private sector[4]	0.79	0.54
Fixed Capital expenditures	2.33	1.56
Investment in infrastructure	0.85	0.39
Primary surplus	0.38	3.09

Sources: Afonso and Araújo (2005), Brazilian National Accounts 2003, IBGE.

1/ Adjusted to higher levels of GDP in revised National Accounts. 2/ The new National Accounts revised tax burden in 2003 up to 31.9% of GDP. 3/ It includes: dividends, withdrawals from income of quasi-corporations, property income attributed to insurance policyholders, rent, and imputed social contribution. 4/ Considers benefits paid by the INSS + RJU + FTGS + benefits in cash + various current transfers.

Two main items concentrated the expansion in current expenditures in this period. One is interest payments on the public debt, as a consequence of the rise in the level of the public debt, combined with a contractionary monetary policy. The outlook for interest payments is, though, relatively benign: in 2006, they were down to 6.9% of GDP (controlling for the effects of changes in the exchange rate) and are expected to fall further in 2007-10.

The second item is pensions and social assistance transfers, which increased substantially between 1995 and 2003. By contrast to interest payments, this item has continued to rise along an unsustainable path. This expansion in current expenditures, on the back of

continued increases in the tax burden and the lowering of public investment, might have compromised growth in different ways:

- Ferreira and Nascimento (2005) estimate that the decline in public investment has diminished annual GDP growth by about 0.4 percentage point, while the rise in taxes, by substantially increasing the capital tax rate, reduced incentives to invest and lowered annual GDP growth by about 1.5 percentage point.[5] Not surprisingly, the World Bank's 2003 Investment Climate Survey (ICS) in Brazil reveals that firms rate the high tax burden as the most important obstacle to their growth (World Bank, 2003).
- The increase in the tax burden, which more formal companies producing capital goods and inputs to civil construction find hard to elude , may be part of the explanation for the rise in the relative price of investment goods.
- The high tax burden fosters informality, discouraging productivity growth and human capital accumulation (McKinsey, 2004).
- The increase in the tax burden was accompanied by a rise in the complexity of the tax system and the administrative burden associated to it, further penalizing firms. Firms perceive this administrative burden to be their sixth most important obstacle to growth.
- The rapidly expanding current public expenditures have also burdened monetary policy, used through most of the last fifteen years as the single instrument to control inflation and balance the expansion in aggregate demand and supply. This helped to boost interest payments on the public debt and discourage investment and growth (Adrogué, Cerisola and Gelos, 2006). Another consequence has been a very high base interest rate, which together with high spreads make credit very expensive to firms and consumers. A significant part of this spread stems from direct and indirect taxation on financial intermediation. Firms ranked the high cost of finance as the second most important obstacle to their growth (World Bank, 2003).

This unbalanced mix of fiscal and monetary policies also helped to fuel macro instability, which firms see as the fourth most critical obstacle to growth. However, as indicated in Table

[5] See World Bank (2006) for further evidence on the negative impact on growth of the rise in the tax burden and the changed composition of government spending. In particular, the study argues that "the long-run elasticity of per capita GDP with respect to the public capital stock is larger than of the private capital stock" and that higher taxes reduce GDP growth by depressing private capital accumulation.

1.5, in recent years not only have the key macro indicators become more favorable, but there has also been a decline in volatility, as indicated by lower standard deviations. This partly reflected the more friendly external environment, with the absence of the recurrent external financing crises of t1995-2002, and that, so far, the resulting exchange rate appreciation has not prevented the country from recording record trade surpluses. It remains to be seen whether this lower volatility and improved macro indicators will stand a less friendly external environment.

Table 1.5: Means and standard deviations of selected macro indicators

	Period	Industrial Output (% per year)[1]	Inflation (% per month)	Real interest rate (Selic, % per month)	Change in real exchange rate (% per month)
Mean	1975-86	4.4	5.7	-0.2	-0.2
	1987-89	0.3	21.7	0.7	-1.3
	1990-94	0.4	25.3	0.3	-0.9
	1995-2002	2.1	0.8	1.1	0.8
	2003-06	3.6	0.5	0.9	-1.5
StandardDeviation	1975-86	7.8	3.8	2.1	3.2
	1987-89	7.0	10.4	3.9	4.2
	1990-94	10.7	16.6	5.1	4.5
	1995-2002	6.0	0.9	0.9	4.8
	2003-06	4.2	0.6	0.6	3.2

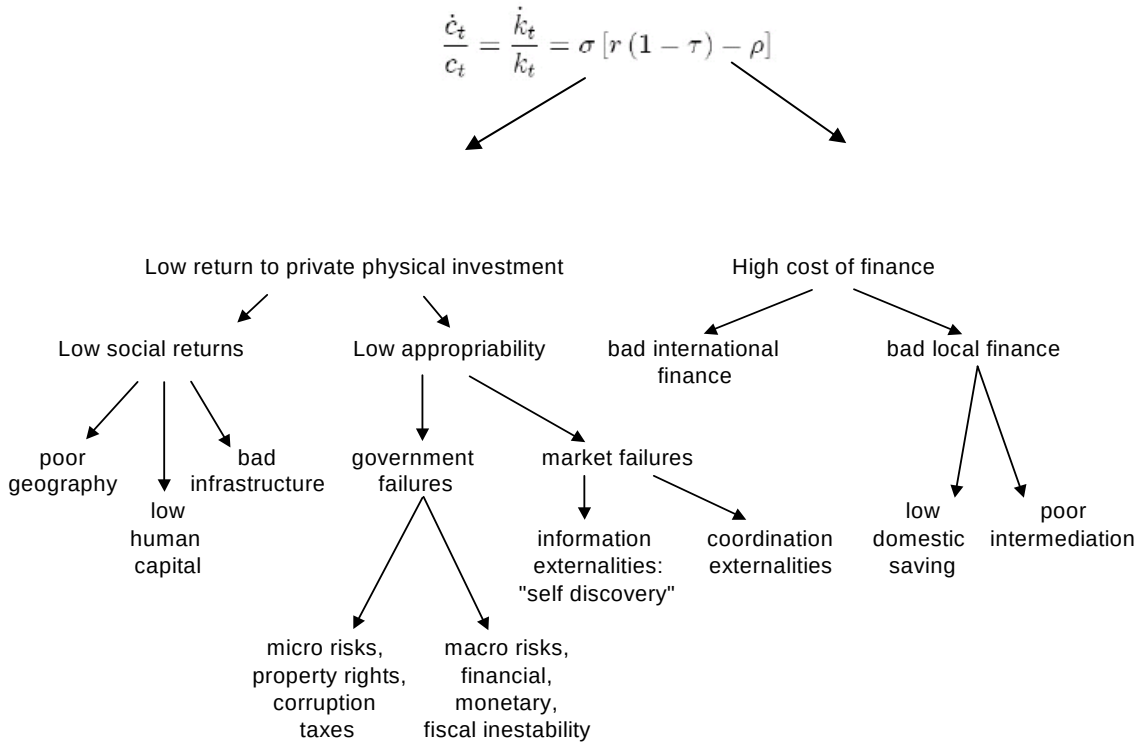
Source: IPEADATA. 1/ Rate of change against same month in previous year.

With this preliminary overview of the Brazilian economy, we now proceed to discuss the methodology to be used in this paper and then to analyze several hypotheses regarding the binding constraints to an acceleration of Brazil's GDP growth.

2. Theoretical Framework

This paper applies the growth diagnostic methodology (GDM), the theoretical framework proposed by Hausmann, Rodrik and Velasco (2005) (HRV) for identifying the binding constraints to growth in specific country circumstances. The GDM assumes that private physical investment is the key symptom of healthy growth and focuses on identifying the factors that, directly or indirectly, constrain it. Ideally, the goal is to single out from among all the possible constraints the ones most likely to be binding in specific circumstances, since eliminating these constraints should then have the greatest impact on increasing growth. The analysis starts by asking whether low private physical investment arises from (1) low returns to capital accumulation or (2) high cost of financing this accumulation, and then proceeds in the sequencing illustrated in Figure 2.1.

Figure 2.1: GDM decision tree



Some key considerations of the growth diagnostics methodology can be summarized as follows:

(i) A country might exhibit several constraints that could eventually limit its growth performance, but not all of them might be equally important. The key to the methodology is the observation that if a factor is constraining growth, one should typically observe it to be in short supply and yielding high returns. For example, the economy may be able to deploy additional resources in high-yield activities, but may be prevented from doing so because they are just not adequately provided. Therefore, the tightness of the constraint should be observed in the price the society is willing to pay for the scarce resource.

(ii) Binding constraints may change. In the normal course of successful economic reform, binding constraints are removed and the economy grows until a new binding constraint limits it. Moreover, even when no binding constraint is removed, political/economic events or shocks can be such that new binding constraints supersede earlier binding constraints.

(iii) Given a list of potential constraints, the search for those that are binding involves qualitative investigation to test each one against the implications that would be observed if it were the binding constraint. Investigations of this sort are, like all scientific inquiry, such that each hypothesis can be rejected, but none can be "proven". Instead, when a hypothesis is tested against multiple implications, and is not rejected under any of them, then we gain a degree of confidence that we have identified the binding constraint.

Although the GDM is an attractive framework to perform growth analyses, it also presents some shortcomings. For example, the GDM rests strongly on the idea that the main problem inhibiting growth can be traced to a low level of private physical investment. Yet several growth and development accounting exercises have consistently shown that total factor productivity (TFP) is the most important factor explaining long-run differences in growth rates and in income levels across countries (see for example, Prescott, 1998; Hall and Jones, 1999 and Easterly and Levine, 2001). In the GDM framework, the effects of TFP on growth operate only through its indirect impacts on the investment rate. As argued in the GDM framework, investment might indeed be low because productivity is low, but TFP may also substantially affect economic growth directly. The GDM approach does not address the possibilities, for example, that the investment level may be high but its social returns low, because of distortions in intertemporal relative prices, or that productivity might be low because existing investment is

being misallocated into low-return activities, even though private and social returns are both on average high and the financing is available. Given the strong dose of "capital fundamentalism" in the GDM framework, a careful analysis of productivity issues is warranted, particular for economies in which the investment demand is found to be healthy. Furthermore, the decision tree as outlined above also does not address the possibility that low private returns may arise not just because of appropriability problems, but also as the result of distorted relative prices or a financial system that does not allocate savings efficiently across investors. Such distortions may affect not just the productivity of investment, as outlined above, but its level as well.

From an empirical point of view for the case of Brazil, the growth accounting exercise in the previous section shows that although TFP growth has also been relatively disappointing, low investment is the main suspect of the growth slowdown in last two decades. In the next section, we use the GDM as a guideline to structure the discussion of several potential binding constraints to faster growth in Brazil. As a rule, we carry out four basic tests to assess the relevance of each constraint. First, we ask whether Brazil is different from the world norm or the regional standards regarding the specific variable, using cross-country comparisons that control for income level. Second, we analyze whether the constraint has changed in a way consistent with the growth deceleration described in section 1. Third, we use business surveys, such as the Investment Climate Survey (ICS), to examine how firms rate the importance of the constraint. Fourth, we look at prices and other variables to check whether they signal the presence of excess demand – for instance, when a certain input or activity is paid an abnormally high return. We also seek other approaches to complement the research. For example, we apply Klenow and Rodriguez-Clare's (2005) methodology to assess whether there are specific barriers to the accumulation of knowledge. We also resort to regression analysis to check whether the presence of a certain constraint is consistent with the profile of sector or municipal output.

Following the tree-based approach sketched in Figure 2.1, we first test hypotheses related to Low Returns to Private Physical Investment (section 3) and then we investigate hypotheses related to the High Cost of Finance (section 4).

3. Hypotheses testing: Low Returns to Private Physical Investment

a. Low Social Returns

1. Inadequate Infrastructure

In the GDM framework, the quality of capital infrastructure affects the social return on private physical investment by influencing its productivity. For instance, good roads speed up the transportation of goods, allowing the same number of trucks to transport a larger volume of freight. They also lower depreciation and maintenance costs. Good telecom infrastructure allows transactions to be carried out with greater speed and reliability, and in many cases make personal contact unnecessary. Electricity supply is vital for most machinery and equipment to operate: when not provided by regular electricity companies, they have to be generated by the firms themselves, at a higher cost and lower quality.

To what extent is infrastructure a binding constraint to growth? Table 3.1 shows that the slowdown in economic growth coincided with a significant drop in the pace of expansion in infrastructure stock. Reforms clearly failed to reverse this process, except for telecom, which experienced a boom especially after the sector was opened to private investors (1996) and the former state monopoly privatized (1998). In electricity, the expansion of generation capacity accelerated slightly in 1995-2004 after the remarkable slowdown in 1981-94; but this only after the ruinous power shortage of 2001-02, which reflected exactly the failure of output capacity to accompany the growth of consumption.

Table 3.1: Average annual rates of expansion in selected infrastructure sectors (%)

	Extension of road network (km)		Electricity (Generation capacity, MW)	Telecom (Number of phone lines) [3]
	Total	Paved Roads		
1931-1950[1]	4.6	5.1	4.5	9.0
1951-1960[2]	5.7	21.6	6.3	7.0
1961-1980	5.4	9.3	10.2	9.6
1981-1994	0.8	4.5	4.0	7.3
1995-2004	0.6	3.0	4.6	20.6

Source: Pinheiro, Gill, Severn and Thomas (2005), ANATEL and Gvconsult (2004), apud Afonso, Biasoto and Freire (2007).

1/ For number of lines, growth rates refer to 1937-50; 2/ In the case of telecom, growth rates refer to 1951-59; 3/ Fixed plus mobile, in service.

This power shortage is the most eloquent example of how the slow expansion in Brazilian infrastructure stock can be a binding constraint to an acceleration of growth, a phenomenon that may recur, given the long implementation periods of power generation projects.[6] Meanwhile, the private sector is penalized by the low quality of electricity supply with frequent brown- and blackouts, which damage electrical equipments and stop production, keeping resources idle. According to the World Bank's 2003 Investment Climate Survey, losses owing to power outages range from 0.8% of annual output in electronics to 3.5% in footwear (World Bank, 2007). The same survey revealed that over 15% of the Brazilian firms use their own power generators to deal with these problems, a proportion that rises to 50% among large firms. Diseconomies of scale make this electricity much more expensive than that generated by large power plants.

The most significant slowdown occurred in the expansion of the road network, both regarding its total extension, which virtually stagnated, and the proportion of paved roads.

[6] The Empresa de Pesquisa Energética (2005), the government institution in charge of planning the expansion of the electricity sector, estimates a 6% annual rise in the consumption of electricity for an annual expansion of 5% in GDP. ABDIB (2006) points out that to grow 3.5% per year Brazil needs to add four thousand MW to its generating capacity, against an average estimated increment of only half that amount projected for 2006-12.

Moreover, little has been spent on the maintenance of existing roads, a nontrivial problem considering that most of them were built in the two decades spanning from the mid-1950s to the mid-1970s. In 2006, the National Confederation of Transport (CNT, Confederação Nacional dos Transportes) assessed the quality of roughly (the main) half of the paved roads in Brazil, classifying 25% as good or excellent, 38% as inadequate and 37% as bad or very bad. In addition to causing hundreds of deaths every year, the poor condition and high congestion of Brazil's roads reduces the productivity of private investment. The World Bank (2007) reports that this adds half billion dollars a year in vehicle operational costs alone. Moreover, the aforementioned Investment Climate Survey revealed that losses owing to poor transportation infrastructure range from 2.2% of annual output in electronics to 4.7% in auto-parts. Small and medium firms in labor-intensive industries suffer the most from inadequate infrastructure services.[7]

The decline in the rate of expansion of the infrastructure stock reflected, in part, the fact that stocks were initially small and rose over time. But that was only part of the story, for a similarly significant reduction was recorded in investment per se (Table 3.2). After reaching 5.4% of GDP in 1971-80, when measured in constant 1980 prices, the rate of infrastructure investment dropped by a third in the following decade, and had fallen an additional 50% by the mid-1990s, when it reached just a third of the level recorded in the seventies. Proportionately, a less significant decline took place in telecom, whereas in both electricity and transport the rate of investment fell to less than a fourth of the 1970s' level. The rate of infrastructure investment recovered somewhat in the second half of the nineties, but with differences across sectors. In 1999-2000, the rate of investment stayed below the already low 1990-94 level in electricity and transport, but increased in sanitation and more than doubled in telecommunications.

This contraction in infrastructure investment reflected the retrenchment in public investment, including both the government per se and its companies, and the failure of the privatization cum regulatory reform to reverse this decline.[8] Because the private sector invested nearly nothing in infrastructure until the second half of the 1990s, the decline shown in Table 3.2 between the 1970s and 1995-96 can be entirely attributed to lower public sector investment. Public infrastructure investment declined further from 1999 onwards, largely due to the

[7] See World Bank (2007) for further evidence on the negative effects of Brazil's infrastructure on firms' productivity and competitiveness.

[8] See Pinheiro (2005) for a discussion of the factors leading to the contraction in public infrastructure investment and the failure of privatization and regulatory reform to spur greenfield investment projects.

reclassification of state enterprise investment as a result of privatization – in telecom alone, investment fell by 0.8% of GDP with the sale of Telebras (Table 3.3). Yet, the further contraction in public investment in transport and electricity in 2002-03 cannot be attributed to accounting, since there have been virtually no privatizations in either sector since 2000.[9]

Table 3.2: Investment breakdown (as percent of GDP, in constant 1980 prices) [1]

Year	1971-1980	1981-1989	1990-94	1995-96	1997-98	1999	2000
Total	23.5	18.0	14.9	17.0	16.4	16.1	16.5
Residential building	4.95	4.71	4.03	3.99	4.24	3.97	3.60
Petroleum	0.95	0.88	0.39	0.35	0.36	0.45	0.51
Public Sector (excludes Transport) [2]	3.00	1.43	1.86	1.65	1.68	1.10	1.20
Infrastructure	5.42	3.62	2.16	1.79	2.77	2.70	2.58
Electricity	2.13	1.47	0.85	0.52	0.79	0.77	0.67
Telecommunication	0.80	0.43	0.50	0.66	0.98	1.17	1.07
Transport	2.03	1.48	0.69	0.48	0.68	0.56	0.63
Sanitation	0.46	0.24	0.07	0.13	0.32	0.20	0.21
Others	9.18	7.36	6.46	9.22	7.35	7.88	8.61

Source: Bielschowsky (2002: 25-29).

Note: 1/ Does not take into account 2007 revision in national accounts. 2/ Public Sector = non-financial public sector, excludes transport.

[9] In transport, in particular, privatization took place in areas that historically had seen little investment, such as railways, and yet investment by the federal government in transport dropped from an average 1.44% of GDP in 1976-78 to a mere 0.13% of GDP in 2002-04 (Frischtak and Gimenes, 2005).

Table 3.3: Infrastructure investment by public administration and state enterprises (% of GDP, current prices)[1]

	1995-96	1997-98	1999-2000	2001	2002	2003
Total	2.54	2.58	2.28	1.66	1.20	1.20
Transport	0.78	0.79	0.85	0.76	0.55	0.62
Telecommunications	0.78	0.81	0.43	0.03	0.03	0.03
Electricity	0.60	0.50	0.51	0.51	0.40	0.31
Sanitation (water and sewage)	0.39	0.48	0.49	0.37	0.24	0.23
Public administration	0.92	0.89	0.90	0.75	0.52	0.60
Federal	0.16	0.19	0.21	0.16	0.14	0.15
State	0.26	0.30	0.46	0.40	0.24	0.26
Municipal	0.51	0.41	0.23	0.18	0.15	0.19
State enterprises	1.62	1.69	1.38	0.91	0.68	0.60

Source: Afonso and Araújo (2005). 1/ Adjusted for changes in GDP in revised national accounts.

To foster private investment in infrastructure, substantial ownership and regulatory changes were implemented in 1996-2000. Private investors now control the telecom and railway sectors, the country's largest ports, some of the main highways, two-thirds of the distribution and a fifth of the generation of electricity, together with a small but non-negligible share of sewage and water services. Along with privatization, these six sectors saw the dismantling of a regulatory framework that in some cases had been in place for half a century. Yet, the expansion in the stock of infrastructure continued at a slow pace. ABDIB (2006) estimates that in recent years actual investment covered only 65% of the needs for capital accumulation in telecom, 45% in transport and 33% in sanitation. At least three factors contributed to these frustrating results:

(i) Private investment in infrastructure in the 1990s was largely geared to buying the companies being privatized, not to expanding the existing capital stock; greenfield projects accounted for less than a quarter of the total volume of private investments in infrastructure (World Bank, 2007).

(ii) In comparison to other countries within or outside Latin America, the participation of private investors in infrastructure in Brazil is relatively low (World Bank, 2007).

(iii) Ownership and regulatory reforms succeeded in increasing productivity and investment but from low levels; investment in particular was largely concentrated on the rehabilitation and modernization of existing facilities. The only exception was the telecom sector, in which output capacity increased annually at double-digit rates. [10]

It has long been acknowledged that infrastructure can have an impact on growth stronger than other types of investment, especially in a context in which it is relatively scarce. A more recent literature has also explored the effects of infrastructure development on income distribution, also concluding that they can be large.[11] Ferreira and Nascimento (2005) estimate that the decline in public investment since the early 1980s, largely concentrated on infrastructure, lowered annual GDP growth by about 0.4 percentage points.[12] The authors conclude that a return of the public investment rate to its pre-1980 level would have sizeable impacts on output growth. According to Calderón and Servén (2003), 35% of the increase in the gap of GDP per worker between Brazil and East Asia since the early 1980s resulted from this slower accumulation of infrastructure capital. In another study (Calderón and Servén, 2004), they estimate that if the stocks and quality of Brazilian infrastructure rose to the level of Costa Rica, the country with best infrastructure in Latin America, its annual GDP growth rate would rise by 2.9 percentage points.[13] Ferreira and Araújo (2006) find that in Brazil long-run output elasticities are especially large for infrastructure investments in electricity and transportation. Using data from the Investment Climate Assessment, Escribano et al. (2005) show that infrastructure is one of the main determinants of total factor productivity (TFP) in Brazil and other LAC selected countries. Without necessarily subscribing to anyone of these findings in particular, these pieces of

[10] There are signs, though, that this may be changing, typically in cases in which firms provide infrastructure services for their own use. In rail transportation, for instance, the rate of investment stayed around 0.06% from 1997-98 to 2002-03, but in 2004-05 rose to 0.14% of GDP, while going from being predominantly public to become entirely private (ANTF; Frischtak and Gimenes, 2005). In ports, too, companies have started to invest more intensely (Estado de São Paulo, April 08, 2007).

[11] See Ferreira (199x) for a review of the earlier studies in this area, and Calderón and Servén (2004) and World Bank (2007) for a discussion of the more recent studies.

[12] See World Bank (2006) for further evidence in this regard.

[13] Income distribution would also improve substantially. Bringing Brazil's infrastructure to the standards observed in Korea (the median of East Asia and the Pacific) would increment its growth rate by 4.4 percentage points.

evidence appear collectively compelling in identifying infrastructure as a potentially important binding constraint to economic growth in Brazil.[14]

However, there are four main arguments against this conclusion. First, different business surveys show that firms do not perceive infrastructure as the main factor compromising their competitiveness or limiting their expansion. In the World Bank's 2003 Brazil Investment Climate Survey, electricity, transport and telecom were three of the four least important obstacles to growth out of a list of twenty one potential constraints: a fifth or less of the managers interviewed considered them a major or severe obstacle to growth (see section 3.2.a). Likewise, when asked in the same survey to grade the severity of several problems as constraints for their operation and growth, using a four-point scale of rising severity, infrastructure was not ranked as a main binding constraint, with average grades varying from 0.62 for telecommunications to 1.20 for electricity and 1.28 for transportation.

This micro evidence has to be taken with a grain of salt, though. For one, because it is possible that firms react in this way because poor infrastructure affects all of them in the same way, and therefore does not impact their ability to compete, differently from high taxes, ranked as the most important obstacle, which drive a wedge between the competitiveness of formal and informal firms.

Second, the stock of Brazilian infrastructure compares well with that of other countries in the region, and with emerging economies in general, with the noteworthy exception of the proportion of paved roads (Table 3.4). In telecom, Brazil has a relatively good density of fixed and mobile phones, in both cases above the average for LAC and middle-income countries. Income level, more than supply constraints, seem to be the main limitation to a further deepening of telephone penetration in Brazil, since there are millions of installed lines not in use due to lack of demand. The contrast in electricity is not much different, regarding both level of per capita consumption and access.[15] For water and sanitation indicators for Brazil are exactly the same as for the LAC region and better than for middle-income countries. In transport, though, Brazil has both a low road density -- partly the result of its large area, a substantial share of which covered with dense forests -- and poor road conditions, with just 5.5% of them paved, and not necessarily

[14] Cited in World Bank (2007). Similar, even if less strong evidence is reported by Subramanian, Anderson and Lee (2005).

[15] Performance is less favorable in the case of transmission and distribution losses, but this is likely due to the more intense use of hydro-electricity, with several hydro power plants being located far from the main consumer markets.

well paved. In the cases of electricity, sanitation and transport, the constraint is clearly on the supply side. The deficiencies in infrastructure become more evident, though, when Brazil is contrasted to Chile and Korea.

Scatter plot diagrams of these infrastructure indicators built with the entire country sample reported in the World Development Indicators (not shown here) reveal, however, a statistically significant non-linear association with per capita income. As shown in Table 3.5, when we control for income level, we verify that Brazil presents several infrastructure indicators with an unfavorable statistically significant difference from the trend line. Note, in particular, the large negative coefficient recorded for the proportion of paved roads. In light of this evidence, a case can be made that, particularly in transport and electricity, the quality of Brazil's infrastructure to a large extent reflects the high investment levels dating back to the 1950-85 period. If it keeps the recent investment rates, Brazil's infrastructure is likely to lag behind that of other large emerging economies, such as China and India.

Table 3.4: Comparative infrastructure indicators

	Brazil	Chile	Mexico	Korea	USA	Middle-income countries	LAC
Fixed main lines (per 1000 inhab)	230	206	174	542	606	192	180
Mobile subscribers (per 1000 inhab)	357	593	370	761	617	293	318
Consumption per capita KWH	1883	2880	1801	7018	13078	1720	1615
Access to electricity (% of population)	95	99	n.a.	n.a.	n.a.	90	87
Transmission and distribution losses (% of output)	17	6	15	3	7	11	16
Access to improved water source	89	95	91	92	100	83	89
Access to improved sanitation facilities	75	92	77	n.a.	100	61	75
Road density (thousand km per sq km x Million inhabitants)	1.1	6.6	1.7	20.5	2.3		
% of roads paved	5.5	20.2	33.5	76.8	58.8	50.8	26.8

Source: World Bank, World Development Indicators. Note: data for access to water and sanitation is for 2002; for roads and electricity for 2003, except for access to electricity, which refers to 2000; and for telecom 2004.

Table 3.5: Brazil: Differences from trend line [a/]

Variable	Coefficient	t-Statistic	R^2	# Obs	Obs.
Fixed line density	55.5	5.6	0.86	139	
Mobile line density	-35.5	-1.8	0.85	139	
Per capita electricity consumption	-373.0	-1.4	0.73	113	
Transmission and distribution losses	2.7	3.6	0.46	112	Regression includes dummy for Moldova
Access to water	1.2	0.7	0.50	116	
Access to sanitation	-2.1	-0.8	0.62	110	
Road / (sq km*million inhab)	-116.7	-3.9	0.41	138	Regression includes dummy for Trinidad Tobago
Proportion paved roads	-47.0	-14.5	0.46	130	
Air freight / GNI (PPP)	0.0	-2.2	0.60	129	Regression includes Dummy for Singapore
Air passenger / million inhab	-96.2	-1.8	0.79	129	Regression includes dummy for Ireland

Source: Regressions using WDI indicators. a/ Coefficient of dummy variable for Brazil in regression of variable in first column as a function of per capita gross national income (in PPP) and per capita GNI squared.

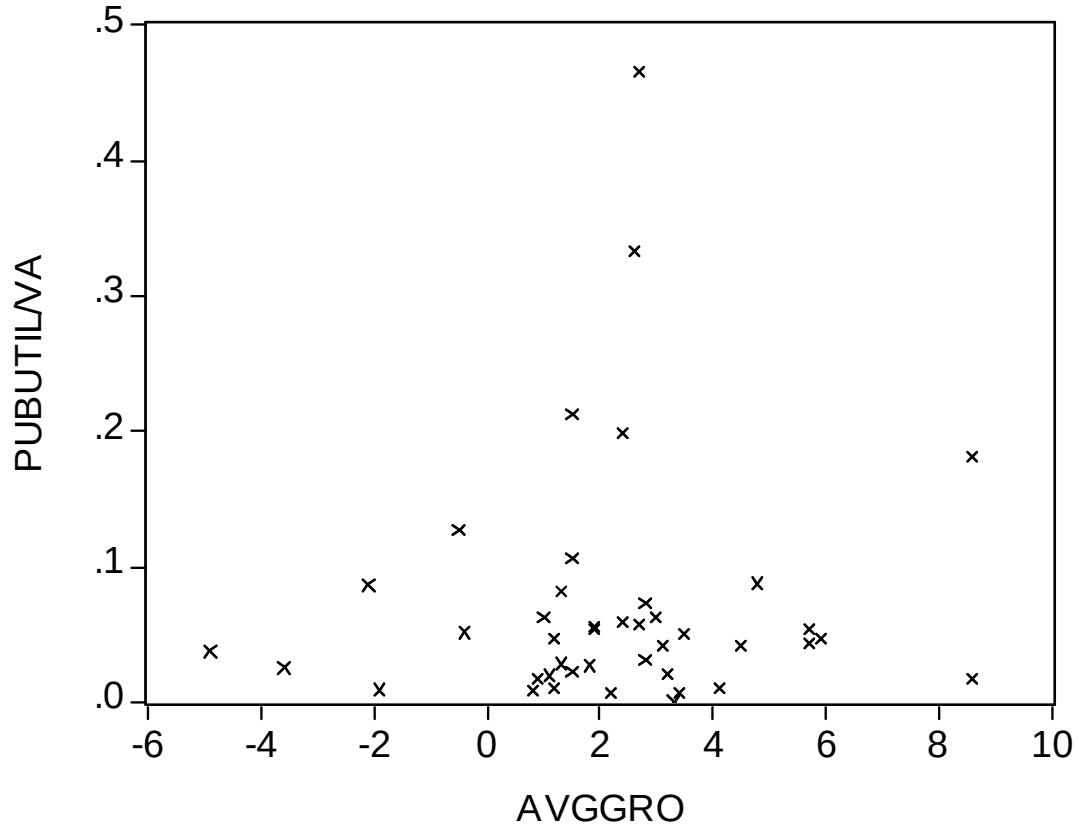
Third, there is no evidence that sectors that use infrastructure services more intensely have grown less than those that do not. In particular, there is no clear association at sector level between the rate of sector growth in value added in 1996-2004 and the intensity of consumption of infrastructure services in 1995, measured as the ratio of consumption of public utility services to value added. Figure 3.1 portrays this (lack of) association for the consumption of public utility services, which reflects basically how intensely the sector uses electricity. Likewise, a regression of average sector growth (AVGGRO) against the consumption of communications, transport and

public utility services does not suggest that sectors that rely more intensely on these inputs grew less than the ones that do not depend so much on them:[16]

AVGGRO = 2.05 -38.0*Com -0.20*FServ +6.45*Ins -0.06*Putil +12.5*Transp -0.79*Exp
(3.65)(-1.49) (-0.04) (0.27) (-0.02) (3.14) (-0.59)

$R^2 = 0.194$

Figure 3.1: Average Sector Growth (AVGGRO) and Consumption of Public Utility Services (PUBUTIL/VA)



Source: IBGE, National Accounts.

[16] Based on data extracted from IPEADATA. Notes: 1/ Estimated using data for 42 sectors and least squares estimation, with White Heteroskedasticity-Consistent Standard Errors & Covariance. 2/ Variables defined as intermediate consumption as a proportion of value added. 3/ t-statistics in parenthesis.

We also examined whether the GDP of municipalities further away from the state capital grew less than those nearer the capital in 1997-2004, which in most cases are the largest markets. If it did, it could be an indication that Brazil's poor road conditions were hurting growth. As shown in Table 3.6, there is no indication of such negative influence: on the contrary, municipalities located further from the state capital performed better, on average, than those closer by, controlling for initial per capita GDP and size (measured by population). Using an index reflecting the cost of transportation from the municipality center to the closest state capital yields a coefficient that is not statistically significant.

Table 3.6: Regression for Average Municipal GDP Growth in 1997-2004 1/

	Intercept	ln (per capita GDP 1996)	Population (million inhab.)	Population squared	Distance to state capital (1000 km)	Transportation cost (to closest state capital)	R-Squared
Coefficient	0.0799	-0.1438	-0.0177				0.788
t-Statistic	65.03	-112.61	-2.55				
Coefficient	0.0804	-0.1433	-0.0500	0.0046			0.788
t-Statistic	65.61	-110.70	-6.63	5.74			
Coefficient	0.0743	-0.1432	-0.0436	0.0040	0.0233		0.789
t-Statistic	37.79	-110.04	-5.84	5.00	4.13		
Coefficient	0.0804	-0.1432	-0.0502	0.0046		0.0000	0.788
t-Statistic	46.28	-108.71	-6.61	5.74		0.01	

Source: Based on data extracted from IPEADATA. . Notes: 1/ Estimated using data for 42 sectors and least squares estimation, with White Heteroskedasticity-Consistent Standard Errors & Covariance. 2/ Variables defined as intermediate consumption as a proportion of value added.

Fourth, although the returns to infrastructure investment may be high, so are those of investing in education, lowering the tax burden or increasing the primary fiscal surplus to more quickly lower the public debt to GDP ratio. World Bank (2007) highlights that the social return to investment projects in infrastructure are usually lower than those in education. Ferreira and Nascimento (2005) estimate that lowering taxes may generate a higher impact on growth than raising public investment. But the evidence in this regard is mixed. Thus, World Bank (2006) estimates that by relocating 1% of GDP in public expenditures from social transfers to public infrastructure investment would raise growth by 0.6 percentage point; a similar relocation from social transfers to education would raise GDP growth by just 0.1 percentage point. This difference is attributed to the fact that the public sector already spends 4% of GDP in education, against 1% of GDP in infrastructure.

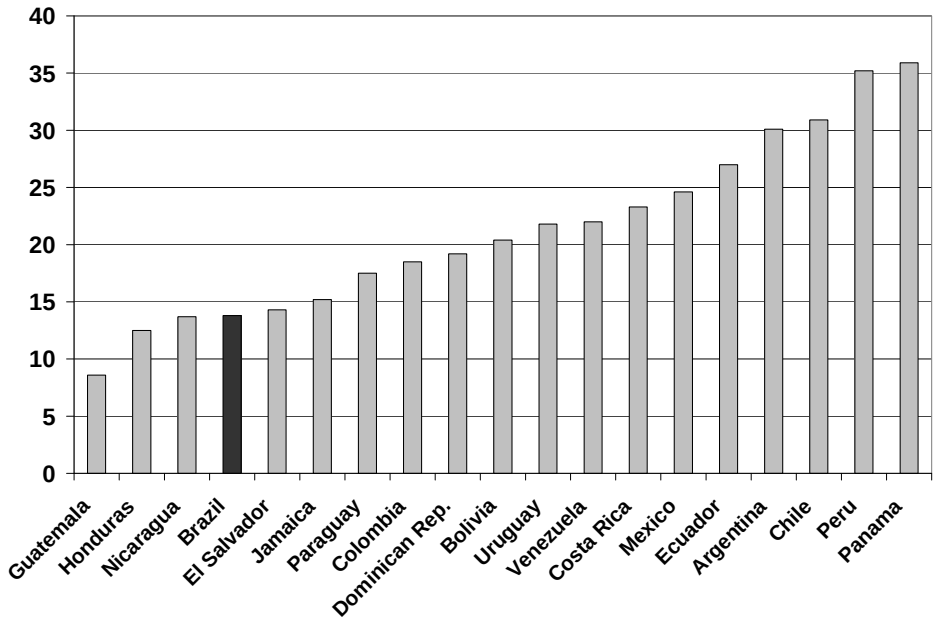
In sum, to accommodate higher growth rates, Brazil needs to improve its transport infrastructure, enhance investment in electricity generation, and expand access to clean water and improved sanitation facilities, which would possibly most benefit the poor. But considering the preponderance of the evidence, we tend to share the view expressed in World Bank (2007), that although "evidence shows that higher infrastructure investments may lead to higher growth rates and better social indicators", "it is not possible to claim that infrastructure is a binding constraint to higher sustainable growth rates in Brazil - especially when compared to high current expenditures and high levels and incidence of taxation". This is not to say, of course, that it may not become a binding constraint, if infrastructure investment rates stay at their current low levels.

2. Human capital

Human capital has long been recognized as an important engine to economic development.[17] Figure 3.2 shows that Brazil has a relatively low level of skilled labor when compared to other countries of the region, an early indication that it might have a problem in this area. In this section we look at several indicators to analyze whether the shortage of human capital is a binding constraint in Brazil today.

[17] See, for example, Lucas (1988) and Mankiw, Romer and Weil (1992).

Figure 3.2: Secondary Level Completed, 2000 (% of pop)



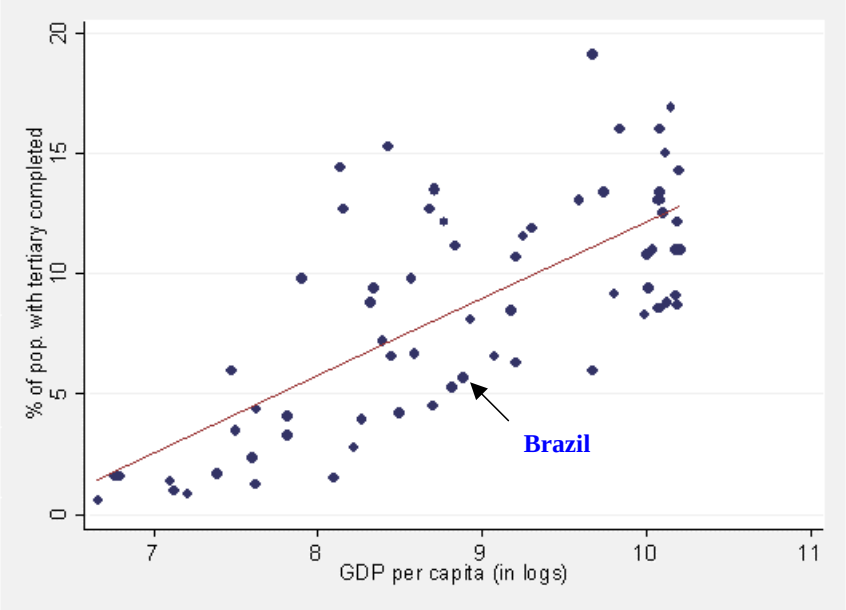
Source: Barro-Lee dataset

A high level of education in the majority of the population might not be feasible for many countries or adequate in several cases. For instance, Acemoglu, Aghion and Ziliboti (2006) argue that institutions and policies best suited to countries at the leading edge of the technological frontier need not be the right ones in less advanced places. In the case of education, the authors argue that the closer a country is to the frontier, the more growth depends on having a highly educated workforce. Away from the frontier, however, education still matters, but university degrees matter relatively less and good primary and secondary education count for relatively more. Figure 3.3a shows that, in fact, higher income countries exhibit larger proportions of their populations with complete post-secondary education.[18] Nevertheless, according to the figure, Brazil is below the trend line. The same is true when we consider completed secondary education (Figure 3.3b). The difference in tertiary education is not statistically significant but the difference

[18] Education data is for the year 2000.

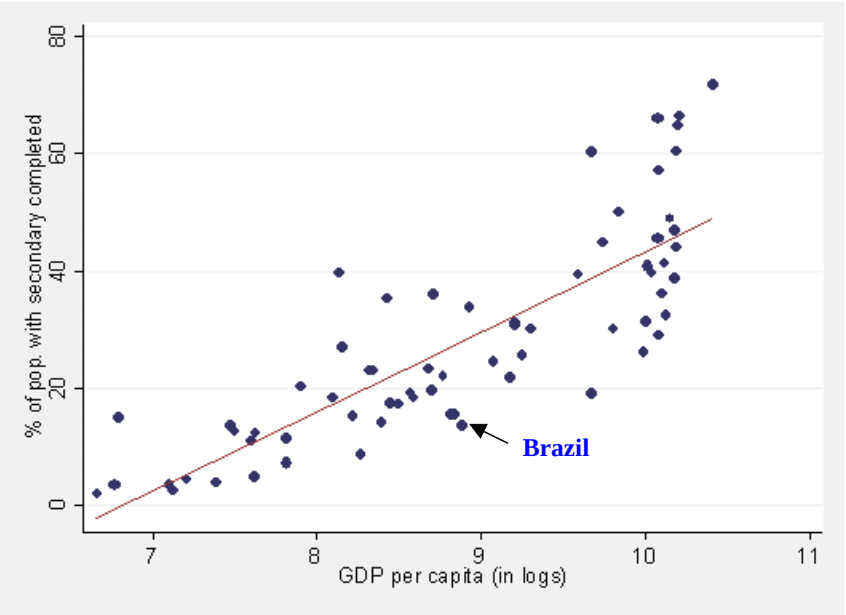
in secondary education is significant at the 10% level. This provides some evidence that even after controlling for level of development, Brazil still has some scarcity of skilled labor.

Figure 3.3a: Tertiary education and development



Source: own calculations with data from Barro and Lee and World Development Indicators

Figure 3.3b: Secondary education and development

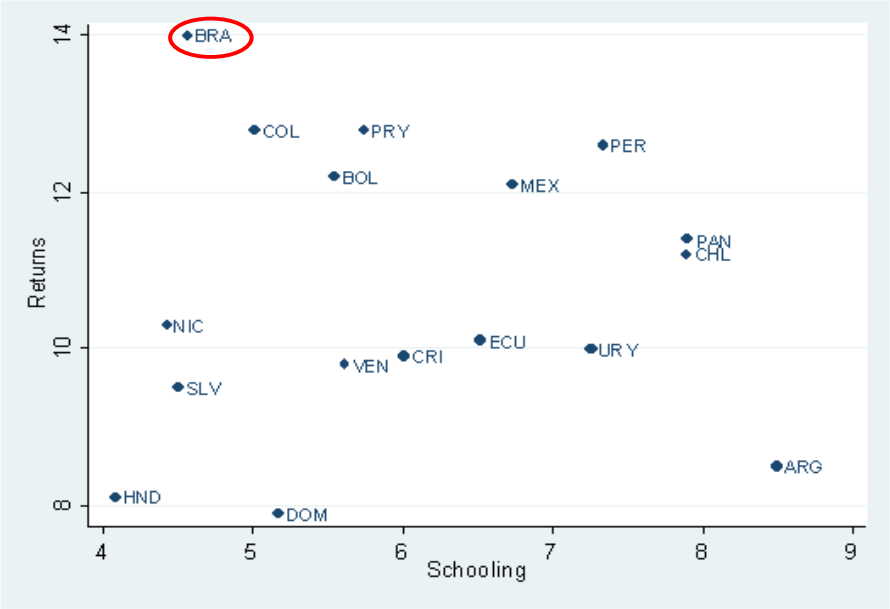


Source: own calculations with data from Barro and Lee and World Development Indicators

Another way to identify the scarcity of human capital is to analyze the returns to investment in human capital. High returns together with a low level of human capital would strongly indicate that the constraint is tight. This is presented in Figure 3.4, in which Brazil is compared to other countries in Latin America, using average years of schooling in one axis and returns to schooling in the other for the period 1996-1997.[19] Judging by the high returns of the few that get educated, the figure indicates that the constraint of human capital is binding. One possibility is that the high returns are consistent with Brazil's level of development. Figure 3.5 shows Mincerian returns to education[20] for 70 countries (for various years) versus their corresponding average income levels. There is a slightly negative association between the returns to education and the country's level of development. According to the figure, however, Brazilian returns on education appear high even after controlling for its level of development. This difference is statistically significant at the 10% level.

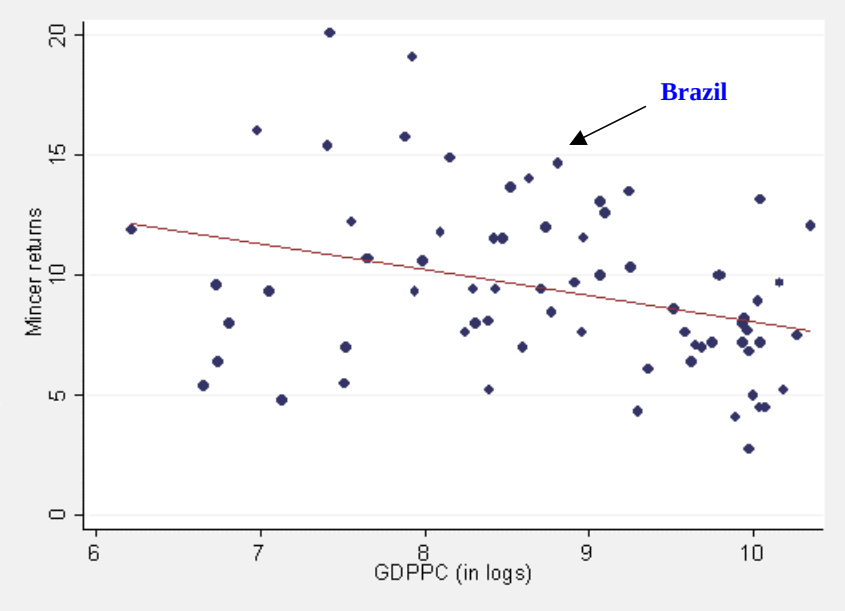
[19] The returns represent how much an additional year of schooling increases the real salary on average.
[20] In particular we report the average change in real wages due to an additional year of education.

Figure 3.4: Returns to education and years of schooling



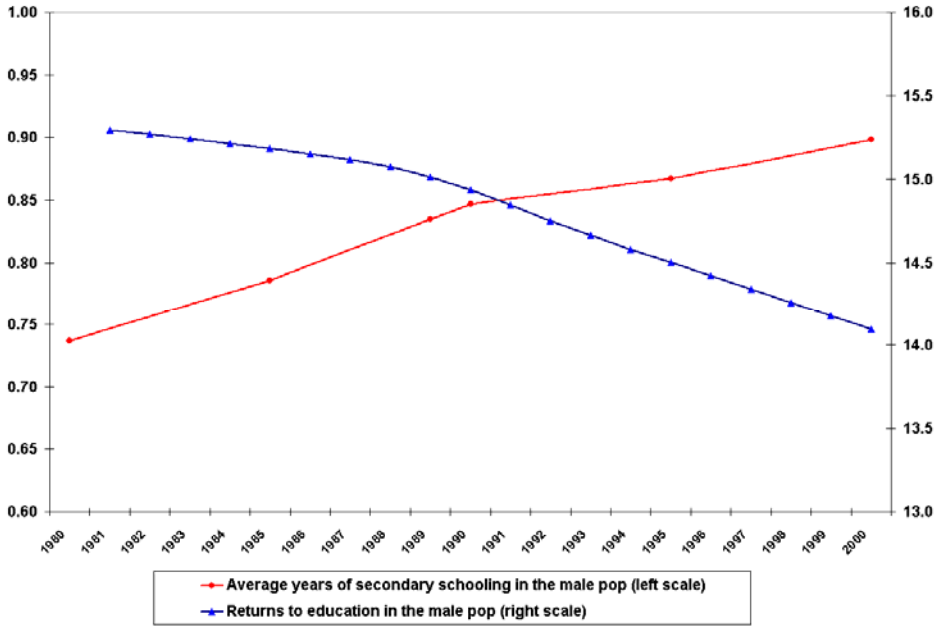
Source: Years of schooling of population age 25 and over are taken from the Barro-Lee dataset. Returns to education are taken from Menezes-Filho (2001).

Figure 3.5: Returns to education and development



An alternative way to explore the importance of human capital as a constraint to growth is to analyze how measures of investment in human capital and their returns are evolving over time. Figure 3.6, for example, shows that Brazil's Mincerian returns to education for males (corrected for the cycle using a Hodrick-Prescott filter) fell from 1981 to 2000. This decreasing trend in returns could actually be consistent with the relationship shown in Figure 3.5; that is: returns tend to fall with the level of development. This trend, could also obey to an increase in the supply of human capital during the same period, which may have released pressure on the returns (see Figure 3.6). Menezes-Filho (2001) provides some evidence supporting this argument. Indeed, Barros et al. (2006) show that the decline in the return to education has accelerated since early in this decade, falling to roughly 12% in 2004. Table 3.7 shows that this trend has continued into 2005.[21]

Figure 3.6: Returns and Years of Schooling



Source: Barro and Lee (years of schooling);
Estimations from Menezes-Filho of IPEA (Mincer returns)

[21] It also reveals that the actual return to education – and, supposedly, the gap with respect to other countries – depends on the set of controls used in the Mincerian regression.

*Table 3.7: Brazil: Mincerian returns to education – 1995-2005 (%)**

	1995	1996	1997	1998	1999	2001	2002	2003	2004	2005
Equation 1	0.098	0.096	0.096	0.095	0.094	0.092	0.093	0.091	0.090	0.089
t-Statistic	(144.13)	(137.50)	(145.94)	(146.43)	(145.75)	(150.14)	(153.94)	(149.03)	(152.68)	(152.62)
Equation 2	0.102	0.100	0.101	0.099	0.097	0.096	0.096	0.094	0.093	0.092
t-Statistic	(149.38)	(142.98)	(151.66)	(152.09)	(151.07)	(155.03)	(159.67)	(153.97)	(157.32)	(157.67)
Equation 3	0.105	0.103	0.105	0.104	0.103	0.103	0.102	0.100	0.098	0.098
t-Statistic	(161.80)	(157.19)	(166.49)	(167.63)	(168.75)	(174.36)	(178.43)	(172.22)	(174.56)	(175.58)
Equation 4	0.118	0.115	0.118	0.119	0.118	0.117	0.118	0.116	0.115	0.114
t-Statistic	(193.77)	(183.93)	(196.93)	(199.72)	(201.05)	(207.69)	(213.24)	(206.38)	(210.94)	(210.03)
Equation 5	0.130	0.126	0.131	0.130	0.129	0.127	0.128	0.125	0.124	0.124
t-Statistic	(213.49)	(200.48)	(215.74)	(219.92)	(221.16)	(224.09)	(229.23)	(221.46)	(225.76)	(224.99)
Memo										
Years of education	6.25	6.49	6.56	6.74	6.84	7.19	7.38	7.59	7.76	7.92

Source: Unpublished results from study described in Ulyssea (2007). * All coefficients statistically significant at 1%. Equation 1 - Controls: region, age, age squared, dummies for gender, position in household, urban vs. rural, and color (equal to one for male, household head, urban, and white), size of municipality, type of occupation, and sector. Equation 2 – Same controls as in Equation 1, except for size of municipality. Equation 3 - Controls: same as Equation 1, except for size of municipality and sector. Equation 4 - Controls: same as Equation 1, except for size of municipality, type of occupation, and sector. Equation 5 - Controls: only age, age squared, dummies for gender and color.

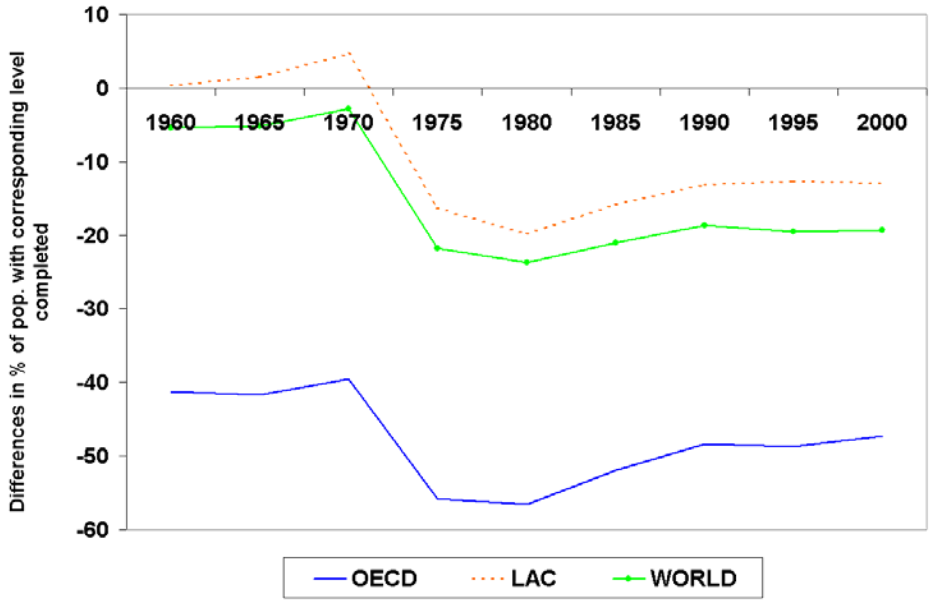
If the high returns signal a binding constraint but they are falling over time, maybe the problem of low human capital is on its way to be corrected, following the long gestation periods of knowledge accumulation, with no immediate policy implications. To shed some light on this issue, we calculate the number of years that would be required for the returns to converge to the level predicted by the regression line in Figure 3.5, assuming that they continue to fall at the current speed. Considering the trend in Figure 3.6, it would take around 60 years for the returns to converge to the predicted line assuming the GDP per capita of 2000, and more than 90 years if

the GDP per capita is allowed to grow at an annual rate of around 1.5%.[22] Even accounting for the possibility that the decline in returns is accelerating, as shown in Figure 3.6 and Table 3.7, this best case scenario would still point to a minimum of one to three decades for the gap to disappear. Although these are only back of the envelope calculations, they are indicative of the persistence of the problem if things were not to change more rapidly.

Another exercise to analyze this convergence issue is to look at the evolution of quantities, instead of prices, with respect to other countries over time. Figures 3.7a, b and c show the evolution of relative stocks of education in Brazil vis-à-vis benchmark groups of countries. The benchmarks are the OECD countries (OECD), Latin America (LAC) and an overall group of 98 countries including developed and developing countries (WORLD). With the exception of the gaps in the stocks of primary level that seem to have stabilized during the 1990s, the initial differences in the stocks of secondary and tertiary levels have widened over time. This is true not only with respect to the OECD but also with the other benchmarks. This is another indication that human capital in Brazil is probably not increasing at a sufficiently rapid pace, despite the 27% rise in average schooling of workers in the last decade (Table 3.7).

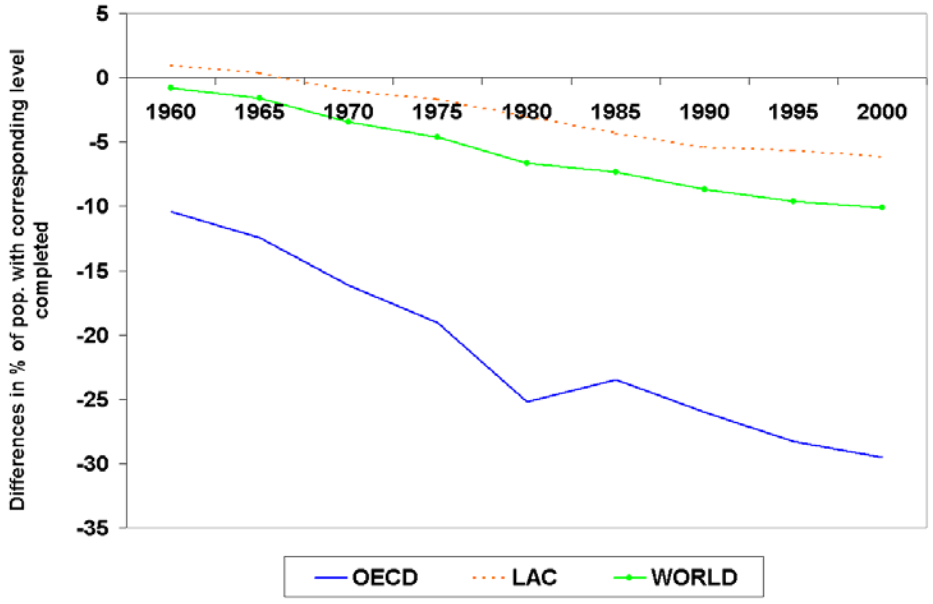
[22] Note that the predicted level of returns fall with the level of income so it would require more years to converge at the same speed.

Figure 3.7a: Differences between Brazil and benchmark in primary level completed



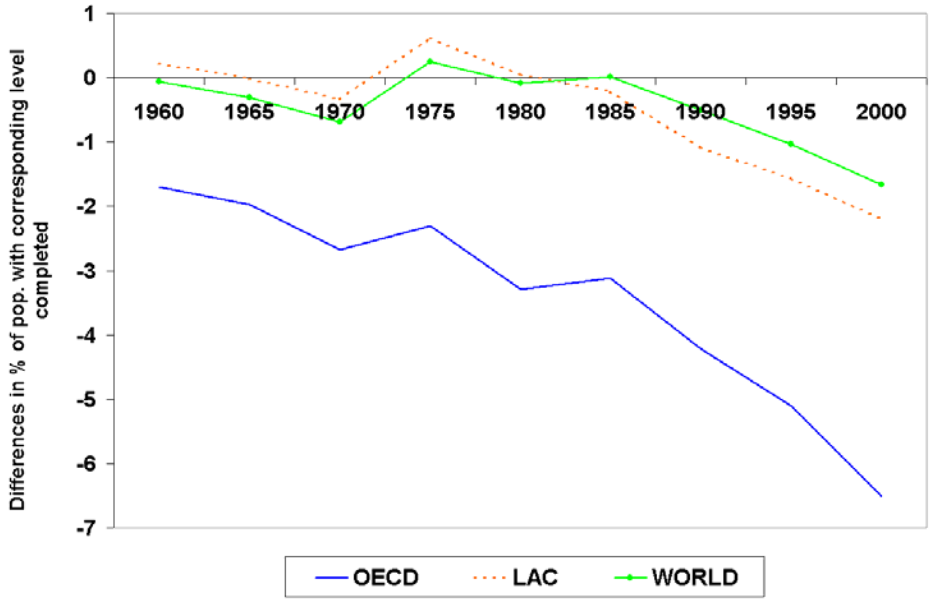
Source: own calculations with data from Barro and Lee dataset.

Figure 3.7b: Differences between Brazil and benchmark in secondary level completed



Source: own calculations with data from Barro and Lee dataset.

Figure 3.7c: Differences between Brazil and benchmark in tertiary level completed



Source: own calculations with data from Barro and Lee dataset.

Finally, looking back, we also observe that (the shortage of) education seems to have constrained growth. Including the average number of years of education of the population aged 25 and more in the regression for average growth in municipal GDP presented in Table 4.5, we see that education may have an important impact on growth in 1997-2004: one additional year of schooling is associated with higher average annual municipal GDP growth (AVGMUNG) by 1.5 percentage point:[23]

AVGMUNG = 0.048 – 0.160* ln(per capita GDP 1996) –0.095*pop +0.009*pop^2

(15.21) (-65.57) (-8.09) (7.52)

+ 0.015*years_educ_1991

(9.95)

R^2 = 0.80

[23] Source: Based on data from IPEADATA. Notes: Estimated with data for 4973 municipalities, using least squares with White Heteroskedasticity-Consistent Standard Errors & Covariance. t-statistics in parenthesis.

From the previous analyses we conclude that Brazil's lack of skilled labor is likely a binding constraint to growth. In this sense, the scarcity of human capital may be putting a brake on the capacity of the economy to expand, which can be inferred from the high levels of the returns of the few that get educated. The returns are surprisingly high even for Brazil's level of development. Returns are decreasing, which is consistent with the gradual rise in the stock of human capital. However, this is taking place at a pace that may not relax the constraint any time soon.

Along the previous lines of reasoning there is also some more anecdotal evidence that supports the view that human capital is a serious constraint for economic growth in Brazil. For example, a recent survey of the national industry confederation (CNI) shows that around 56 percent of firms consider the lack of skilled labor to be a problem. There is also an important variation across firm size, with small firms being more worried about the lack of skilled labor than large firms.[24]

3. Macro risks

Brazil has a long history of macroeconomic instability. For example, inflation during the early 80's was between 100% and 200% per annum and slipped into hyperinflation during 1989/1990 and 1993/1994. However, since 1997, inflation has been in the singledigits, with the exception of 2003 as a consequence of the aftermath of the confidence crisis related to the change in the government. Table 3.8 shows the evolution of some additional macroeconomic variables.

[24] We thank Wagner Guerra for suggesting this evidence.

Table 3.8 Macroeconomic Risk Variables

	1990 - 1994	1995 - 1999	2000 - 2002	2003 – 2006
Inflation (% p.a.)	2010.76	35.80	7.44	8.09
Inflation volatility (% std)	1669.82	102.98	1.28	4.26
Budget balance (% GDP)	-	-6.84	-3.61	-3.26
Primary Surplus (% GDP)	-	0.43	3.38	4.08
RER volatility (sd of log)	0.14	0.17	0.17	0.14

Source: Own calculations based on data from BCB.

While it is clear that during the 1990's macroeconomics was one of the binding constraints to economic growth in Brazil, for the more recent period, macroeconomic stability is at reasonable levels. Inflation and inflation volatility are substantially lower. In addition, the fiscal deficit has been cut in half and the primary surplus has been consistently well above 3% of GDP. Although there is definitely still room for improvement in terms of reducing macroeconomic vulnerabilities to ensure sustainability, nowadays the evidence does not point towards macroeconomic risk as a binding constraint to economic growth.[25]

b. Low Appropriability

1. Inadequate business environment (micro risks)

Recent studies highlight the importance of entry and exit dynamics of firms to promote growth and job creation in industrial and developing countries.[26] The key is to have an investment climate that promotes this process.[27] Countries can exhibit business environments in which it is costly to start up a business, costly to adjust employment, costly to close a business, and the enforcement of contracts is difficult, among other things. These aspects tend to discourage

[25] We discuss some related issues in more depth in section 4, when dealing with the cost of finance.
[26] See for example, Bartelsman, Haltiwanger, Scarpetta (2004)
[27] "The investment climate is the set of location-specific factors shaping the opportunities and incentives for firms to invest productively, create jobs, and expand. Government policies and behaviors exert a strong influence through their impact on costs, risks and barriers to competition" (World Bank, 2005).

investment and limit productivity growth. In this section we investigate whether Brazil has an inadequate business environment, and if so, whether this is a binding constraint to its economic growth.

Brazil does not rank well globally with respect to regulations and policies that affect the entry and exit of firms (see Table 3.9). In several indicators for starting and closing a business, for example, Brazil falls even behind the Latin American average. Table 3.9 shows that Brazil also performs poorly in terms of labor market flexibility, with recent analyses suggesting that job security could be a potential barrier to fast labor reallocation, in particular during recessions. Enforcement of creditors' rights is another potentially important factor fostering market entry and performance. Countries with highly effective creditor rights normally show lower credit volatility, which is central to plan investment (Galindo, Micco and Suárez, 2004). Table 3.10 shows that there is still plenty of space to improve Brazil's creditor rights and, in general, the enforcement of contracts.

Table 3.9: Selected Doing Business Indicators (2007)

		Brazil	LAC	OECD
Starting a Business	Procedures (number)	17	10.2	6.2
	Duration (days)	152	73.3	16.6
	Cost (% of GNI per capita)	9.9	48.1	5.3
Closing a Business	Time to complete procedure (years)	4	2.6	1.4
	Cost of bankruptcy proceedings (% of estate)	12	13.6	7.1
	Recovery rate (cents on the dollar)	12.1	25.7	74
Employing workers	Difficulty of hiring a new worker index	67	34	27
	Job security index (Botero et al, 2004)	0.69	0.5	0.33
	Firing costs (weeks of wages)	37	59	31

Difficulty of hiring a new worker: measures (i) whether term contracts can be used only for temporary tasks; (ii) the maximum cumulative duration of term contracts; and (iii) the ratio of the minimum wage for a trainee or first-time employee to the average value added per worker. Job security: the average of (i) protection of grounds of dismissal; (ii) protection of dismissal procedures; (iii) notice and severance payment; and (iv) right to job security in the constitution. It ranges from zero to one.
Source: Doing Business 2006 (World Bank), otherwise indicated

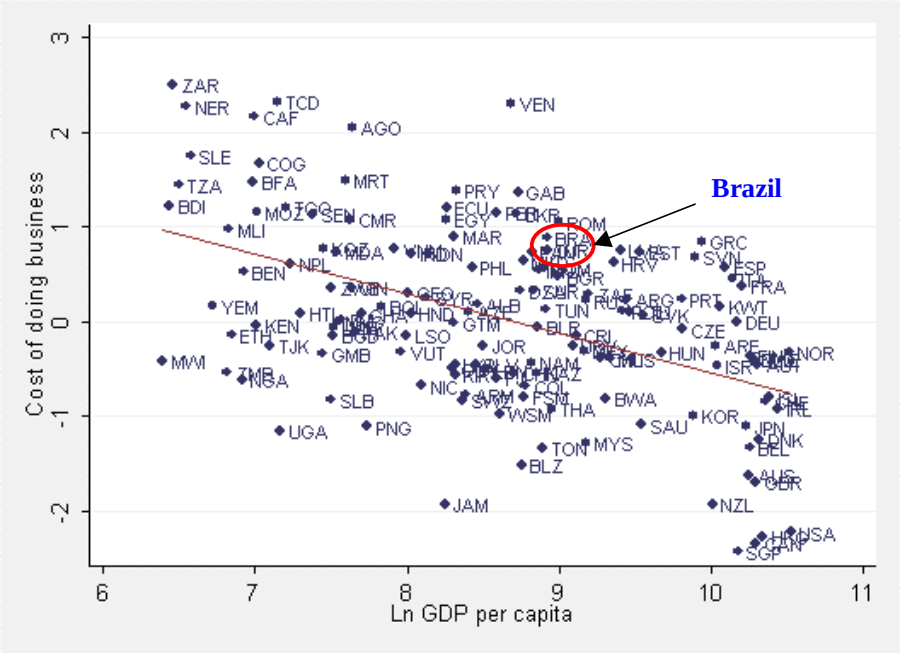
Table3.10: Other Business Environment Indicators

	Brazil	LAC	OECD
Creditor rights [1]	1	1.7	2.3
Rule of law [2]	43	37.4	89.6
Days to enforce a contract [3]	616	641	351
Effective creditor rights [4]	0.11	0.16	0.52

Creditor rights: degree to which secured creditors are protected during bankruptcy procedures. A score of one is assigned when each of the following rights are defined in laws and regulations: (i) there are restrictions, such as creditor consent or minimum dividend, for a debtor to file for reorganization; (ii) secured creditors are able to seize their collateral after the reorganization petition is approved; (iii) secured creditors are paid first out of the proceed of liquidating a bankrupt firm; and (iv) if management does not retain administration of its property pending the resolution of the reorganization. Rule of Law: includes several indicators that measure the extent to which agents have confidence in and abide by the rules of society. It ranges from zero to one. Effective creditor rights: is the product of Creditor rights and the Rule of law (both normalized between 0 and 1).
Sources: [1] Djankov et al (2005); [2] World Bank Governance Indicators; [3] Doing Business 2006 (World Bank); [4] Based on IPES (2005).

This preliminary assessment suggests that Brazil faces some limitations in its business environment that may be hindering competition and firm dynamism. The question is whether these limitations represent a binding constraint to economic growth today. One initial way to explore this question is to see whether Brazil's shortcomings are remarkably large relative to its level of development. Figures 3.8 to 3.10 present scatter plots of business environment indicators and GDP per capita. Figure 3.8 shows the first principal component of several 'Doing Business' indicators from the World Bank. As shown in the plot, there is, in general, a negative association between the cost of doing business in a country and its level of income. The figure also shows that Brazil is above this trend line, which suggests that the cost of doing business in the country is high relative to its level of development. This difference, however, is statistically not significant.

Figure 3.8: Cost of doing business and GDP per capita

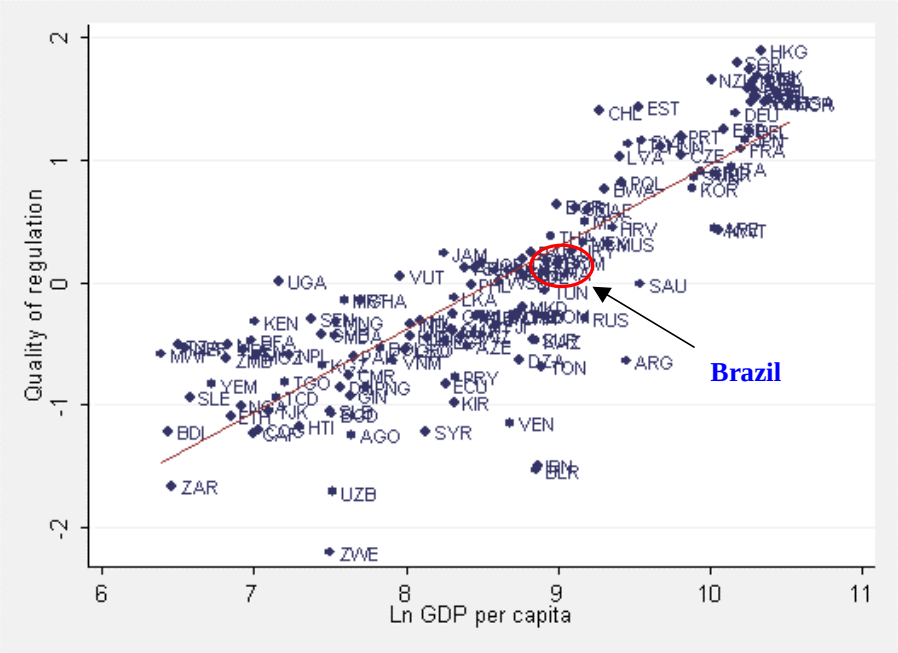


Source: Based on data from the Doing Business indicators

Figure 3.9 performs a similar exercise with a measure of the quality of regulation taken from Kaufmann, Kraay and Mastruzzi (2006). As shown in the plot, the quality of regulation and the level of development are positively associated, and Brazil is below the trend line. This difference is again not significant. Finally, Figure 3.10 shows a measure of the rule of law, also taken from the same authors, which is positively associated with income. One more time Brazil is below the trend line but the difference is not statistically significant.[28] Therefore, we can not argue, based on these numbers, that Brazil has a particularly anomalous business environment, once we control for its level of development.

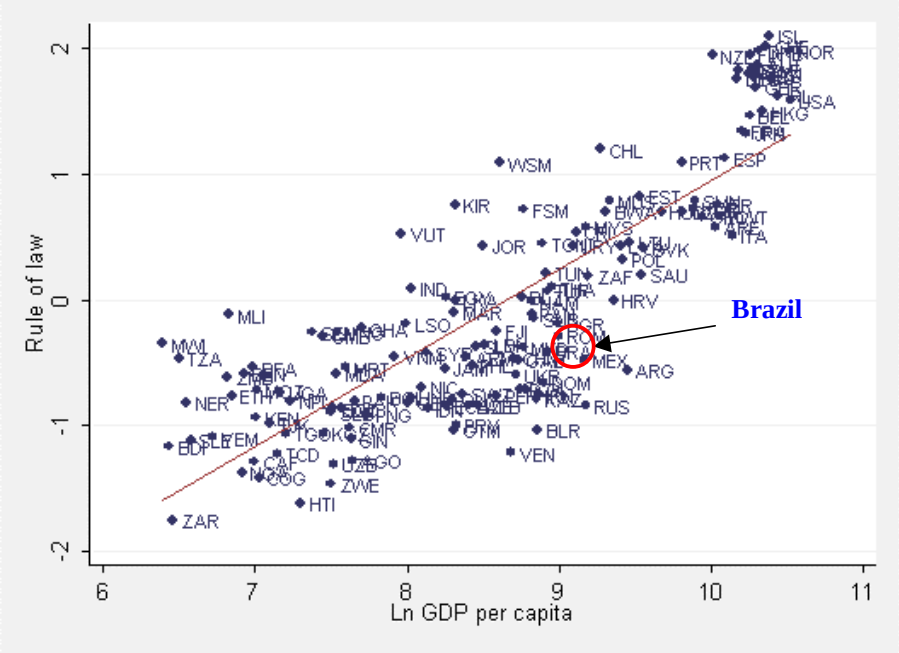
[28] A test based on a linear combination of these three differences turned out to be also insignificant.

Figure 3.9: Quality of regulation and GDP per capita



Source: Based on data from Kaufmann, Kraay and Mastruzzi (2006)

Figure 3.10: Rule of law and GDP per capita



Source: Based on data from Kaufmann, Kraay and Mastruzzi (2006)

Another way to explore whether an inadequate business environment is an important constraint to growth is to look directly at the opinions of plant managers regarding the limitations to growth their firms face. We employ the World Bank's Investment Climate Survey for Brazil to this end. One caveat to this exercise is that some distortions of the business environment might not appear as problems for the firms; for instance, distortions affecting creditors rights might not be viewed as problems by entrepreneurs as they affect mostly creditors; however, they could have an indirect impact through the high cost of finance.

Table 3.11 indicates the percentage of firms that consider a particular obstacle to the expansion of their business as "major" constraint or "severe".[29] The table shows the results for the overall sample as well as for large firms and for a group including medium and small enterprises. According to the survey, obstacles related to the business environment are not at the top of the list. Labor regulations and anti-competitive practices are ranked 8th and 9th respectively. Concerns with the enforcement of contracts, which are related to the legal system and conflict resolution, are ranked 14th. A proxy for cost of entry is given by the difficulty of obtaining business license and operating permits. This obstacle is ranked 15th. Only 'economic and regulatory policy uncertainty' appears high in the list, but the concern here seems to be on the 'uncertainty' rather than on the policies per se. Only the high cost of financing could be related to problems in the business environment if they reflect, for instance, distortions affecting the creditors rights (as argued before). The hypothesis of high cost of finance as a binding constraint is considered more exhaustively in the next section.

[29] The precise question is "Please tell us if any of the following issues are a problem for the operation and growth of your business. If an issue poses a problem, please judge its severity as an obstacle on the following scale: 0=No obstacle, 1=Minor, 2=Moderate, 3=Major, 4=Severe.

Table 3.11: Obstacles to Growth – Entrepreneurs' Perceptions

Obstacles to growth		All firms	Large	SMEs
1.	Tax rates	84.46%	81.33%	84.61%
2.	Cost of Financing (e.g. interest rates)	83.18%	81.33%	83.27%
3.	Economic and regulatory policy uncertainty	75.90%	70.67%	76.15%
4.	Macroeconomic instability (inflation, exch rate)	74.89%	77.33%	74.78%
5.	Corruption	67.20%	45.33%	68.25%
6.	Tax administration	66.14%	60.00%	66.43%
7.	Access to Financing (e.g., collateral)	60.46%	50.67%	60.93%
8.	Labor regulations	56.87%	57.33%	56.85%
9.	Anti-competitive or informal practices	56.36%	48.00%	56.77%
10.	Crime, theft and disorder	52.23%	40.00%	52.82%
11.	Skills and education of available workers	39.61%	29.33%	40.10%
12.	Customs Regulations	37.76%	36.99%	37.80%
13.	Trade Regulations	34.78%	34.72%	34.78%
14.	Legal system/conflict resolution	32.84%	30.67%	32.95%
15.	Business Licensing and Operating permits	29.83%	21.33%	30.24%
16.	Electricity	20.29%	18.67%	20.37%
17.	Access to Land	19.86%	8.11%	20.43%
18.	Transportation	19.26%	25.33%	18.97%
19.	Patents and Registered Trademarks (INPI)	16.09%	9.33%	16.42%
20.	Standards and Quality (INMETRO)	15.89%	8.33%	16.25%
21.	Telecommunications	6.16%	1.33%	6.39%

Source: Own calculations from Investment Climate Survey

According to this evidence, it seems that other obstacles, different from the government failure to provide an environment that facilitates competition and firm dynamism, might be more stringent in limiting growth in Brazil today.

It should be pointed out that the these surveys could exhibit some bias in the sense that the firms (and/or industries) that suffer the most from an inadequate business environment might be precisely the ones that are underrepresented in the sample. In other words, an inadequate business environment might have already limited the existence or growth of industries that are sensitive to this problem and thus they are not observed in the sample, while the ones being observed are the firms or industries for which this problem is not particularly important. To control for this possibility, we perform an alternative exercise in the spirit of Rajan and Zingales (1998). Due to data availability, the exercise is focused on one particular area of the business environment, labor regulation.

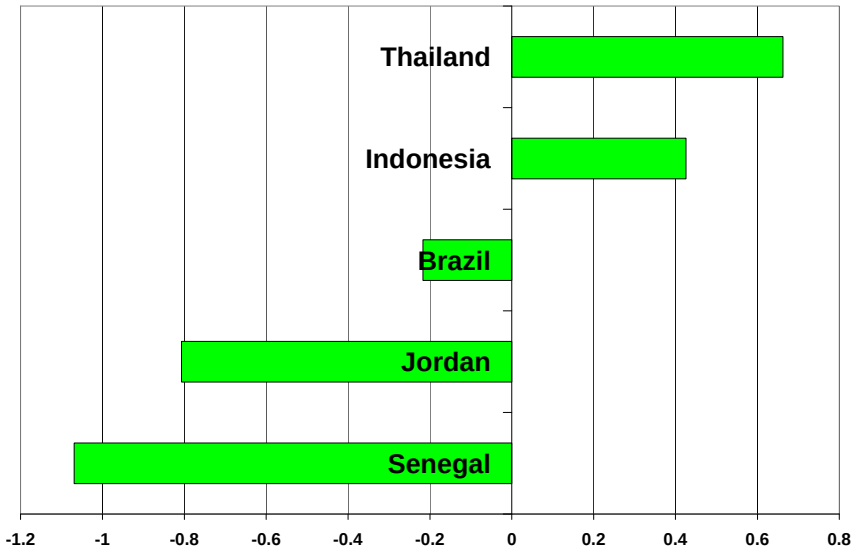
The idea is that stringent labor regulations that increase the cost of hiring and firing affect firm dynamism by limiting the possibility of adjusting employment when needed. There is, however, considerable variation in the degree of labor turnover across industries (see Bartelsman, Haltiwanger, Scarpetta, 2004) Therefore, stringent labor regulations will affect more those industries that depend more on a flexible labor market. What we want to do here is to see whether Brazil is particularly under-specialized in those industries. This would be a sign that some aspects of the business environment –in this particular case, an inadequate labor regulation- might be a significant distortion in factor allocation and therefore a significant constraint to growth in Brazil.

We employ estimates of job creation and job destruction by industries for the US from Davis, Haltiwanger and Schuh (1998) to construct a measure of industry-specific labor turnover. With this measure and with data for 38 countries and 19 industries (taken from UNIDO) we regress the percentage of total value added of industry *i* in country *c* on industry dummies, industry dummies interacted with GDP per capita (to control for differences in the structure of production between developed and developing countries), our measure of the industry's labor turnover and the interaction between this variable and a dummy for the country of interest, in this case Brazil. [30] The estimated coefficient on this interaction variable is negative but not

[30] The country's dummy variable also enters in the regression without interaction.

significantly different from zero, indicating that there is no evidence to conclude that Brazil's labor markets are remarkably rigid and possibly a binding constraint to growth. Therefore, Brazil is not particularly under-specialized (or over-specialized) in industries that are prone to suffer more from rigid labor regulations. For comparison purposes, we present the result for Brazil together with the results for other countries where this effect turned out to be statistically significant. This is shown in Figure 3.11.

Figure 3.11: Estimated coefficient on country/labor turnover interaction



Source: Own calculations

Summarizing, in this section we have presented a battery of indicators and tests to analyze whether an inadequate business environment that limits competition and firm dynamism is a binding constraint to growth in Brazil. Based on the analysis, we conclude that while Brazil's business environment is far from being adequate, it is not currently a binding constraint to its economic growth.

2. Informality

There are several channels through which informality could limit the prospects of economic growth. Informal firms invest little to avoid becoming "visible" and at the same time they tend to exhibit low productivity, as they cannot take advantage of scale economies. Also, by avoiding taxes, ignoring product-quality and safety regulations, and infringing copyrights, they

can gain a cost-advantage and compete successfully with firms in the formal sector. This may lead firms in the formal sector to lose market share and to invest at a sub-optimal level. There is also a fiscal impact, as the presence of informal firms implies lower receipts (a macro problem) and higher taxes on the formal firms (a micro distortion problem). All in all, the overall efficiency in the economy would fall, contributing to a problem of low social returns.

Brazil's informal economy is around 39.8% of the gross national income (ILO), higher than the world average of 32.5% and well above other Latin American countries like Mexico (30.1%), Argentina (25.4%) or Chile (19.8%). Some analyses for Brazil suggest that its high level of informality imposes a major obstacle for the growth of the country (see McKinsey, 2004). Assessing whether informality is really a binding constraint in Brazil requires an exploration of its types and causes.[31] Data on informality are notoriously difficult to obtain. We employ IBGE's 2003 survey about the "Economia Informal Urbana" and Mckinsey's studies about informality in Brazil and other countries.

According to the McKinsey report, close to 56% of the population employed in Brazil in 2002 was in the informal sector. In the agriculture sector, this figure goes to 90% while in the non-agriculture sector it is 46%. The IBGE's 2003 survey provides useful information to unveil some characteristics of the informal firms in the non-agricultural sector of Brazil. Some of them are shown in Table 3.12. According to the survey, the average size of informal firms is really small: 80% of them consist only on one individual that works without partners or co-workers.[32] Most of the firms are in the service sector (84%) and mostly on construction, retail sales and repair. Only 16% of the informal firms of the sample were in the manufacturing sector. The education of the average worker is remarkably low: almost 70% did not complete high school level and 44% did not even complete elementary school. When asked the reason to start the firm, the main answer was "could not find a job" (31%). Only 8% of the firms started because somebody had some "experience in the area".

[31] Indeed, it would be important to differentiate whether this is truly a binding constraint or it is just the outcome of a binding constraint that may reside elsewhere.
[32] This percentage goes to 92% if we consider firms of one or two workers.

Table 3.12: Some Basic Facts About Informal Firms* in Brazil

		%
Size	Percentage of informal firms with only one worker	80
Sector	Percentage of informal firms in manufacturing	16
	Percentage of informal firms in services	84
	of which:	
	Construction	21
	Retail sales and repair	40
	Other	39
Education	Percentage of workers in informal firms with elementary school not completed	44
	Percentage of workers in informal firms with high school not completed	69
	Percentage of workers in informal firms with college completed	7
Reasons to start an informal firm	Percentage of firms declaring "could not find a job"	31
	Percentage of firms declaring "complement household income"	17
	Percentage of firms declaring "experience in the area"	8
Main difficulties encountered in previous year	Percentage of firms declaring "lack of clients"	49
	Percentage of firms declaring "large competition"	44
	Percentage of firms declaring "lack of credit"	13
	Percentage of firms declaring "lack of appropriate infrastructure"	8

* IBGE defines informal firms as economic units consisting on the self-employed and employers with up to 5 workers

Source: “Economia Informal Urbana, 2003”. IBGE

Given these characteristics, it is clear that informality in Brazil entails a substantial amount of workers in precarious situations with low human capital and no access to formal jobs. Even if the firms associated with these workers have a cost-advantage by avoiding taxes and regulation, it is hard to imagine that they can compete successfully with their formal peers. Indeed, when asked what was the main difficulty encountered in the past 12 months, the two main answers were "lack of clients" and the "large competition". Moreover, only 12% of all the firms expressed concern for the "lack of credit" and 8% for the "lack of appropriate infrastructure", suggesting that improving efficiency or productivity is not an important issue for the informal firms. At least part of the informality in Brazil seems to be not a matter of choice but rather the option of last resort for otherwise low skilled unemployed workers that enter the sector involuntarily while queuing up for salaried jobs.[33]

Therefore, given the apparently low capacity to compete, it is not clear that the presence of informal firms in Brazil slows down the overall growth of the economy by disrupting incentives in the formal economy in any significant way. More generally, evidence of aggregate growth effects of informality are scarce in the literature. For example, while some of the early studies, like Loayza (1996), found a negative relationship between informality and growth in cross-country regressions, they have been later criticized for not controlling for the relevant correlates of growth, such as regulation, human capital, and initial GDP per capita (Schneider and Klinglmair, 2004). Once these other aspects are considered, the estimated coefficients tend to be fragile (see World Bank, 2007). The McKinsey report argues that there is a negative association between the extent of informality and the level of productivity at the industry level in Brazil. However, this correlation does not prove causality and it is subject to the same criticisms made by Schneider and Klinglmair.

In summary, although the presence of informal firms might be associated with some inefficiencies related to their small size, it appears hard to argue that they significantly disrupt the incentives of the formal firms to invest and innovate. Therefore, we rule out the hypothesis

[33] Neri et al. (1997) show that there is a relatively high rate of transition from formal to informal jobs and vice versa. See also Reis and Ulyssea (2005).

that informality, as reflected in the nature of labor contracts or the sheer size of companies, is a binding constraint to economic growth in Brazil.[34]

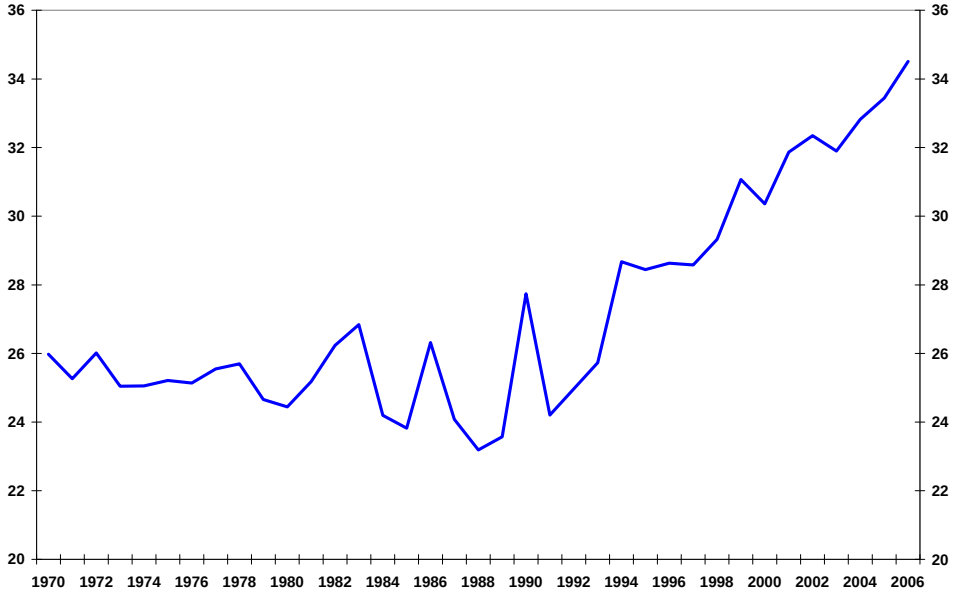
Two final arguments before closing this section. First, the available data only allows for an empirical assessment of informality that focus on labor contracts, and thus fail to consider potentially more damaging types of informality, such as not paying taxes or abiding to product, workplace and environmental regulations. Second, and related to the previous point, informality could be seen not as *the* binding constraint but as the outcome of a binding constraint that resides elsewhere. For instance, a business environment with stiff regulation, or the presence of high taxes in an economy, might not only cause firms to switch to the informal economy but might also depress overall investment and ultimately growth. Indeed, recent evidence shows that informality might recede slightly as a reaction to improvements in the business environment (see for example, Monteiro and Assunção, 2006). However, whether the business environment or the size of the tax burden is the binding constraint in Brazil is analyzed in other parts of this report.

3. Distortionary Taxes

Complaints about the high tax burden in Brazil are generalized across the country. Figure 3.12 shows the evolution of the tax burden. While it was around 25% during the 1970s, 1980s and part of the 1990s, it has been rising almost continuously since then. Starting from 1996, the tax burden has increased by around one percentage point of GDP every year. In 2006 it reached 34.5% a very high rate for international standards. Figure 3.13 shows the tax burden for several developed and developing countries together with the levels of GDP per capita.[35] Brazil's tax burden looks high for its level of income. A country with the income of Brazil would typically have a tax burden that is around 10 percentage points of GDP lower. The question we want to address then is whether this high tax burden is harming the country's economic growth.

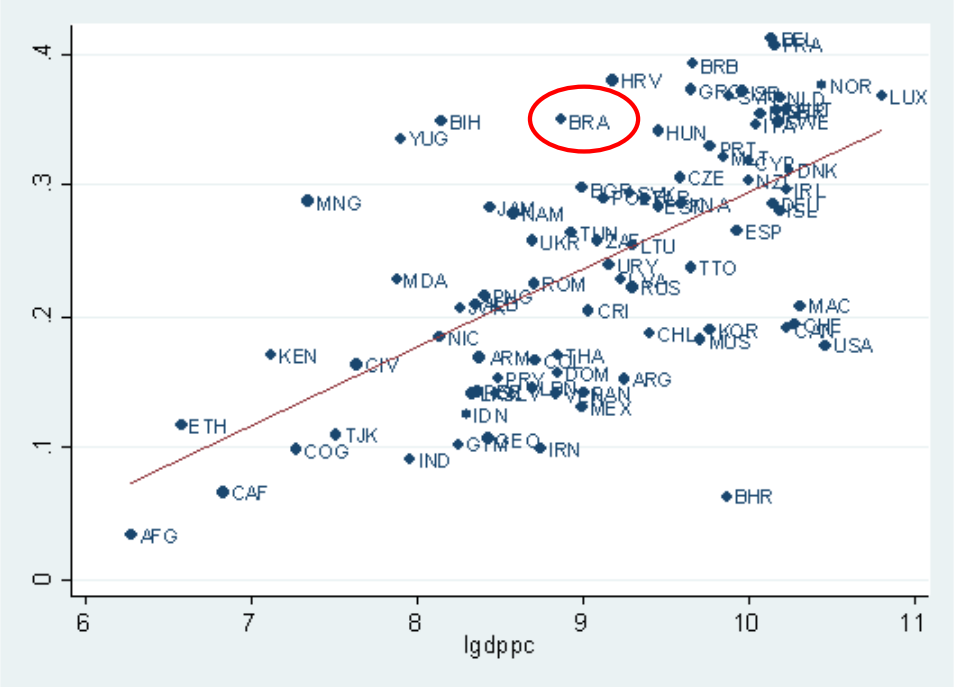
[34] In this regard, it is important to consider the definition of "informal" firm used in IBGE's 2003 survey (economic units consisting on the self-employed and employers with up to 5 workers), which on the one hand includes firms that are perfectly formal and on the other excludes medium and large informal firms.
[35] Data range from 2002 to 2005.

Figure 3.12: Evolution of Tax Burden in Brazil



Source: IBGE and IBPT

Figure 3.13: Tax Burden (% of GDP)



Source: IBPT, WDI and PWT

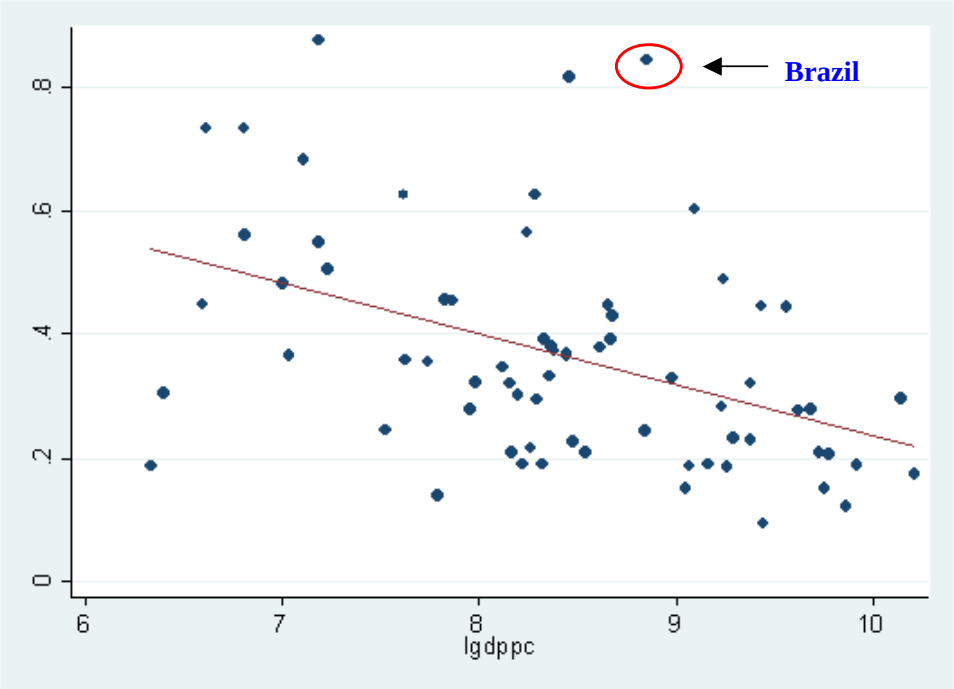
The endogenous growth theory provides the appropriate framework to link taxes and growth. Under this framework, a tax on capital income would lower its after-tax return creating a disincentive to accumulate capital. Hausmann, Rodrik and Velasco (HRV) recognize that there is a high level of taxation in Brazil that depresses returns to capital, but the authors downplay its effect on growth. They argue that investment in Brazil is remarkably low not because of low after-tax private returns but, instead, because of lack of funding. Interestingly, HRV attribute the lack of funding, in part, to the high tax burden of the country. The authors argue that a very large part of national income gets taxed away in order to finance the high levels of entitlements and social transfers. The HRV story, then, is a story of a macroeconomic distortion of low disposable income (there are not enough savings to invest due to the high tax burden on domestic income), not one of a microeconomic distortion in which high taxes reduce the incentives to invest because they depress the returns to capital. That is to say, they view the tax system as transferring funds from high- to low-saving agents, lowering aggregate savings and in this way limiting investment levels.

The argument that taxes affect growth by reducing disposable income and thus constraining the available resources for investment is in principle plausible. For example, according to the Instituto Brazileiro de Planejamento Tributario (IBPT), if one adds the taxation incidence on wages (the employee's responsibility) with that on consumption, on average, 35% of the wage-earned incomes gets deducted at the source or included as taxes on the acquired products and services. The incidence on company earnings can be even higher. There is one factor, however, that weakens HRV's hypothesis. If a country has full access to international capital markets, then the decisions for savings and investment should be independent from each other. As discussed in Section 4, this has not been necessarily the case for Brazil in the past, but since 2003, external financing conditions do not seem to be a major constraint to economic growth. Therefore, the story of low disposable income from high taxation might be less relevant today than in the recent past.

The above argument does not imply, however, that taxes are not affecting economic growth in Brazil today. To start, it is worth casting doubts on the HRV argument that the high level of taxation has not lowered the incentives to invest by affecting the private returns to capital. According to the Investment Climate Survey for Brazil, for example, entrepreneurs in Brazil view the high tax rate as the number one obstacle to firm's investment and growth (see

Table 3.11 on this report). It is possible that the majority of firms in the country views the tax rate as a very important limitation to growth simply because it is such a tangible factor relative to other obstacles included in the survey. If so, however, this would be a problem in other countries too. Figure 3.14 indicates that this is not the case. In some countries, the percentage of firms indicating that the tax rate is a major problem for growth is as low as 10% (far lower than many other factors). According to the figure, there is also a stable relationship whereas the higher the income of the country the lower the percentage of firms in that country that complaint about the tax rate, with Brazil way above the curve, scoring second among the 68 country surveyed.

Figure 3.14: Percentage of firms indicating "Tax Rates"
as a major or severe obstacle to growth

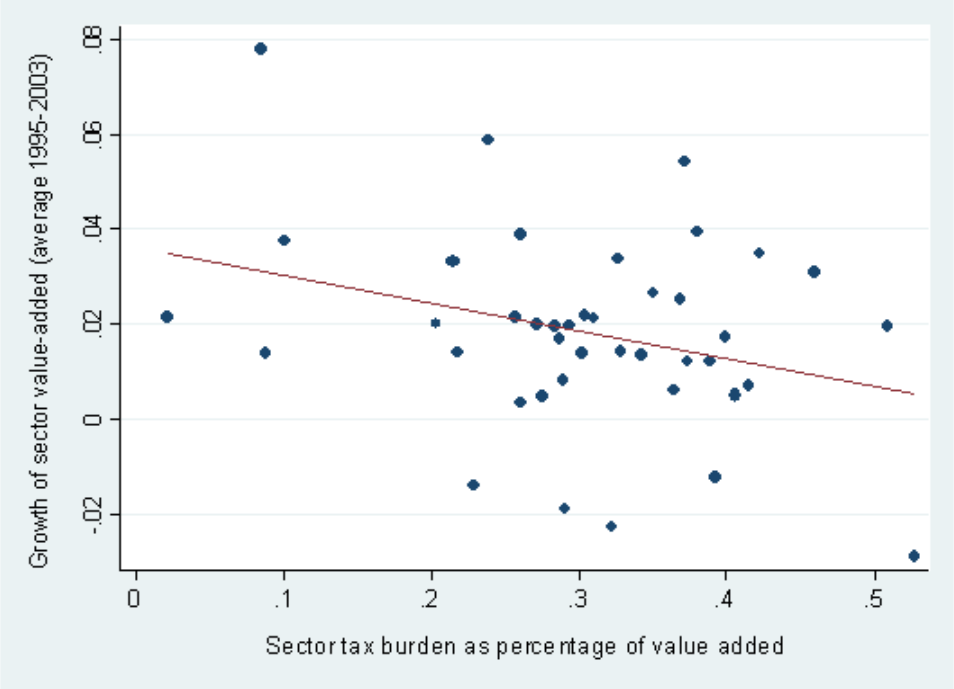


Source: own calculations employing 68 Investment Climate Surveys

One outcome of the uneven Brazilian tax system is the large variability in the tax burden that exists across sectors of the economy. In what follows we take advantage of this variance to identify whether there is an association between the sector's tax burden and its economic

performance. Figure 3.15 shows this relationship: There is a negative relationship between the tax burden of the sector and the growth rate of its value added.[36] This relationship is statistically significant at conventional levels. While we cannot allege any causality from this relationship, the result clearly goes in line with the arguments shown above.

Figure 3.15: Sector performance and tax burden



Source: own calculations with data from FGV and IBGE.

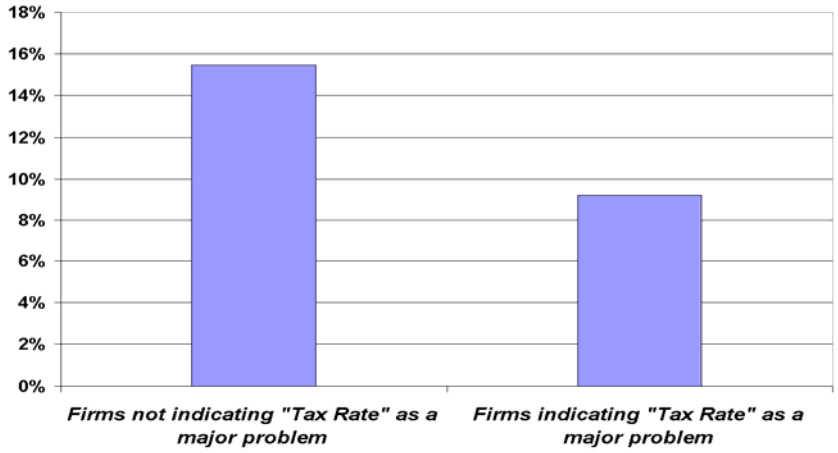
We can perform a similar exercise at the firm level. Using the Investment Climate Survey for Brazil we separate the firms responding that the tax rate is a major problem for growth from the rest and compare the average growth rates of sales of the two groups. Figure 3.16 shows the results. The firms indicating that the tax rate is a problem grew on average 6 percentage points slower than their counterparts, for which this is not a major problem. The difference is

[36] The sector tax burden is calculated as a percentage of the sector's value added. Data is for the 2000-2001 period. The source of this variable is Fundação Getulio Vargas. The growth rate for the sectoral value added is taken from IBGE.

statistically significant at the 1% level. This relationship also holds within sectors. In six out of the nine sectors, firms indicating that the tax rate was a major problem grew on average slower than their counterparts within that sector. Once again, this is not a formal proof of the effect of taxes on firm's performance, but the evidence appears to support the hypothesis that the high level of taxation in Brazil lowers the returns to capital and thus the incentives to invest and grow.

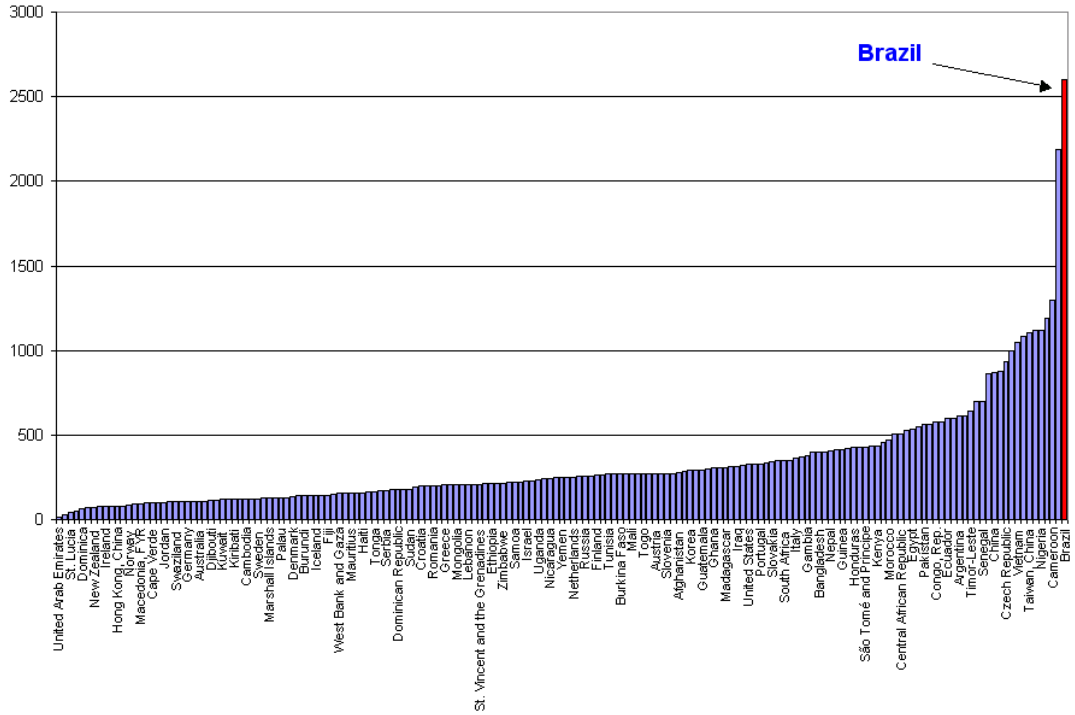
The problems with the high tax rates are made worse if taxpayers have to spend a considerable amount of time and effort paying the taxes. For instance, according to the IBPT, there are 68 taxes in Brazil and 3200 tax codes including laws, provisional measures, decrees, regulations and institutions. There are also multiple tax rates and bases for calculation as well as several tax agencies. The high cost of complying with tax obligations in Brazil due to the existing tax complexities could be another factor hampering investment and growth. Figure 3.17 shows the amount of time that firms in Brazil spend on paying taxes and complying with tax regulation compared to other countries. This indicator for Brazil is not only the largest in the whole sample of 173 countries but also exceeds by more than 7 times the sample average.

Figure 3.16: Average growth rate of sales (2000-2003)



Source: own calculations with data from the Investment Climate Survey, Brazil

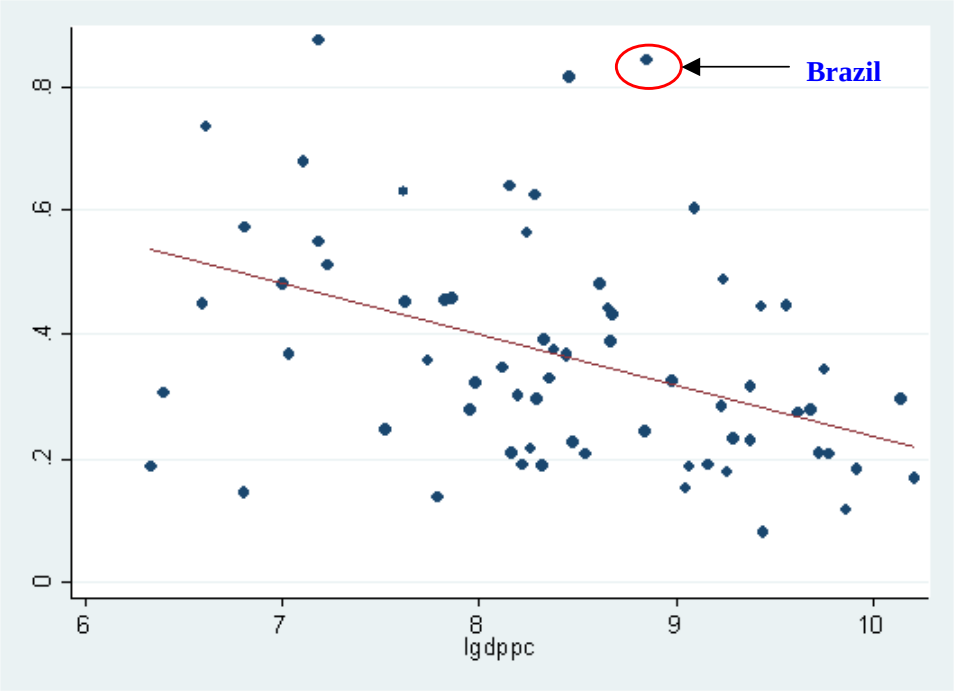
Figure 3.17: Time (hours) paying taxes



Source: Doing Business 2006, World Bank

Also, Figure 3.18 shows information from the Investment Climate Survey about the tax administration (a reflection of the inefficiencies of paying taxes) as a constraint to growth. The percentage of firms indicating "tax administration" as a major obstacle to growth is once again extremely high, particularly when we take in consideration Brazil's level of income.

Figure 3.18: Percentage of firms indicating "Tax administration"
as a major or severe obstacle to growth



Source: own calculations employing 68 Investment Climate Surveys

A significant distortion in the Brazilian system relates to indirect taxes on goods and services, the most significant of which is the *imposto sobre circulação de mercadorias e serviços* (ICMS), a type of value-added state tax that has over 50 different rates. Within certain limits, each state is free to determine its rates. There is one tax code for each state (27) which complicates the articulation of the entire system, particularly for contributors in more than one jurisdiction. Besides creating incentives for fiscal war among states, the ICMS induces interstate trade to be subject to many different and complex rules probably limiting the free flow of inputs, goods and services across the territory. Daumal and Zignago (2005) for example, show that the Brazilian market fragmentation is high in comparison with other countries. For instance, a Brazilian state trades 11 times more with itself than with another Brazilian state. The equivalent figures in France, US, Canada and Russia are 6, 4, 2 and 2, respectively.

In this section we have not presented a thorough evaluation of the impacts of Brazilian taxation on economic performance, which would go beyond the scope of the present paper. Rather, we have gathered some simple benchmarks and associations to highlight the potential

severity of the problem. The hypothesis of a binding constraint cannot be proven, only rejected. Although a more complete investigation on the incidence of taxation in Brazil is required in order to fully grasp the microeconomic impacts of taxes on growth, the evidence that we were able to gather does not allow us to reject the hypothesis that the size and complexity of taxes are binding constraints to economic growth in Brazil. More research on this point is warranted.

4. High price of investment

A potential limitation for increasing investment levels is that the price of investment is too high. Bacha and Bonelli (2005) conclude, for instance, that: "Increases in the relative price of investment that reduced the purchasing power of savings, associated to declines in the productivity of capital, seem to have been the most important factors behind the observed loss of (growth) dynamism". Eaton and Kortum (2001) argue that cross-country differences in the rate of capital accumulation owe more to differences in the domestic price of investment, vis-à-vis that of consumption goods, than to differences in savings rates. Pinheiro (2006) shows that despite the partial recovery in the savings rate in recent years, the rate of capital accumulation has declined steadily as a result of a rise in the relative price of investment.[37]

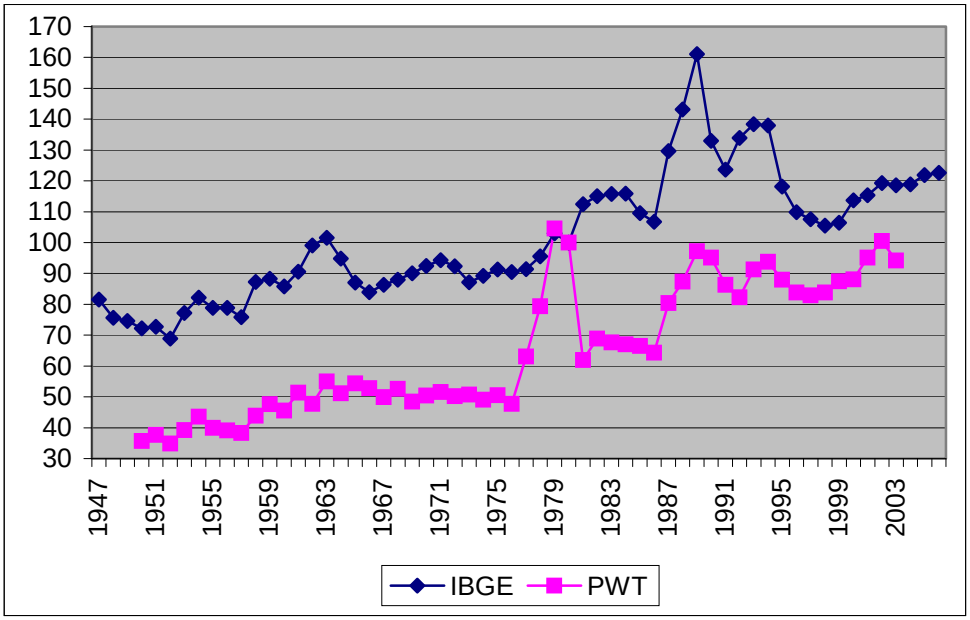
Several studies call attention to the rising cost of investment since the mid-1970s as an explanation for the slowdown in the rate of capital accumulation.[38] Figure 3.19 presents the ratio of investment and GDP deflators derived from both the national accounts published by IBGE and the Penn World Tables. Both tell essentially the same story: the relative price of investment goods increased during the 1950s, stabilized between the early 1960s and the mid-1970s, increased again in the following decade and a half, came down with the trade liberalization cum currency appreciation of the mid-1990s, and then went up again with the 1999-2002 devaluation. According to IBGE numbers, which show a more conservative rise in the ratio of deflators, the relative price of investment in 2003-06 was 29% higher than in the high growth 1968-78 period.

This significant rise in the relative price of investment raises three types of questions. First, what have been the causes of this phenomenon? Is this the result of trade barriers?, real exchange rate misalignment?, a measurement problem? Despite the relevance of lowering the

[37] Defined as the ratio between the price deflator of gross fixed investment and that of GDP In fact, this might be an indication that the low level of domestic savings might not be a binding constraint: if it were, then we should not have observed declining rates of capital accumulation in the presence of rising saving rates.
[38] See, for instance, Pinheiro (2004), Pires de Souza (2004), Bacha and Bonelli (2005), and IEDI (2006).

cost of investment to allow an acceleration of GDP growth, there is not, to our knowledge, a conclusive assessment of why these costs increased so much in the last two decades. Indeed, it is not even clear the extent to which this rise stems from measurement errors in the computation of the price indices used to calculate investment at current prices and, indirectly, the investment deflator. A second related question concerns the degree to which investment prices in Brazil are out of line with international standards, that is, whether the rise in the ratio of Brazil deflators opened or closed the gap to the international norm. Finally, there is a question of what can be done to bring down the price of investment.

Figure 3.19: Ratio of fixed investment to GDP deflators (1980 = 100)



	1947-67	1968-78	1979-86	1987-89	1990-94	1995-2002	2003-06
IBGE	83.0	91.1	109.8	144.6	133.4	112.0	120.5
PWT	44.9	54.0	75.1	88.3	89.7	88.7	94.2

Sources: IBGE and Heston, Summers and Aten (2006).

Investment statistics are among those that changed the most in the revised national accounts. In the statistics available until mid-March 2007, the rise in the ratio of investment to GDP deflators reflected increases in the deflators of both construction and machinery and equipment, basically of the same magnitude, although their short-term dynamics diverged considerably due to the greater sensibility of machinery and equipment prices to movements in the exchange rate. In these old statistics, investment was calculated by first estimating a constant price series based on the 1985 economic censuses and real changes in construction, machinery and equipment, and other less important items; the constant price series was then inflated using specific wholesale price indices for each item. In particular, during the period of high inflation and price freezes, starting with the Cruzado Plan (1986) and lasting up to the second Collor Plan (1991), computation of the National Civil Construction Price Index (INCC) and the Wholesale Price Index (IPA), used by the IBGE to estimate investment at current prices, became more precarious.[39] The new statistics, in turn, use investment estimates for each year, based on income tax statements and specific surveys carried out by IBGE. These currently cover the 1995-2004 period, with statistics for 2005 and 2006 being derived from the quarterly national accounts, which use the old-system, applied to the most recent available annual figure.

Figures 3.20 and 3.21 show that there were serious measurement problems in the old statistics. The figures compare the old and new series for the ratio of deflators, looking separately at construction and machinery and equipment. The difference between the two series indicates that values for construction were grossly overestimated, whereas the opposite happened to machinery and equipment.[40] That the aggregate series for investment in the old and new series seem to fit so well, as shown in Figure 3.19, was mere coincidence. It is impossible to tell how much this value mismeasurement reflects errors in price or quantity changes.[41]

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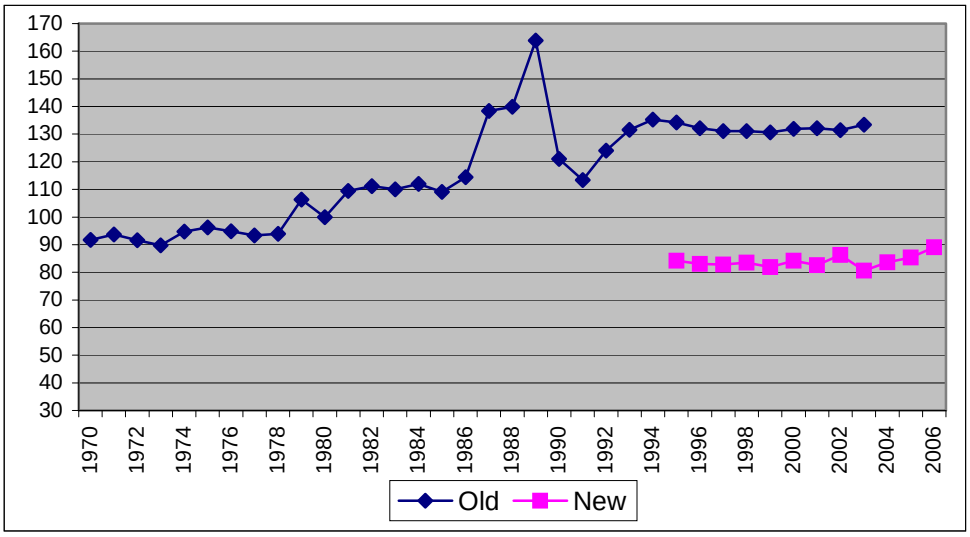
[39] This is consistent with the significant rise in the relative cost of investment in the second half of the eighties.

[40] Pires de Souza (2004) notes that the old national accounts showed a growing contribution of construction to total investment, from 60% in the 1980s to 66% in 1990 and 68% in 2002. This share was high for international standards. The author, as well as Bacha and Bonelli (2005), mentions a study by Burstein, Neves and Rebelo (2004), with a sample composed of OECD countries, plus Brazil and Argentina, which averaged a 51% share of construction in investment. In the new National Accounts, the share came down to an average 46% in 2000-06.

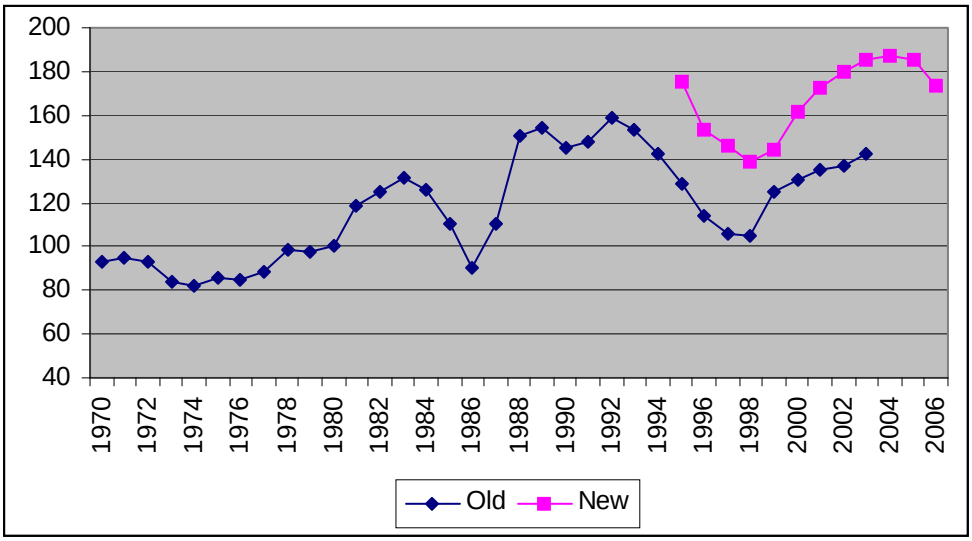
[41] If real growth in construction investment was overestimated, while that in machinery and equipment underestimated, out estimates of the growth in capital stock (Table 1.2) are overestimated, with a larger bias in the post-1990 period.

Figure 3.20: Ratio between construction and GDP deflators (1980 = 100)



Source: IBGE.

Figure 3.21: Ratio between machinery and GDP deflators (1980 = 100)

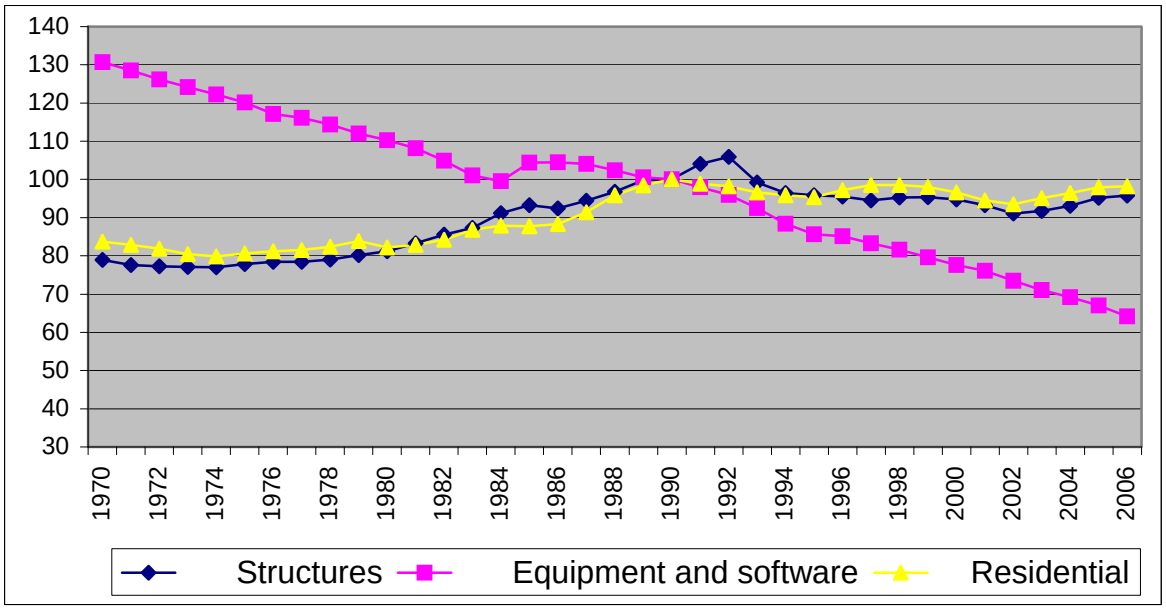


Source: IBGE.

As for the new series, they essentially reproduce the short-term dynamics of the old ones. The relative prices of construction fluctuate much less, consistently with the patterns identified by Burnstein, Neves and Rebelo (2004), and show a recent upturn, which may be at least partly explained by the fact that the 2005-06 statistics rely in the old methodology and these relative price increases may be revised down. Yet, the fact that they have not come down, despite the government having eliminated or reduced a number of taxes formerly levied on construction materials, is in itself worrisome. The relative price of machinery, in turn, fluctuated considerably, essentially as a result of exchange rate movements. In 2006 it was back to the same level observed in 1995.

There are other sources of bias that may have not been captured even in the new series. Chamon and de Carvalho Filho (2006) identify a significant bias in Brazil's CPI index; a similar (upward) bias may exist in the case of investment. Considering that the consumption basket has a lower share of tradables than investment (Burnstein, Neves and Rebelo, 2004), and that this bias stems at least in part from unmeasured quality gains resulting from trade liberalization, the bias would be larger for investment prices than for consumption prices. This would cause the price of investment relative to consumption goods to have risen less than suggested by the new national accounts. Indeed, when comparing the changes in the relative price of investment in Brazil and the US, the discrepancy for the relative price of machinery (and software) becomes evident (Figure 3.22). Thus, while the series for (non-residential) structures and residential investment are similar to that for construction in Brazil, the one for machinery shows a substantial decline unparalleled in Brazil.

Figure 3.22: USA: Ratio between deflators for machinery and GDP deflator (1980 = 100)



Source: Bureau of Economic Analysis.

Another disturbing fact about the large rise in the relative price of investment in the old national accounts, originally raised by Bacha, Bonelli and Medina (2005), is that the system in place prior to that showed a much more modest rise. Thus, fixing the relative price of investment in 1980 at one, the statistical system that prevailed until March 2007 pointed to a value in 1995 of 1.33, whereas the one in use prior to it indicated a more reasonable value of 1.15.[42] The authors also note that the wide swings in the relative price of equipment in the late 1970s and 1987-89 are even more substantial (and likely wrong) when these are broken down in national and imported goods.

To what extent are investment prices in Brazil out of line with international standards? To what degree have the supposed rise in the relative price of investment closed (or opened) the gap between Brazil and the the international norm? To answer these questions, we use the recently published version 6.2 of the Penn World Tables (Heston, Summers and Aten, 2006).[43] Table 3.13 compares Brazil to a sample of countries regarding the level of investment prices,

[42] See Bacha, Bonelli and Medina (2005) for a more detailed comparison between the two systems of national accounts.
[43] See Pires de Souza (2004) and IEDI (2006) for similar comparisons for earlier periods.

equalizing US GDP price in each year to 100, and the ratio between investment and GDP prices. Three conclusions stand out when comparing Brazil to other countries in the Table:

- Brazil was, by far, the country with the largest rise in the ratio of investment to GDP prices, between 1970-73 and 2000-03, thus confirming that the rise in this ratio may account for lower growth, by reducing the purchasing power of savings. Yet, in this latter period the relative price of investment was lower in Brazil than for the world median and the average of Latin American and Caribbean countries. The comparison with high-performing emerging countries yields less clear cut conclusions, but most of them have higher ratios between investment and GDP prices than Brazil, notably in the case of the Asian countries.
- The price of investment in Brazil, compared to US GDP prices, came down from 1970-73 to 2000-03 and in this latter period was lower than the world median and the average for Latin America and the Caribbean. Thus, the comparatively large rise in the relative price of investment, for international standards, reflected a below par change in consumption prices, not an atypically high rise in investment prices. Yet, the price of investment in Brazil surpassed in this latter period, by a significant margin, the levels observed in a number of high-performing emerging countries, such as Chile, China, India, Indonesia, Malaysia, Philippines and Thailand.
- There seems to be a negative association between the relative price of investment and per capita income levels (measured in PPP terms). This is illustrated in Figure 3.23. A regression between the logs of the two variables yields a correlation of 0.63 and shows that the ratio of deflators comes down 0.25% for each 1% rise in income (or, depending on causality, a 1% reduction in the relative price of investment raises per capita by 4%). Possibly, these differences may reflect more closely a higher price of consumption goods and services in high-income countries, than a lower price of investment in low-income economies.[44] More importantly, when we control for income levels, we find that the relative price of investment in Brazil is "below the line" and the difference is statistically significant a 1%.

[44] Note, though, that Burnstein, Neves and Rebelo (2004) find a negative correlation between income level and the share of construction in investment, which weakens this argument, for it implies that in poor countries a larger part of investment consists of nontradable goods and services. This negative association is consistent with the decline over time in the share of construction in US aggregate investment (Pires de Souza, 2004)).

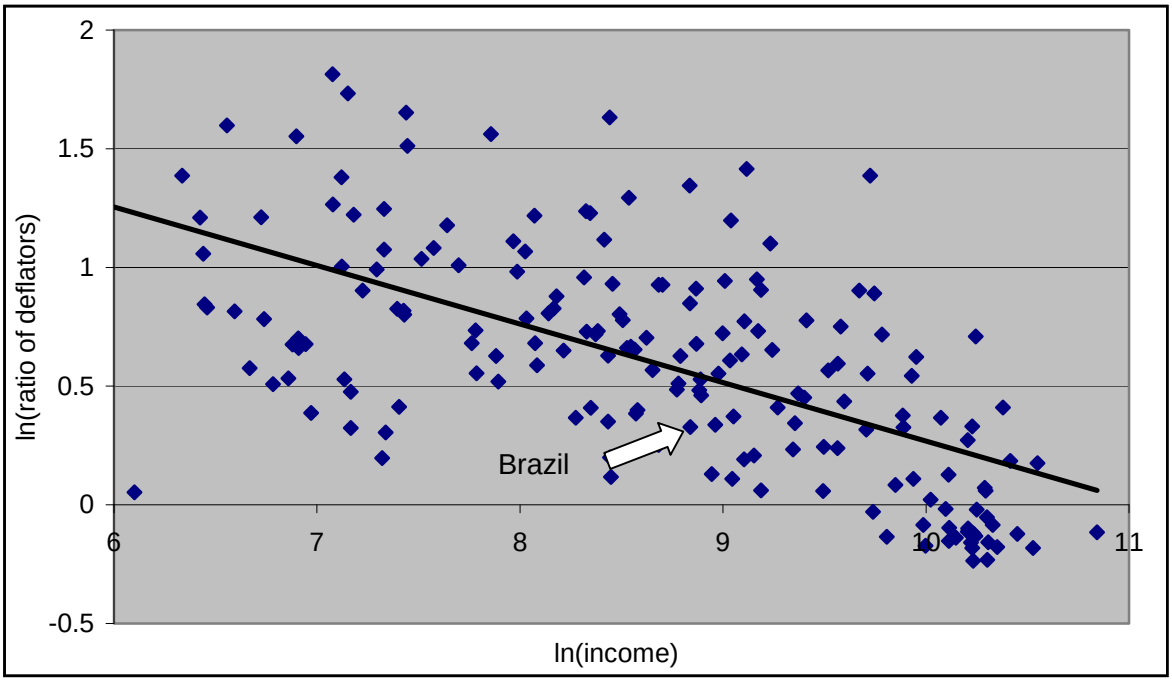
Table 3.13: Investment price and ratio of investment to GDP prices in selected countries (US GDP price = 100)

	Investment prices		Ratio of investment to GDP prices	
	1970-73	2000-03	1970-73	2000-03
Argentina	102.3	55.6	1.30	1.26
Brazil	70.4	55.1	0.75	1.40
Chile	49.8	40.2	0.83	1.06
China	84.4	35.3	1.11	1.49
Colombia	67.1	52.6	1.60	1.63
El Salvador	52.1	87.9	2.13	1.94
France	79.2	77.9	0.98	0.83
Germany	67.7	86.3	0.86	0.90
Hungary	53.7	59.9	1.61	1.27
Índia	57.1	33.9	1.50	1.98
Indonésia	31.1	27.6	1.03	1.50
Ireland	66.3	119.8	0.91	1.07
Japan	64.6	119.1	1.00	0.87
Korea	44.7	58.5	1.14	0.87
Malaysia	54.7	44.4	1.15	1.28
Mexico	63.8	82.1	1.12	1.12
Pakistan	55.0	33.2	1.23	1.68
Paraguay	56.4	50.9	1.79	2.23
Peru	39.0	56.4	1.10	1.22
Philippines	40.0	34.6	1.64	1.44
Poland	95.2	56.6	1.35	1.06
Portugal	51.6	69.7	1.12	1.09
Russia		47.4		2.18

South Africa	94.3	72.1	1.93	2.08
Spain	47.8	80.3	0.98	1.02
Thailand	30.7	32.5	0.88	1.14
Turkey	103.3	63.5	1.78	1.29
United Kingdom	66.5	88.1	1.00	0.88
United States	97.7	83.4	0.98	0.83
Venezuela	90.4	85.3	1.13	1.39
"World" median[1]	67.1	72.1	1.53	1.74
Latin America & Caribbean average	74.1	85.9	1.65	1.62

Source: Heston, Summers and Aten (2006).
1/ Medians for between 151 and 188 countries depending on available data.

Figure 3.23: Ratio of investment to GDP prices in 2000-03
as a function of per capita income (PPP) in 2003



Source: Heston, Summers and Aten (2006).

The above cross-country comparisons do not support the view that the price of investment in Brazil is too high, or that it is the binding constraint to growth. Yet, the unfavorable comparison with high-performing countries suggests that there is rationale for policy to focus on trying to bring these prices down. What can be done? A direct policy measure would be to reduce taxes on capital goods and construction materials, which would make special sense considering the large rise in the tax burden discussed elsewhere in this paper. However, market imperfections may render these direct measures ineffective or possibly costly if they do not attack the root of the problem. Beyond selective taxation, there are essentially three other measures that could help to bring down the cost of investment:

First, provide greater access to investment finance at a reasonable cost, notably for households and small businesses, to facilitate housing construction, which accounts for about a third of total investment. This is a sector marked by low productivity and high costs, to a large extent due to low scale of production and long completion periods, in turn a consequence of the lack of finance. An example is the substitution of housing construction by specialized firms by construction carried out directly by the dwelling owner, who buys materials at the local retail store (high distribution costs) and uses rudimentary production techniques.[45] To some extent, this problem reflects the scarcity, high cost and short repayment periods of loans in Brazil. This is relatively clear in the housing sector, in which the inability to turn future income and real collateral into capital, by borrowing in credit markets, has condemned many households to live in slums. Lending for the housing sector has declined steadily since the 1980s, when the public guaranteed system went bankrupt, falling from 25% to 6% of total credit from the second semester of 1988 to the first semester of 2003. It has recovered, marginally, in recent years, rising to 1.7% of GDP in December 2006.

Second, sectors that are key suppliers of construction materials are highly concentrated, protected from imports by natural barriers, and beneficiaries of regulations that lower potential competition. That is the case, for instance, of the cement sector, which accounts for most of the 96% real increase in the wholesale price of non-metallic mineral products, from 1980 to 2006 (calculated using the GDP deflator). The exercise of market power is apparently the likely

[45] In addition to increasing the cost of investing and reducing economy-wide productivity, this situation has adverse consequences for income distribution, since the poor usually bear the higher cost of construction. Probably, small and medium-size companies also suffer from a similar problem when investing in construction.

explanation for this significant rise in prices.[46] Thus, a more effective action of anti-trust authorities, far and beyond mere restrictions to new mergers and acquisitions, and a reduction in import barriers would likely reduce the price of these goods.

Third, the price of investment started to climb when the import substitution strategy was extended to the capital goods industry, in the mid-seventies, and it is very likely that there is a connection between the two. Trade liberalization in the early nineties gave back to firms the ability to import capital goods, and in this way lower investment costs and increase their productivity. But Brazil still keeps comparatively high protection in machinery and equipment, foregoing the opportunity to benefit more from embodied R&D through imports (Eaton and Kortum, 2001). To this end, Brazil could consider a further reduction in these barriers, possibly, but not necessarily, as part of trade negotiations.

5. Market Failures: Innovation Shortfalls

A frequent recommendation among economic analysts is that Brazil should establish a more innovation-friendly environment and spend more on R&D (OECD, 2006). Brazil spends about 1% of GDP on R&D, which is less than half the OECD average. Brazil also performs poorly according to indicators such as the number of patents filed in the US and Europe. Even with respect to Latin America, Brazil falls behind according to some innovation variables (see Table 3.14). Therefore, the argument goes, the country could benefit from an economic policy that fosters productivity-enhancing innovation in the business sector. Is this lack of investment in R&D and, in general, in innovation be a binding constraint to growth in Brazil?

[46] Salvo (2004) presents some evidence that the cement producers in Brazil apparently practice a (tacit) geographic division of market.

Table 3.14: Selected Innovation Variables

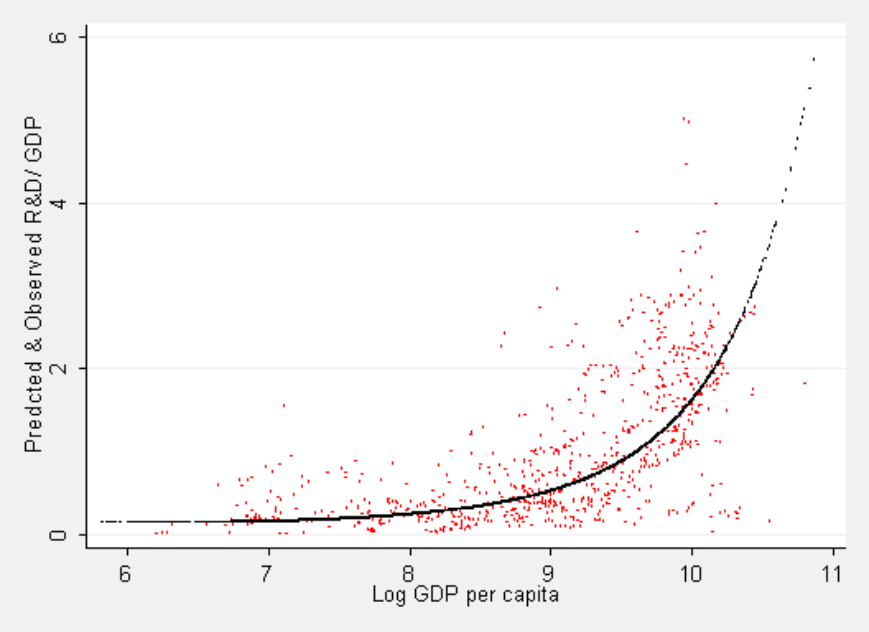
	Brazil	Latin America	Western Europe
1. Total Expenditure for R&D as % of GDP, 2004	0.98	0.26	1.94
2. Science Enrolment Ratio (%), 2004	8.35	8.5	11.02
3. Patents Granted by USPTO / Mil. People, avg 2001-05	0.75	0.82	77.64
4. Scientific and Technical Journal Articles / Mil. People, 2003	47.87	22.79	628.54
5. Royalty and License Fees Payments (US$/pop.), 2004	6.51	7.49	452.12

Source: KAM database, World Bank

In order to answer this question, it is important to first acknowledge that there is a problem with the type of uniform benchmarking exercise mentioned above, because it fails to recognize that investment in innovation is one activity, among others, whose level is influenced by the economy's pattern of specialization (Maloney and Rodriguez-Clare, 2005). The key issue is to determine the point at which a country suffers from an innovation shortfall relative to what is to be be expected given the country's specialization and accumulation pattern. Therefore, we first analyze whether Brazil really suffers from an innovation shortfall and, if it does, then investigate if this is a binding constraint to its economic growth.

First, we consider the work in Lederman and Maloney (2003), LM, in which the authors argue that R&D rises exponentially with the level of development as measured by GDP per capita. The relationship is shown here in Figure 3.24. We would like to compare the level of R&D in Brazil to the one predicted by this relationship and check whether Brazil is an outlier.

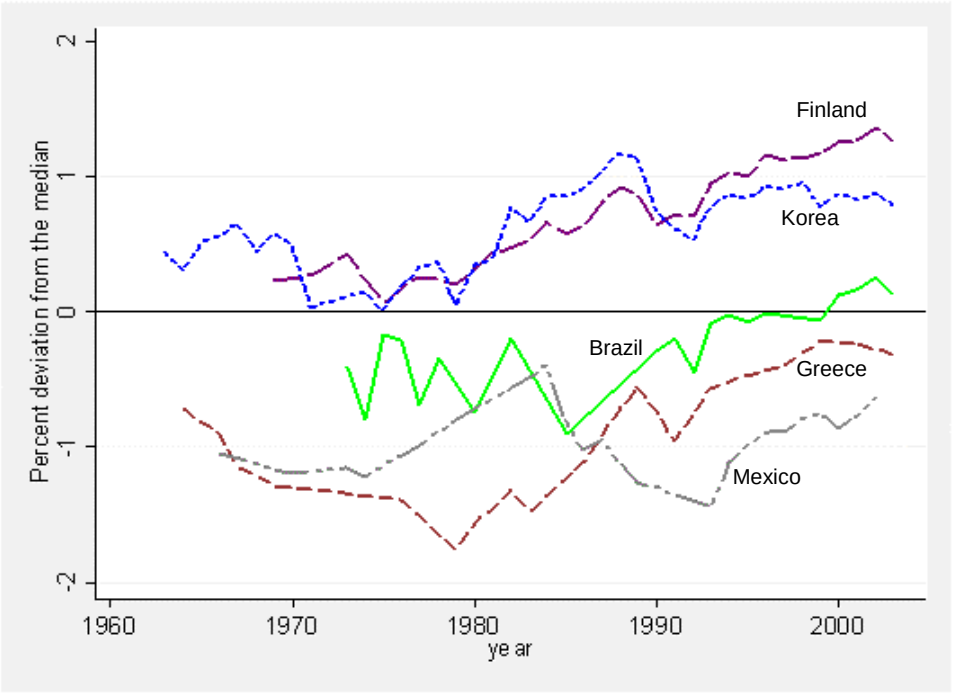
Figure 3.24: R&D/GDP vs GDP per capita



Source: own calculations using Lederman and Maloney (2003) dataset

Figure 3.25 shows the residuals from a more general and flexible specification that includes log GDP, log GDP squared, log labor force, and log labor force squared, and year dummies as explanatory variables. As argued by LM, this specification allows for independent effects related to the size of the economy and size of the labor force rather than per capita income or development per se. The figure shows countries like Korea and Finland exhibiting substantial "take offs" relative to the median trajectory. The figure also shows other countries that hover below the predicted value for their characteristics. This is the case of Brazil, which had similar levels of income as Korea prior to its take off but failed to follow the same path. Only recently has Brazil reached a value of R&D expenditures consistent with its level of development.

Figure 3.25: R&D/GDP –Deviations from the median



The substantial "take offs" in Finland and Korea are also observed in other countries like Israel and Taiwan. Moreover, China and India appear to be following in the footsteps of these "take off" countries (not shown). LM argue that these deviations from the median are fully justifiable by the high rates of return to R&D typically observed in developing countries. If this line of reasoning is followed, the conclusion would be that Brazil needs to keep upgrading its R&D efforts, as the country is still far away from these "over-achievers".

The capacity of a country to foster R&D, however, might be severely limited by its pattern of specialization. Table 3.15 shows the average R&D investment rate by sectors in the OECD. The figures go from 0.2% in construction to 37.4% in office, accounting and computing machinery. Therefore, the overall investment in R&D is very dependent on the pattern of specialization of the country.

Table3.15: R&D Investment Rates by Industry, 2000
In per cent

	OECD average
TOTAL MANUFACTURING	5.8
Food products, beverages and tobacco	1.2
Textiles, textile products, leather and footwear	1.2
Wood, paper, printing, publishing	0.6
….Wood and products of wood and cork	0.6
….Pulp, paper, paper products, printing and publishing	0.7
Chemical, rubber, plastics and fuel products	8.5
....Coke, refined petroleum products and nuclear fuel	2.4
....Chemicals and chemical products	12.3
.....Chemicals excluding Pharmaceuticals	6.8
.....Pharmaceuticals	25.5
....Rubber and plastics products	3.4
Other non-metallic mineral products	1.4
Basic metals and fabricated metal products	1.6
....Basic metals	2.3
.....Iron and steel	2.4
.....Non-ferrous metals	2.5
....Fabricated metal products, except machinery and equipment	1.2
Machinery and equipment	12.1
....Machinery and equipment, n.e.c.	5.5
....Electrical and optical equipment	16.9
.....Office, accounting and computing machinery	37.4
.....Electrical machinery and apparatus, nec	7.1

.....Radio, television and communication equipment	24.8
.....Medical, precision and optical instruments, watches and clocks	15.1
Transport equipment	9.6
....Motor vehicles, trailers and semi-trailers	9.9
....Other transport equipment	11.3
.....Building and repairing of ships and boats	3.0
.....Aircraft and spacecraft	22.0
.....Railroad equipment and transport equipment n.e.c.	9.3
Manufacturing nec	1.3
ELECTRICITY, GAS AND WATER SUPPLY	0.6
CONSTRUCTION	0.2
TOTAL SERVICES	0.4

Total business expenditure on research and development by industry as a percentage of industry's value added

Source: OECD Structural Analysis Data Base

To test whether Brazil's current pattern of specialization helps explain the R&D gaps observed with the OECD countries, we calculate what the R&D level in the OECD countries would be if they had the specialization pattern of Brazil (following the methodology in Maloney and Rodriguez-Clare, 2005).[47] Results are shown in Table 3.16. According to the table, in 12 out of the 18 OECD countries of the sample, R&D investment rates would be higher than the ones currently observed had these countries the economic structure of Brazil (these are the countries in which the ratio of simulated-to-observed R&D is higher than one). Therefore, the results from these countries would indicate that Brazil is under-investing in R&D, given its current pattern of specialization. Even when we consider the results from the other six countries of the sample (in which the ratio simulated/observed is smaller than one) we can still argue that Brazil is under-

[47] Ideally, we would like to calculate the R&D level in Brazil if it had the specialization pattern of the OECD countries. Unfortunately, there are not comparable rates of R&D investment at the sectoral level in Brazil.

investing in R&D. For example, if Sweden had the economic structure of Brazil, its overall R&D investment rate would be 8% lower than the one currently observed, but Brazil's overall R&D investment rate is much lower, only one third. Similar arguments apply to the other 5 countries. Therefore, although these six countries would have invested less in R&D, had they had the economic structure of Brazil, they would not have invested that much less. We can conclude then that the economic structure of Brazil is not an excuse for the lack of R&D investment observed in the country.

Table 3.16: OECD R&D Investment Rates with Brazil's Economic Structure

1995-2000 Average

	Simulated RDI using Brazilian shares	Observed	Estimated / observed
Austrália	1.05	0.75	1.40
Belgium	1.58	1.42	1.12
Canadá	1.24	1.09	1.14
Czech Republic	0.68	0.74	0.91
Denmark	1.73	1.39	1.24
Finland	1.69	2.11	0.80
France	1.65	1.49	1.11
Germany	1.38	1.69	0.82
Italy	0.64	0.57	1.12
Japan	1.77	1.97	0.90
Korea	1.24	1.92	0.65
Netherlands	1.46	1.13	1.29
Norway	1.47	0.93	1.58
Poland	0.35	0.30	1.16
Spain	0.55	0.45	1.22
Sweden	2.74	2.99	0.92
United Kingdom	1.50	1.31	1.15
United States	2.05	1.90	1.08

Source: OECD Structural Analysis Data Base, IBGE

Another factor that could explain the R&D gap between Brazil and other countries is that Brazil is using other means to tap technological knowledge, such as FDI or licensing or education. In that case, Brazil's apparent low levels of R&D could be just a reflection of a

strategy that relies less on R&D and more on substitutes, which may in fact be more effective for developing countries.

FDI in Brazil does not offset the R&D shortfall. In fact, relative to its size (GDP), FDI in Brazil is not high. Between 2000 and 2004, for example, FDI represented 3.2% of Brazil's GDP, below the average for Latin America (3.7%). Moreover, in Europe the share of FDI inflows relative to GDP was on average more than 3 times that of Brazil and yet many of the countries, such as Finland, Denmark and Sweden, also topped Brazil in terms of R&D indicators. Moreover, it is not clear the extent to which FDI is an appropriate conduit for acquiring knowledge given the low productivity spillovers from FDI that have been typically found in the empirical literature.

Another way of obtaining foreign technology is by importing machinery and capital goods. Foreign technology and machinery, however, might not work until they are adapted, tried and tested to local conditions. Therefore, the adoption of technology might require substantial expenditures. None of these expenditures, however, are included in the R&D data. The question then is whether Brazil would still appear as lacking investment in technological knowledge when a broad measure of R&D (that includes innovation and technology adoption) is considered. To tackle this question we employ a framework developed by Klenow and Rodriguez-Clare (2005), KR.

The KR framework can be used to identify whether a country's low income is due to low investment in physical capital, low investment in human capital, or low TFP. TFP is the result of accumulated investments not only in R&D but also in technology adoption (all of which is called knowledge capital), which is the kind of measure we like to examine in order to determine whether Brazil continues to have a shortfall in investment in knowledge acquisition when considering not only R&D investments but also investments in technology adoption.[48]

The model is based on a Cobb-Douglas production function of the form $Y = K^{\alpha}(AhL)^{1-\alpha}$, where Y is total output, K is the physical capital stock, A is a technology index, L is total labor force and h is average human capital per worker that follows the Mincer specification, $h = e^{\gamma s}$ where s is years of schooling. Output can be used for consumption (C),

[48] The interested reader can refer to Klenow and Rodríguez-Clare (2005) for a more complete description of the model. Here we provide a brief sketch of the model and present the main results.

investment (I), or research (R), $Y = C + pI + R$, where p is the price of investment. Physical capital is accumulated according to: $\dot{K} = I - \delta K$. There is a world technology frontier, denoted by A*, that increases thanks to the R&D performed in all countries. A* grows at a rate equal to g. Each country's A relative to the world level –which is denoted by $a = A/A^*$ -is determined by the country's efforts on research. There is also a free flow of ideas from the rest of the world to any particular country at a rate ε. In steady state, the following expression holds:

$$a = 1 - \frac{g}{\lambda s_R k + \varepsilon} \quad (1)$$

where s_R is R&D as a share of GDP (i.e, $s_R \equiv R/Y$), $k \equiv h(K/Y)^{\alpha/(1-\alpha)}$ and λ is the productivity in R&D.[49]

Policies and institutions are such that, implicitly, profits are taxed at the rate τ and there is an extra cost of R&D, captured by the parameter ϕ, so that the unit cost of R&D in terms of units of output is $1+\phi$.[50] The firm's decision about how much to invest is determined by a dynamic optimization problem, which yields two first order conditions: one for investment in physical capital and one for R&D.

The first order condition for investment in physical capital yields the following steady-state condition[51]:

$$p(K/Y) = \alpha\left(\frac{1-\tau}{r+\delta}\right) \quad (2)$$

The second first-order condition determines R&D, and hence relative A in steady state:

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[49] A country's R&D investment is the sum of R&D performed by firms, which undertake R&D together with accumulation of physical capital to maximize the present value of their future stream of profits, which are equal to total income net of wages paid and net of taxes.

[50] The model also allows for an R&D externality, captured by parameter μ, so that a firm's *A* increases not only thanks to its own R&D, but also thanks to R&D performed by other firms in the economy. μ goes from zero (no externalities) to 1 (full externalities).

[51] Where *r* is the equilibrium steady-state real interest rate, assumed to be equal across countries.

(3) $\Omega(1-\alpha)\lambda k(1-a) - ga/(1-a) + \varepsilon(1-a) = r$

where $\Omega = (1-\tau)(1-\mu)/(1+\phi)$ is a composite distortion term that captures the effect of taxes and externalities.

The point of this exercise is to use data on Y, K and h to estimate the size of the distortions: τ and ϕ (the barrier to physical capital accumulation and the barrier to knowledge capital accumulation, respectively). For this, parameter values are required for α, γ, δ, r, g, ε, λ and μ. KR uses the following parameter values for the calibration: $\alpha = 1/3$, $\gamma = 0.085$, δ=0.08, r=0.086, $g = \varepsilon$=0.015, λ=0.38 and μ=0.55.52

Table 3.17 presents the results for Brazil as well as for the average of 12 Latin American countries shown in Maloney and Rodriguez-Clare (2005) using this framework.53 Columns 1-3 show the corresponding values for human capital, price of investment and capital-output ratio respectively. Column 4 calculates the income tax τ implied by equation (2). The negative tax for Brazil would suggest that the country does not have a disincentive to accumulate physical capital: with a capital-output ratio equal to that of the U.S and a price of investment 1.4 times higher, the implicit tax is smaller than that of the U.S.

Column 5 presents the composite capital-output ratio $k \equiv h(K/Y)^{\alpha/(1-\alpha)}$ as a ratio of the U.S. level. Column 6 shows the TFP level A calculated directly from the data and expressed as a ratio of the corresponding U.S. level (this is obtained from y and k by applying $y \equiv Y/L = Ak$). Next, equation (1) is used to calculate what would be the implied R&D investment rate that is consistent with the level of productivity observed (this is shown in column 7) and equation (3) is used to calculate the R&D tax ϕ necessary for the model to be consistent with this R&D

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[52] α, γ and δ are standard in the literature. g is obtained from the average TFP in the OECD countries. r is obtained by noting that with a tax rate of 25% in the US (that is τ =0.25) and given data for the capital-output ratio and the relative price of investment in the US, then equation (2) implies r =0.086. Finally, ε, λ and μ are calibrated to US data assuming that ϕ =-0.2 in the US.

[53] The sources for the country-specific variables (years of schooling, labor force, physical capital, price of investment and GDP) were Barro-Lee dataset and the Penn World Tables.

investment rate (shown in column 8). The table shows that Brazil's actual TFP is 64% of the US, which implies an R&D rate of 1.7%. For this to be an equilibrium, the model requires an R&D tax of 41%. Therefore, Brazil seems to have a disincentive to innovate.

Table 3.17: Development Accounting Exercise

	1	2	3	4	5	6	7	8	9
Country	h	p	K/Y	τ	Rel. k	Data rel. a	Implied s_R	ϕ	Data R&D
Brazil (1)	1.5	1.3	1.7	-7%	0.5	64%	1.7%	41%	0.9%
LAC average	1.8	1.3	1.2	18%	0.6	53%	1.3%	47%	0.3%
U.S.	2.7	0.9	1.7	25%	1.0	100%	2.5%	-20%	2.5%
Brazil (2)	1.8	1.3	1.7	-7%	0.6	52%	1.0%	107%	0.9%
Brazil (3)	1.8	1.3	1.7	11%	0.7	48%	0.8%	81%	0.9%

Source: own calculations

It is worth noting that the last column of Table 3.17 shows the value of measured R&D relative to GDP that are significantly lower than the model's implied R&D (in column 7). In this framework, measured R&D only considers a small portion of overall innovative and technology adoption efforts, excluding investments that would normally be classified as technology adoption. The advantage of the KR approach is that the implied R&D, inclusive of investments in technology adoption, is more representative of an overall measure of innovate effort to be mapped into TFP growth. However, although the model provides a good approximation for broad international patterns, it may be way off for particular countries because the calibration assumes common parameters for all the countries. We now adjust the model to Brazil in two respects: the Mincer coefficient and the capital income share α.

With respect to the Mincer coefficient, several estimates show that for the case of Brazil it is much higher than the value selected in the calibration ($\gamma = 0.085$). According to Psacharapoulos and Patrinos (2002), for example, the average return to schooling in Brazil is

around 14.7%; Hausmann, Rodrik and Velasco (2005) estimate a coefficient of 13.2%. Menezes-Filho (2001) shows an estimation of 12.6%. Correspondingly, we changed the Brazil calibration to a Mincer coefficient of 13%. The results of this adjustment are shown in the second to last row of Table 3.17 (labeled Brazil (2)). Using this Mincer coefficient, *h* increases from 1.5 to 1.8, which by itself implies a decline in *A* of 18%. The R&D investment rate and the R&D implicit tax that go with this recalibration are 1% and 107% respectively. Brazil now appears to have an even larger innovation problem.

The second adjustment has to do with the capital income share α, which was assumed to be 1/3 for all the countries. Recent studies of Brazil's growth experience have used values of α in the range of 0.35 to 0.5 (see Pinheiro et al (2005); Ellery Jr. et al. (2003) and Bacha et al (2003)). Therefore, we adjusted α to be equal 0.4 in Brazil. The results of this adjustment, together with the new Mincer coefficient, are shown in the last row of Table 4 (labeled Brazil (3)). There is a small increase in *k* and a small decrease in productivity. For this smaller productivity level to be consistent with the model, the investment in R&D has to be lower as well as the implicit tax on R&D that goes with it. Although the tax on R&D decreased somewhat relative to the previous simulation, it is still very high, indicating a substantial problem of innovation in Brazil. Note also that the implicit capital investment tax is now positive, suggesting that constraints in the accumulation of physical capital might also be a problem behind Brazil's low level of income.

The KR framework confirms that Brazil appears to have an innovation problem when a broad concept of knowledge capital (that includes investments in R&D and technology adoption) is used. We further explore this issue by employing firm level data to analyze what might be the potential obstacles for this type of investments.

First, we use the Industrial Survey of Technological Innovation (PINTEC –Pesquisa de Innovação Tecnológica), a triennial survey conducted by IBGE that studies the technological innovation activities developed in the Brazilian industrial enterprises. Table 3.18 shows the proportion of firms that rank a particular obstacle to innovation as high or medium. According to the survey, the scarcity of qualified personnel and lack of information (about technology and about the market) are among the concerns frequently raised by firms. However, the main obstacles seem to be related to the high costs of innovation, the excessive risks involved and the lack of credit sources. These problems could be seen as broadly mapping into the standard

market failures studied in the literature: individual firms cannot handle the lumpiness, risks, and long gestation periods of innovation projects.[54] This points in the direction of credit market failures as the principal binding constraint for innovation and technology adoption in Brazil.

Table 3.18: Obstacles to innovation by firm size (workers), 2001-2003 (%)

	Total	From 1 to 99	From 100 to 499	500 or more
High costs of innovation	79.7	79.8	79.5	76.4
Excessive risks	74.5	74.6	75.4	72.0
Lack of financial sources	56.6	57.4	53.2	45.2
Lack of qualified personnel	47.5	49.2	38.2	29.8
Lack of information about technology	35.8	37.5	25.4	21.6
Difficulty to adapt to norms and regulations	32.9	34.1	27.3	19.7
Lack of information about the market	30.5	31.3	25.9	22.1
Lack of cooperation opportunities	29.6	30.8	20.5	23.1
Lack of technical services	25.5	26.3	20.6	18.3
Weak response from consumers	24.0	24.0	23.3	24.7
Organizational rigidities	17.9	17.4	19.9	24.6

Source: PINTEC, IBGE.

To complement the results in Table 3.18, we estimated an econometric model that takes into consideration several factors that have been identified in the literature to affect (positively and negatively) the propensity of firms to invest in innovation. This allowed us to confirm whether the obstacles identified in the PINTEC survey are truly limitations to investments in innovation, given the standard determinants of R&D. The first set of explanatory variables in the

[54] Note that these market failures may apply also to projects of technology adoption as some of their expenditures might look like R&D in the sense that they are costly and their effects are random (Howitt and Mayer-Foulkes, 2002).

empirical model includes the usual measures considered in the literature on R&D determinants in the "Schumpetarian tradition": size, market share and diversification.[55] We model firm's size by the number of employees, market share by the share of the firm's sales in industrial sector sales and diversification by the number of different products the firm produces.

There are other forces that may also stimulate firms to innovate given size, market power and diversification, such as industry demand and industry technology opportunities.[56] These two forces are industry-specific and can be controlled in the model with the inclusion of industry dummy variables. We also included the participation of foreign capital in the ownership structure of the firm, which can be very important for developing countries. Finally, we included a set of variables in the model to capture some of the obstacles revealed by the PINTEC survey. We analyzed whether firms that have access to credit or have properly qualified personnel are more able to invest in innovation. The first factor is captured by a dummy variable that takes the value of 1 if the firm has access to an overdraft or line of credit and 0 otherwise.[57] The second factor is proxied by the share of professional workers in the establishment. The PINTEC survey also indicates that the lack of information about technology and the market could be important constraints to innovation. To test whether this is an important factor we include a dummy variable that is equal to 1 if the firm is a member of a producer or trade association, be it a chamber of commerce, an association of firms in the same industry or an association of firms in many industries. The hypothesis is that these memberships may help to solve informational failures about technology and markets.

The empirical strategy consists on estimating Probit and Tobit models for R&D expenditures. In the Probit estimation the dependent variable takes the value of 1 if a firm reports R&D expenditures, while the Tobit estimation is sensitive to the level of the

[55] The inclusion of size is justified on the argument that there are scale economies in R&D activities. Also, in the presence of imperfect capital markets, large firms are better equipped to provide collateral to secure financing for otherwise very risky R&D investment. On the other hand, market concentration allows the existence of monopolistic rents that enable firms within the industry to finance R&D projects. Diversification may also favor the firm's innovative performance: R&D may be an uncertain activity, its outcome may be different from the one expected, or of a larger scope, in which case, diversified firms will be more able to exploit them (Nelson, 1959).

[56] The first of such forces is based on demand factors, such as market growth, commonly known as the "demand-pull hypothesis" (Schmookler, 1966). A large market would make the benefits of innovation more significant. Thus, other factors constant, industries facing greater and more dynamic demand would invest greater resources in technology. The second force, also called "technology-push hypothesis", is based on the role of scientific advancements in stimulating industrial innovative effort. The relative opportunities for a firm to innovate might be partly determined by the scientific progress that occurs in that industry.

[57] We also use the size of the overdraft relative to the firm's sales in an alternative specification.

expenditures. Thus the Probit specification captures the extensive margin (to participate or not) regarding innovation investments, while the Tobit specification identifies the intensive margin (variation in the quantity expended). We employ Brazil's 2003 Investment Climate Survey of the World Bank.[58] Results are shown in Table 3.19.

Table 3.19: Determinants of Investment in Innovation

Dep var: R&D expenditure per employee	Probit	Tobit	Probit (IV)	Tobit (IV)
Number of employees	0.152**	0.153	0.118*	0.019
Market share	0.157***	0.976***	0.177***	1.055***
Diversification	0.049**	0.248**	0.041*	0.209*
Foreign capital participation	-0.067	-0.29	-0.063	-0.251
Overdraft	0.159*	0.771*	0.121	0.677*
Professional share of labor	0.369***	1.642***	0.345***	1.532***
Member association	0.316***	1.705***	0.282***	1.498***
Observations	1397	1397	1380	1380

Regressions include 8 industry dummies, 12 region dummies and a constant

All variables in logs, except dummies

* significant at 10%, ** significant at 5%, *** significant at 1%

Starting with the decision to allocate resources to R&D activities (first Probit column), firm size has a positive and significant impact.[59] It appears that the probability of doing R&D also increases with the degree of market share and level of diversification.[60] The analysis with

[58] The survey covers 1642 manufacturing establishments in 9 industries and 13 estates. All firm sizes were represented based on the IBGE categories and definitions of firm's size. The sample was selected in conjunction by the World Bank and IBGE based on a population provided by the Ministry of Labor (same as the used by IBGE). The 13 estates are selected to represent all five geographic regions in Brazil. Samples were taken at the estate level and were representative of the industries at this level.

[59] This increase with size is a well-documented fact in the empirical literature.

[60] Similar findings are also documented in several studies (see for instance Crepon et al, 1998).

R&D intensity (first Tobit column) shows that firm size has no significant impact on this variable while market share and degree diversification have significant positive impacts. This is consistent with previous work in this line of research (see Cohen and Keppler, 1996, and Crepon et al, 1998). One interesting result is that foreign participation in Brazil does not seem to have an effect either in the decision to engage in R&D activities or in its intensity.[61]

Turning to the other three variables of the model, the results confirm the concerns expressed in the PINTEC survey. Access to credit markets and adequate personnel are significant determinants of R&D investment in Brazil even after controlling for the other standard factors.[62] Therefore, credit market failures and lack of qualified labor can be significant obstacles in fostering innovation activities in Brazil. Likewise, the finding that membership to a business association induces higher investments in R&D underscores the potential importance of access to information or coordination.[63]

So, what can we conclude after all these results? We have found that Brazil has an innovation problem in the sense that the country suffers from low investment in knowledge capital beyond what would be expected given its investment in other types of capital and its patterns of specialization. Based on complementary analyses using the PINTEC survey and the Investment Climate Survey we have identified some of the most important obstacles to investing in R&D as reported by firms and confirmed them with econometric analysis.. These obstacles

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[61] A potential explanation for this result is that only large MNCs invest in innovation and this effect is capture by the number of employees (size) in the regression. An interaction variable that consists on the number of employees times foreign ownership was included in the specification (not shown), but the coefficient for this variable was not significantly different from zero and the previous results remained the same.

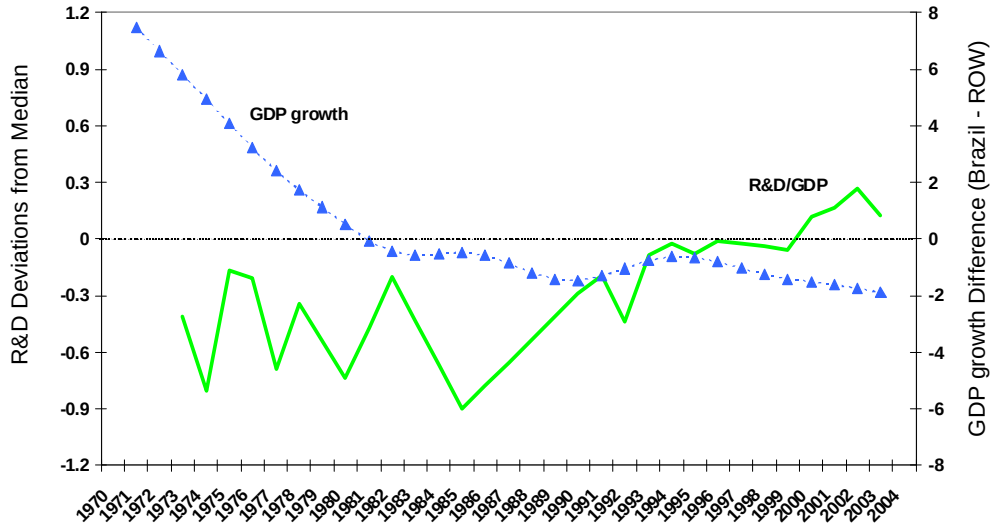
[62] A similar result arises when we use the size of the overdraft (relative to sales) as the explanatory variable.

[63] An important issue in these regressions is the potential endogeneity of the right hand variables. For instance if a firm implements a successful innovation it is most likely that will gain market share and also expands production and employment (size). However, since our dependent variable is not an innovation outcome but an innovation input (expenditures) this might be less of a concern. Nevertheless, we deal with the issue of endogeneity by using lag values of the explanatory variables for which data is available (size, market share, diversification and professional share of labor). The issue of endogeneity may be quite important for the "overdraft" variable: firms with access to credit markets may invest more in innovation, but also firms that invest more in innovation might have better growth opportunities, and so they may be the ones able to raise external finance. To tackle this specific problem of endogeneity we instrument the overdraft of the firm by the average overdraft size of all the firms in the same city. While investment in innovation at an individual firm may lead to greater external finance for that firm, it is not likely that it would explain the average level of external finance in that firm's city group. Results are shown in the right side of the table. The coefficient on overdraft is not significant anymore in the Probit regression but it is still significant in the Tobit regression. Therefore, at least for the intensive margin, we can argue that the positive effect of access to credit on R&D is not the result of reverse causality.

appear related to credit market failures, lack of qualified personnel and lack of information about technology and markets.

Is this innovation shortfall a binding constraint to Brazil's economic growth? We tend to think that so far it has not been. Brazil was able to sustain high rates of growth during the 1970s and part of the 1980s precisely when the deficit in investments on knowledge capital was the highest (see Figure 3.25). Moreover, the improvement in the intensity of R&D investment that has been observed since the mid 1980s does not find a corresponding improvement in the growth rate of output. Indeed, Figure 3.26 shows Brazil's R&D/GDP deviations from the median (same information as in Figure 3.25) together with the difference between Brazil's GDP growth and that of the rest of the world. While Brazil's relative investment in R&D has been improving, its relative GDP growth has been deteriorating over time. True, about 60% of R&D activity is carried out and financed by the government, providing support mainly to universities and research institutions, rather than business-generated activity. Moreover, joint ventures between universities and business are rare. Therefore, the surge in R&D activity 'recorded' since the mid 1980s might not necessarily translate into an important increase in the innovation capacity of the business sector. Furthermore, a severe problem of low investment in innovation and technology adoption is likely to be reflected in a low level of export sophistication, a problem that Brazil does not seem to have (see the next section on structural transformation). Although we conclude that there is a clear shortfall, beyond reasonable doubt, at the same time we notice that the typical manifestations of a constraint on growth that is binding do not appear to accompany it.

Figure 3.26: GDP growth and R&D/GDP

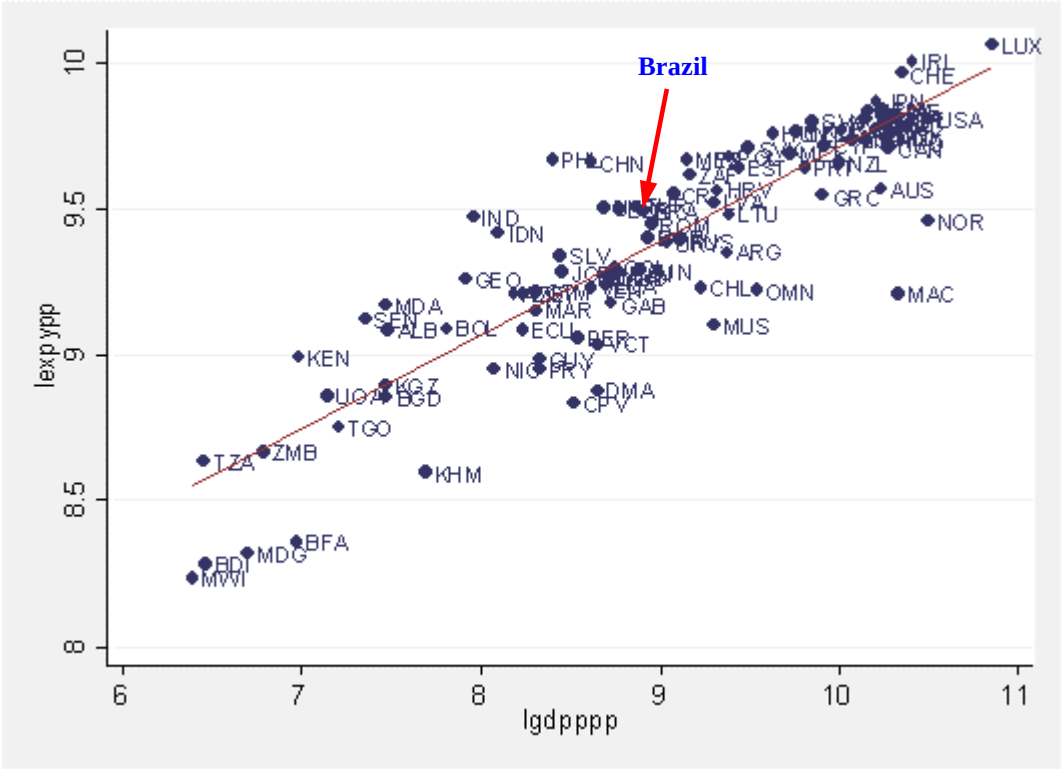


6. *Market Failures: Coordination, Self Discovery and Structural Transformation*

Next, we analyze whether lack of coordination and low self-discovery are constraints to growth in Brazil by considering the 'stock' of discovered products from Hausmann, Hwang and Rodrik (2006), HHR, and its structural transformation over time. In HHR framework, it is not only how much but also what you export that matters for growth. A measure of the level of sophistication of the export basket of a country is given by EXPY, the income level associated with a country's export package.[64] Brazil has a high value of EXPY given its level of income, meaning that it has discovered a relatively high-valued export package (Figure 3.27).

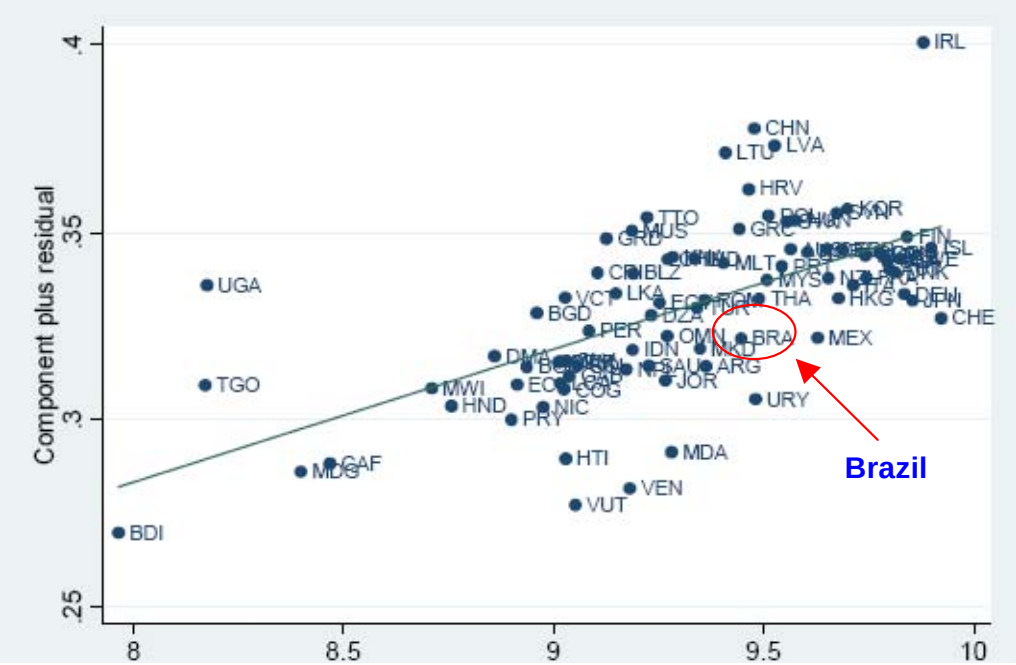
[64] See Hausmann, Hwang and Rodrik (2006) for details on this variable.

Figure 3.27: EXPY vs GDP per capita, 2004



HHR find that these countries with a high-value stock of discovered exports (high EXPY) enjoy faster subsequent growth in GDP per capita (controlling for initial GDP). This finding is robust to controlling for time-invariant country characteristics, levels of human capital, and institutional quality. Figure 3.28 shows the initial value of EXPY versus subsequent GDP growth. The figure shows that Brazil is below the trend line, which means that Brazil grows more slowly than what would be expected given the sophistication of its export basket. This suggests that the process of structural transformation does not reveal a problem and that accelerated growth is not being held back by lack of discovery of newer higher-value goods. Brazil does not grow faster despite its relatively sophisticated basket of exports.

Figure 3.28: Partial relationship between export sophistication and subsequent growth



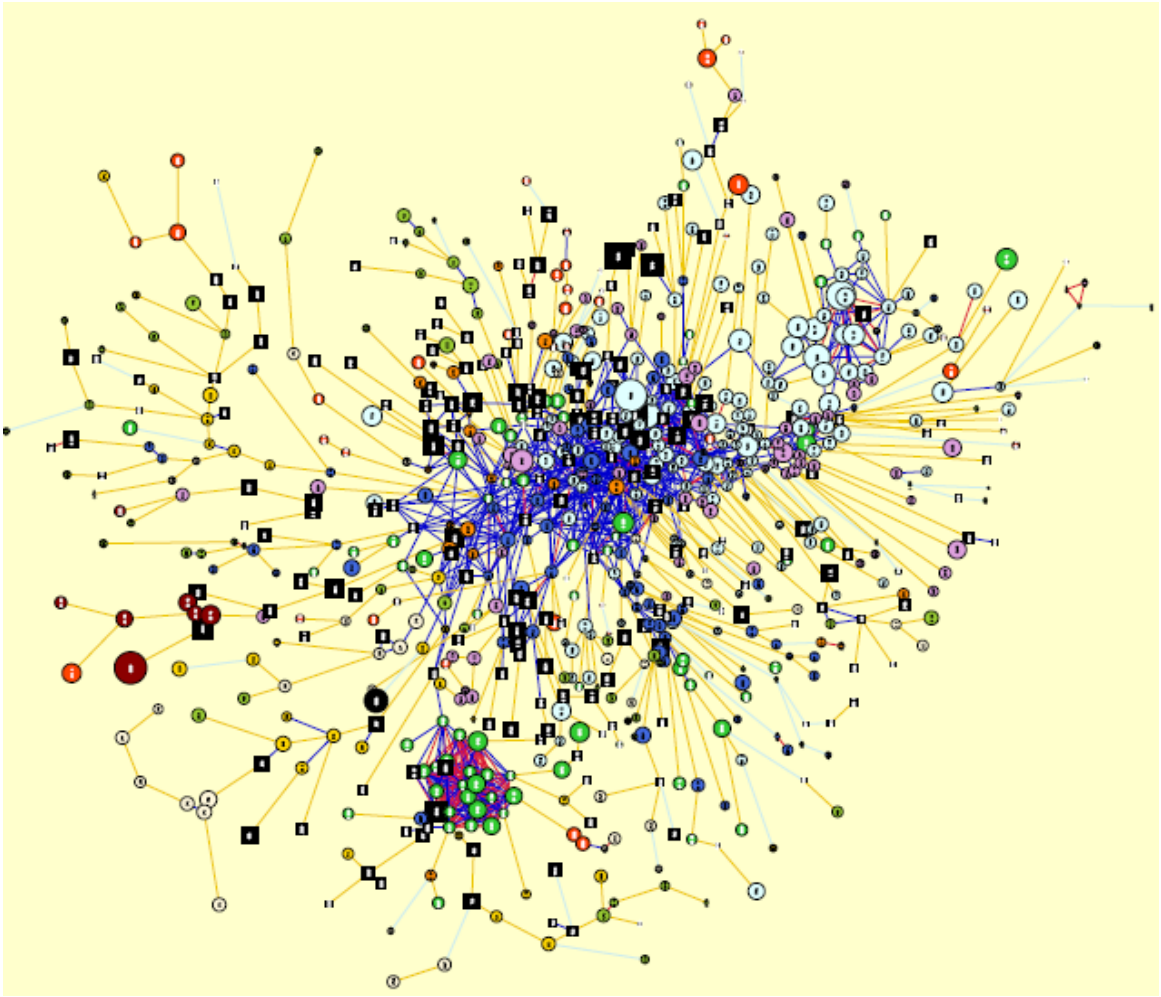
LEXPY

Besides measuring the level of sophistication of the export basket, we also analyze Hausmann and Klinger's (2006), HK, concept of the product space to examine Brazil's structure of production and the opportunities for future discovery and growth.[65] The application of this methodology suggests that the product space of Brazil (Figure 3.29; black squares) is well configured to prompt grow through a process of structural transformation, mainly because it has successfully penetrated the industrial core. According to HK, when a country is producing goods in a dense part of the product space, then the process of structural transformation is easier because the set of acquired capabilities can be re-deployed to nearby products. By contrast, if a country is specialized in peripheral products, then this redeployment is more challenging because

[65] See Hausmann and Klinger (2006) for details.

there are few products requiring similar capabilities. In the latter case, the probability of experiencing output stagnation is much higher.

Figure 3.29: Product Space of Brazil

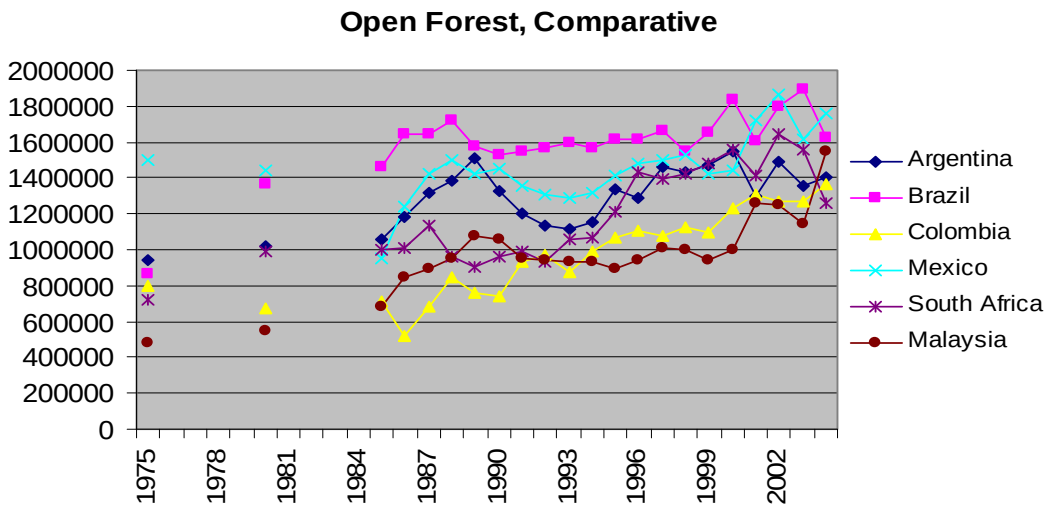


Based on Hausmann and Klinger (2006)

Density of the product space, however, says nothing about how valuable are the expansion opportunities. A comprehensive measure of the degree to which the current export basket is connected with valuable new productive possibilities is the so-called value of the ‘open

forest'.[66] Figure 3.31 shows that the 'open forest' of Brazil compares very well among its Latin American peers and even with other countries like Malaysia. Therefore, the preliminary picture that emerges from this analysis is that Brazil has a relatively well-positioned pattern of comparative advantage and that the opportunities for future growth through structural transformation are open.

Figure 3.31



Based on Hausmann and Klinger, 2006

Thus, the analysis indicates that Brazil's current export basket is relatively sophisticated, that the production structure has penetrated the industrial core and that it is well-positioned in the product space. This suggests that Brazil's current growth is not being held back by a lack of discovery of newer higher-value goods and that the binding constraints to growth lie elsewhere. This conclusion confirms that lack of innovation is not the key.

[66] See Hausmann and Klinger (2006) for details on the construction of this measure.

4. High Cost of Finance

In this section, we explore the factors that might act as a constraint to investment by increasing the cost of funding of investment projects rather than affecting the private return of these investments. The section is structured in the following way. First, we perform the "traditional" analysis on the cost of financing focused on the private commercial banking sector, and show that from this point-of-view Brazil is an outlier compared with other developing countries. The extremely high real lending rates in the banking sector make financing a prime candidate for a binding constraint to investment. We then conduct a more comprehensive analysis of the cost of investment financing looking in more detail to private bank credit as well as public banks and non-bank financing to show that high cost of finance is much less relevant than it appears. While high cost of financing may be relevant for a segment of the market, it does not appear to be a key binding constraint to investment and growth in the aggregate.

The rest of the section is devoted to explaining why investment financing is expensive or not available to certain segments of firms. We first explore the argument of HRV (2005) that low domestic aggregate savings are behind the high cost of financing. While such constraint may have been active in the past, at a time when access to external financing was limited, we show evidence that nor low domestic savings neither bad access to external finance are relevant constraints nowadays. Finally we turn to the financial intermediation costs that explain the observed high financing costs, both high risk premiums and intermediation spreads.

The "Traditional" Approach

A well-documented stylized fact of the Brazilian economy is that real interest rates are extremely high, which have long been major suspects, and culprits, for Brazil's lackluster growth performance. This feature shows up when considering lending rates by commercial banks (Figure 4.1). Even when compared to countries in Latin America and the Caribbean, which historically faced high interest rates, Brazil is an outlier with still extremely high real domestic lending rates. According to the data presented in Figure 4.1, real lending rates in Brazil were around 45%, more than twice the also extremely high rates in Paraguay and Dominican Republic. The corresponding ex-ante real interest rates, net of inflation expectations, have also been between 40% and 50% since 2001 (when data became available). This indicator alone

makes financing constraints a likely candidate for being a major constraint to economic growth in Brazil.

An intuitive preliminary test of the relevance of high financial costs of commercial bank lending as a binding constraint to economic growth is to analyze if movements in the real lending rate are associated with changes in fixed capital investment rates. We plot the this relationship for annual data from 1995 to 2007 in Figure 4.2. There are clearly two distinct periods concerning the relationship between both variables. First, until 1999 there is basically a positive correlation between both variables, which is an indication that financing costs were not a severely binding constraint during that period. From 2000 onwards, the relationship turns slightly negative. The simple correlation coefficient is –0.1, but not statistically significant. Thus, although clearly limited, this first evidence is rather weak regarding the importance of financing constraints as a binding constraint to growth.

Figure 4.1: Ex-Post Real Lending Rates in Latin American and the Caribbean 2005

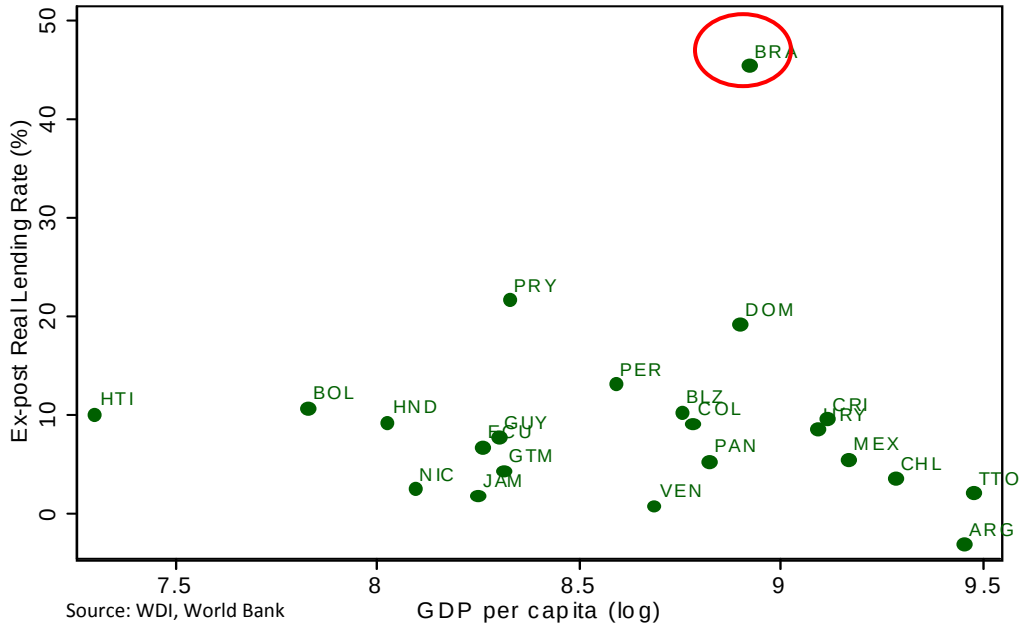
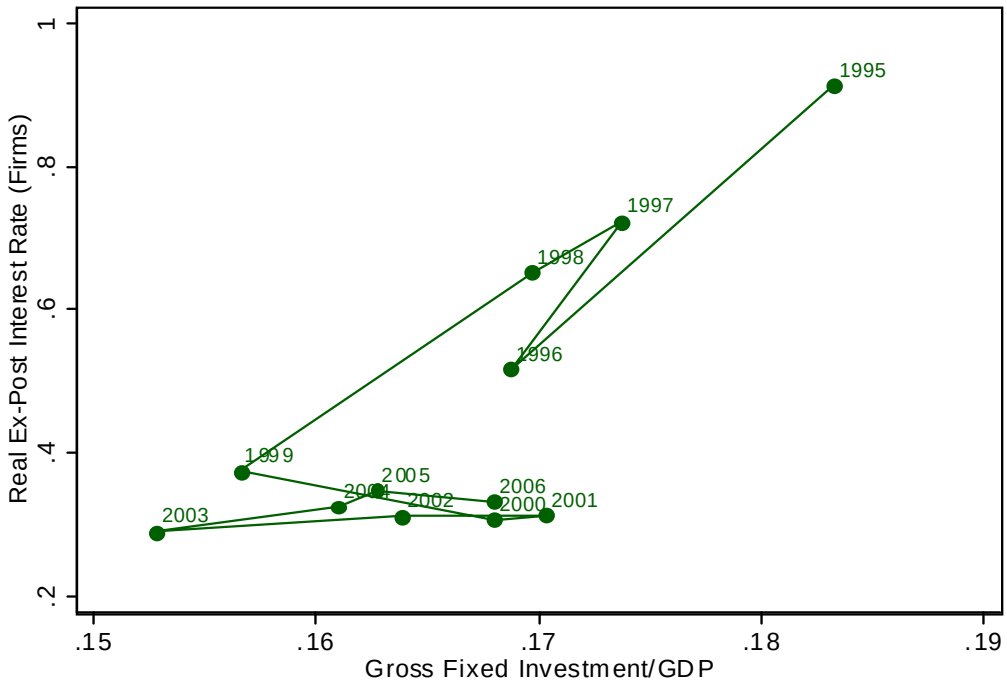


Figure 4.2 Real Interest Rates and Fixed Investment/GDP



Another way to explore the relevance of financial constraints for investment is a test in the spirit of Rajan and Zingales (1998). These authors analyze the impact of financial development on growth rates by sector in a panel of countries. They compute the external financing need by sector of activity using balance-sheet data from large U.S. firms, which is the most developed and sophisticated financial market. Thus, the differences in the financing structure across sectors should tend to be driven by differences in technological characteristics rather than financial market imperfection. Then, they regress the growth rates by industry-country on a series of control variables and an interaction term between an indicator of financial development and the industries "intensity" in external funds in the U.S. The intuition is that if financial development is relevant for economic growth, the sectors that are intensive in external financing should grow less in less financially developed countries.

Here, we use this intuitive approach and perform a slightly different test. Since financial imperfections in Brazil are not recent but rather long-dated, instead of sector growth rates we use the share of each sector's added value in total manufacturing added value (under the assumption that the economic structure has already adjusted to the financial conditions and settled in its

balanced-growth equilibrium). The data are from the UNIDO database and involve 20 sectors in 38 countries.[67] We use the latest date for which information is available for each country. Then, we estimate the following basic regression:

$$\frac{AV_{ij}}{\sum_i AV_{ij}} = \mu_i + \alpha_i \ln GDPpc_j + \beta EXTFIN_i + \gamma EXTFIN_i \times BrazilDummy + BrazilDummy + \varepsilon_{ij},$$

where the dependent variable is the share of the value added in sector *i* and country *j* in country *j*'s total manufacturing value added. We also include industry fixed effects (μ_i), as well as GDP per capita, which is allowed to have a sector-specific impact to capture differences in the patterns of specialization due to differences in the stage of development. The coefficient of interest if γ. In particular, if this coefficient is negative and significant, it would be an indication that sectors intensive in external finance have a smaller share in Brazil. This would be an indication that financing constraints cause substantial allocation distortions and might be binding to growth.

The point estimate of the coefficient of interest is positive (0.021) and not statistically significant at conventional levels. The same result holds if we include country dummies in the regression. This evidence can be interpreted as casting doubt on finance being a binding constraint in Brazil.[68] One major limitation of the previous analysis is that it focuses only on the manufacturing sector. This leaves out other industries, the services sector and agriculture, which represent 11%, 64% and 6% of total GDP, respectively. Thus, it only looks at a small fraction of the universe of firms.

From this preliminary analysis, we conclude that while real lending rates seem extremely high in Brazil, tests of their relevance for actual investment like correlation analysis and the regression analysis by sector performed above do not support the hypothesis that financing is as a major constraint to investment in Brazil. In what follows, we take a more detailed look at Brazil's financial system and how the relevant cost of finance is determined.

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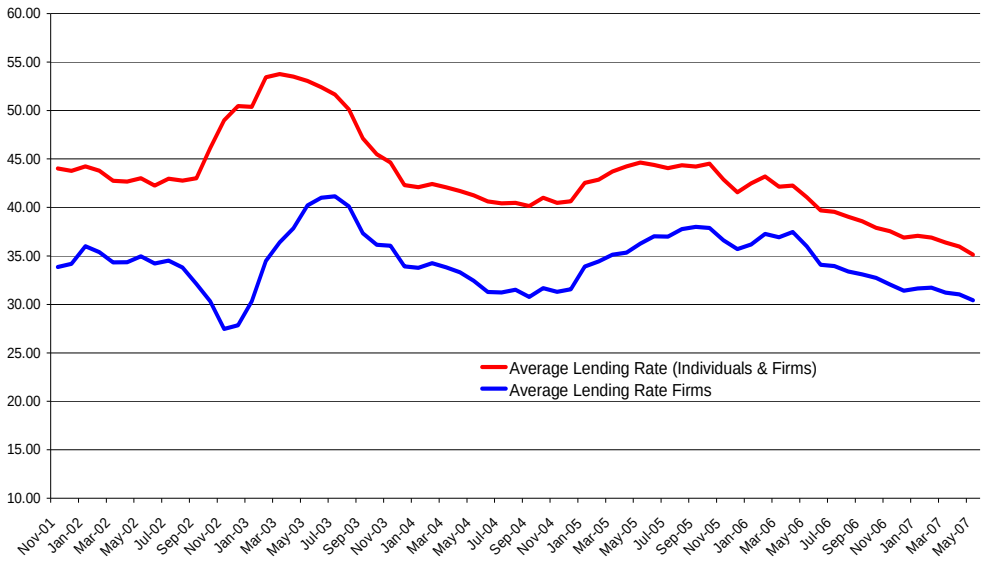
[67] See Rajan and Zingales (1998) for more details on the external financing variable.

[68] However, Terra (2003) estimates investment equations at the firm level in Brazil and finds that firms in sectors classified as intensive in external financing by Rajan and Zingales (1998) are significantly more constraint financially than those in sectors that require less external funding. Thus, this micro evidence goes in the direction of confirming that financing might be a binding constraint.

The cost of finance in a segmented financial system

In Figure 4.3, we analyze more in detail the evolution of interest rates in Brazil's commercial banking system, focusing on *ex-ante*, as opposed to *ex-post*, real interest rates, which are the relevant rates for investment decisions.[69] In addition, we discriminate between the rates faced by firms, directly relevant to our interest in investment, from those by individuals. We first notice that lending rates for firms are significantly lower than rates for individuals.[70] Nevertheless, and even though *ex ante* real interest rates of lending to firms declined sharply in the last couple of years, they are still quite high at around 30 percent by mid 2007.[71]

Figure 4.3: Real Ex Ante Interest Rates (annual %)



In what follows, we discuss several specificities of the Brazilian financial markets that might mitigate the picture that emerges from the previous section regarding the high cost of

[69] In Figure 4.1, we use *ex-post* real rates due to data availability limitations on inflation expectations.
[70] However, credit to individuals for the purchase of new housing would obviously be of interest from this point-of-view. In addition, the rates for individuals might be a good indicator of the cost of funds for small firms, especially in the informal sector.
[71] Inflation expectations are private professional forecasts from the BCB time series database, available since November 2001. We use a one-year horizon, given that the average maturity of loans to firms is around 222 days for 2006, close to a year.

financing faced by firms. In particular, some of these aspects show that the overall cost of credit for firms might actually be much lower than what the analysis based on interest rates in the traditional approach indicates.

The first potentially mitigating factor is the existence of a significant amount of directed credit which represents still a large share of total credit in the economy.[72] As shown in Figure 4.4, while the share of non-directed credit – as well as the share of private banks in total lending – has increased steadily over time from around 1/3 of total funding to around 2/3, the share of directed credit is still around more than 30 percent of total credit in the economy. A large share of these earmarked funds consist of compulsory savings collected by quasi-taxes, like the Fundo de Amparo ao Trabalhador (FAT), Fundo de Garantia do Tempo de Serviço (FGTS) and Development Funds like the Fundo de Garantia para a Promoção da Competitividade (FGPC). The public sector, especially BNDES, play an important role in the allocation of credit in the economy. During 2006 the disbursements made by BNDES to the manufacturing sector amounted to US$ 11,854 million, which represents more that 9% of the value added created by total manufacturing. Therefore, the presence of a large fraction of directed credit might actually make the previous analysis relatively uninformative regarding the presence of financial constraints.

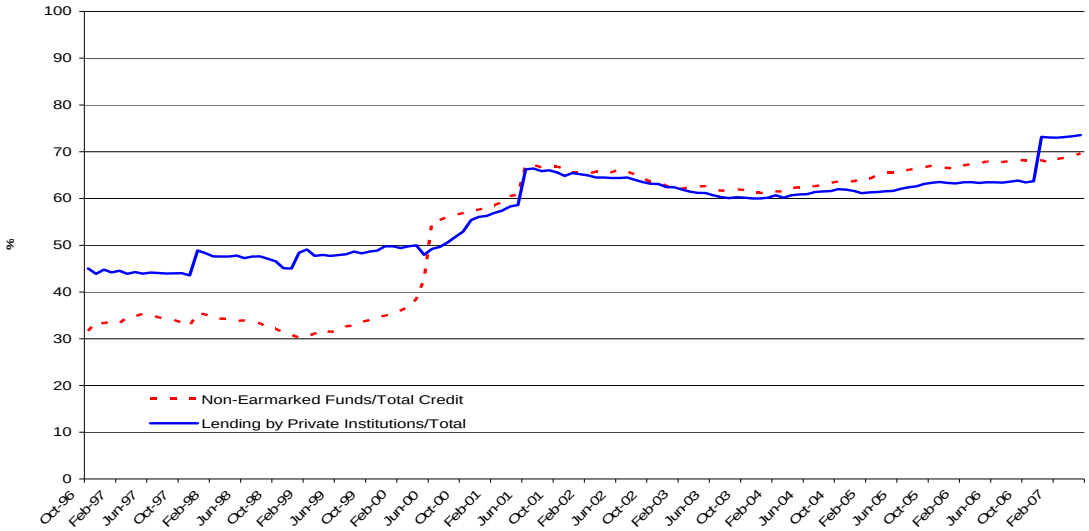
These compulsory savings are channeled to firms by public federal banks at the interest rate paid on these funds plus a spread that includes a risk premium and administrative costs.[73] Although an average rate is not available for these lending operations, there are certain caps for the risk premium (currently 4 percent per annum) and other associated costs. Approximately a reasonable estimate of the overall spread is 4.5% on top of the funding. In Figure 4.5, we compare this rate to the SELIC. As it can be seen the TJLP is always significantly below the SELIC. Currently, while the SELIC rate is around 12 percent, the TJLP is only at 6.5 percent. Given that inflation expectations are currently around 3.7% for the next 12 months, the latter implies a real interest rate of 2.7%. If we include the estimated 4.5% spread on these operations

[72] The data presented on interest rates in this section in general refers to credit operations regarding non-earmarked funds.

[73] The relevant funding rate is the long-run interest rate Taxa de Juros de Longo Prazo (TJLP) which is computed following the inflation target for the next 12 month of the National Monetary Committee plus a premium.

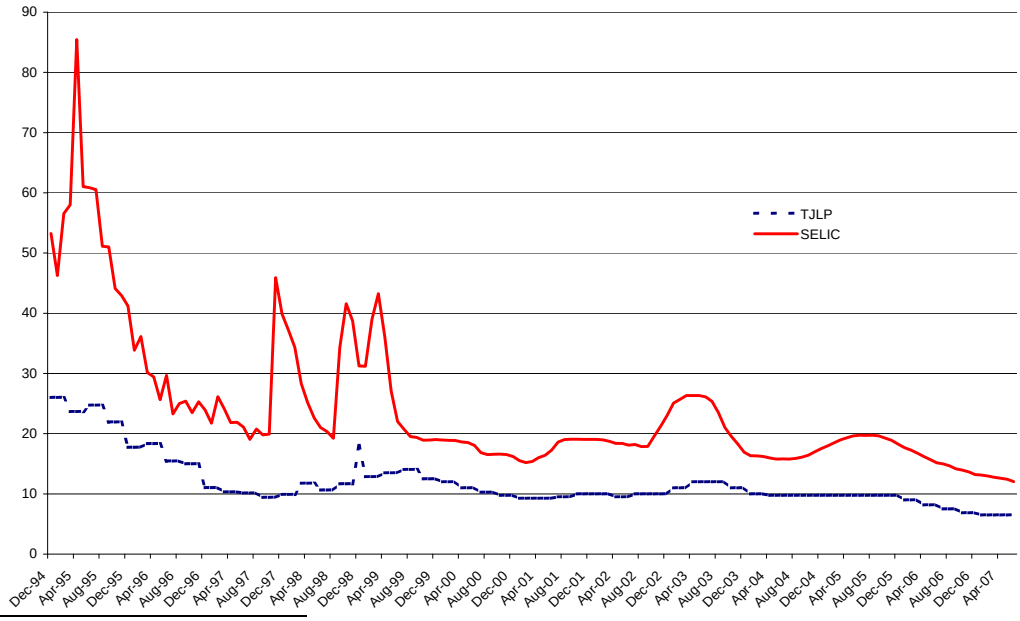
the resulting interest rate firms pay for these funds would be about 7%, way below the prevailing rates for credit from private banks discussed above.[74]

Figure 4.4: Share of Non-Earmarked Funds and Private Lending



Source: BCB

Figure 4.5: SELIC and TJLP Nominal Interest Rates (annual %)



[74] Clearly, this low rate of funding carries implicitly a subsidy.

Taking into account this subsidized directed credit represents around 1/3 of total credit, a "back of the envelope" estimation of the average cost of credit firms face would still be around 22.3% in real terms. It could be argued that subsidized credit lines are infra-marginal and therefore not relevant when considering the relevant marginal cost of finance as a restriction to investment in Brazil. However, this argument is only valid in the absence of market segmentation. Thus, while not all borrowers, particularly small and medium firms, have unlimited access to these funds, most medium and large firms, which account for the bulk of investment in Brazil, do. Although the distribution of investment by company size is itself endogenous, and could be a consequence of limited access to finance by smaller companies, the evidence of excess funds in BNDES in recent years indicates that there is insufficient demand for credit at the current rates. This leads to the conclusion that at least in that segment rates financing investment is not particularly costly.

In Table 4.1, we present some additional characteristics of the credit lines available to firms in the commercial banking system, their spreads and average duration of loans. As it can be seen in the table, most of the credit firms receive goes to finance working capital and current operations rather than investment in physical capital, which only represents around 6.9% of total credit to firms. Thus, the non-earmarked funds available in the financial system are allocated only marginally to investment. This also implies that the share of subsidized credit represents a dominant share of investment credit (85%), much larger than the one third considered above (although at the same time some financing for working capital may hide investment financing to small firms).

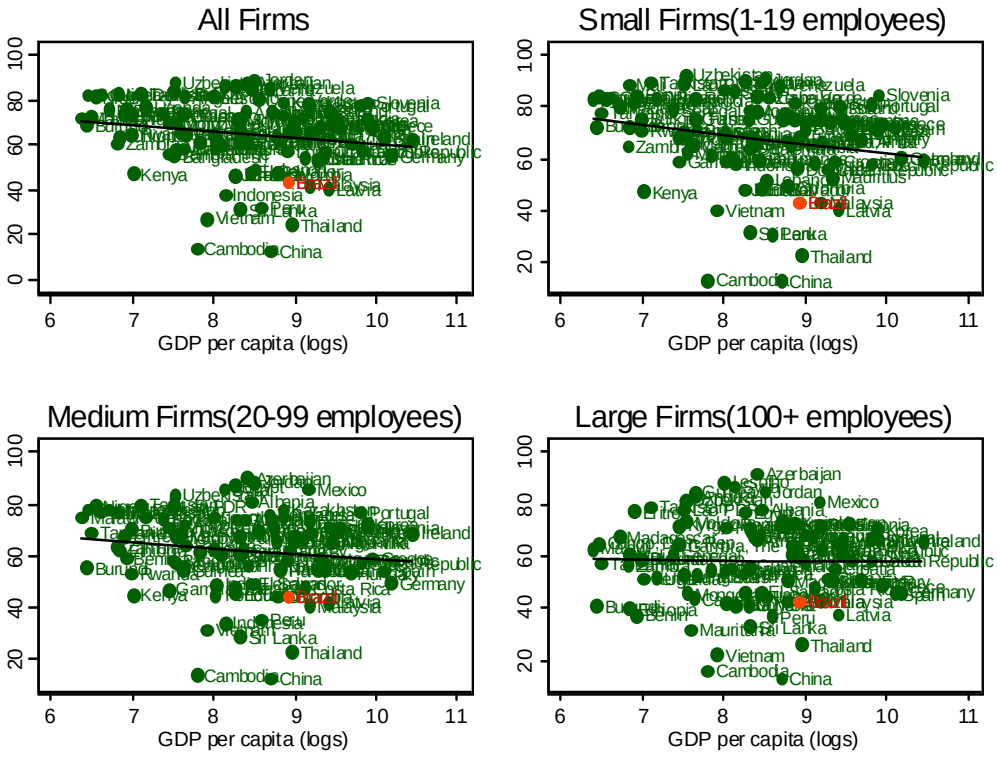
Table 4.1: Spreads and credit allocation of non-earmarked funds

	Nominal Spread (%)			*Share in total credit (%)*			Avg. Duration (Days)
Credit Line	2005	2006	May 2007	2005	2006	May 2007	2006
Hot Money	34.2	37.4	36.6	0.3	0.2	0.3	12.5
Discount of trade bills	23.8	23.7	21.5	6.1	5.7	5.4	32.2
Discount of promissory bills	34.0	36.0	33.6	0.1	0.1	0.1	38.4
Working capital	19.9	19.2	19.2	27.7	29.7	32.1	350.2
Guarantied Overdraft	51.5	53.2	52.0	17.2	16.8	15.7	21.8
Vendor	5.1	5.4	4.5	5.7	5.3	4.3	92.64
Acquisition of goods/real estate	11.8	12.1	7.8	6.1	6.9	7.0	283.3
Others/1	-	-	-	36.7	35.4	35.2	-
Total	25.0	25.4	23.8	100.0	100.0	100.0	221.8

/1 includes mainly anticipation of exchange related to exports and foreign on-lending

An additional indicator that is useful to evaluate the financial environment of firms is the way their working capital. In theory, in the presence of information asymmetries the pecking order for investment financing would be to first use internal funds, then debt and finally equity. In addition, tax treatment issues might make comparisons of investment financing difficult to interpret across countries. However, in the case of working capital, whenever information frictions in credit markets induce the pecking order of investment funding, firms would want to rely on external funding to finance working capital. Thus, a comparison of the fraction of working capital financed with retained earnings and other internal funds could be very informative regarding the relevance of financing constraints. This indicator is reported by the *Investment Climate Surveys* of the World Bank for a group of 100 countries. In Figure 4.6 we show the fraction of working capital financed with internal funds for different firm sizes controlling for GDP per capita (with Brazil labeled in red).

Figure 4.6 Working Capital financed with internal funds (%)



For all levels of size Brazilian firms rely relatively little on internal funds to finance working capital compared to other countries with similar levels of development. It is well below the share expected for its GDP per capita and ranks best among countries in Latin America for small, medium and large firms. Thus, this information again provides evidence that financing constraints do not seem to be currently a major constraint on average for Brazilian firms. In addition, it is interesting to point out that there are no significant differences by firm size in the case of Brazil for this latter indicator.

Table 4.2 presents additional financial indicators of interest. Focusing on the banking sector, as it can be seen in the table below, the Brazilian system is relatively underdeveloped, with credit to the private sector representing around 35 percentage points of GDP in recent years. This level of financial development in the banking sector is slightly below that of the average in the region. It compares especially badly to Chile, where credit to the private sector is around 70 percent of GDP, almost twice that in Brazil. However, capital market development indicators do

not show such a poor picture. In terms of the size and liquidity of the stock market, market capitalization and turnover of equity Brazil is above that in the region and also comparable to East Asia and the Pacific region that is, by-far, the most financially sophisticated region among developing and emerging economies. This evidence also shows that relying only on information from the banking sector leaves out an important part of the sources of finance for firms.

Summing up, in this section we have explored the relevance of high financing costs as a constraint to economic growth in Brazil. Several indicators suggest that financing constraints are binding and holding back economic growth in Brazil. While the traditional analysis, which tends to focus on lending rates in the commercial banking system, shows clear signs of severe problems, there are a series of mitigating factors which lower the cost of funding significantly. There are also important differences across firms. While large firms have reasonable access to credit, small and medium firms are more constrained. Therefore, while high cost of financing does not appear to be a binding constraint overall, at the aggregate level, it may be very relevant for certain segments of firms with underprivileged access to finance.

		Credit to Private Sector by Financial Institution to GDP (%)	Stock Market Capitalization to GDP (%)	Stock Market Turnover Ratio	Stock Market Value Traded to GDP (%)	Private Bond Market Cap. to GDP (%)	Public Bond Market Cap. to GDP (%)
High Income	90's	87.92	62.18	59.67	39.63	31.92	38.11
	00 - 05	101.04	93.97	77.04	76.68	42.13	42.41
East Asia & Pacific	90's	36.72	56.65	65.37	31.54	11.25	18.42
	00 - 05	38.07	44.36	39.88	18.83	15.76	25.42
South Asia	90's	17.69	13.77	40.75	7.21	0.85	27.18
	00 - 05	24.61	16.12	122.34	25.69	0.52	31.91
Europe and Central Asia	90's	20.18	9.63	73.27	5.43	1.58	15.93
	00 - 05	21.23	14.18	62.22	6.21	4.89	29.41
Middle East & North Africa	90's	34.78	24.04	5.36	4.21	-	103.21
	00 - 05	41.93	32.37	8.25	9.56	-	92.87
Sub-Saharan Africa	90's	15.78	27.69	5.36	2.76	13.93	57.28
	00 - 05	16.66	28.82	8.25	6.41	9.71	32.98
Latin America & Caribbean	90's	33.19	21.29	17.07	3.57	4.69	12.39
	00 - 05	38.04	36.72	8.24	3.19	8.02	22.28
Mexico	90's	23.33	30.21	38.77	11.57	2.26	10.37
	00 - 05	16.83	21.45	27.15	5.89	3.74	17.64
Chile	90's	55.77	77.61	9.66	7.83	12.58	25.81
	00 - 05	69.80	93.12	9.73	9.38	21.58	25.16
Brazil	90's	32.32	20.79	57.38	12.86	8.86	22.34
	00 - 05	35.05	41.06	35.18	14.49	10.14	44.99

Table 4.2: Selected Financial Development Indicators
Source: Beck, Demigruc-Kunt and Levine (2000); latest updated version of their database.

(a) Low Domestic Savings and Lack of Access to International Finance

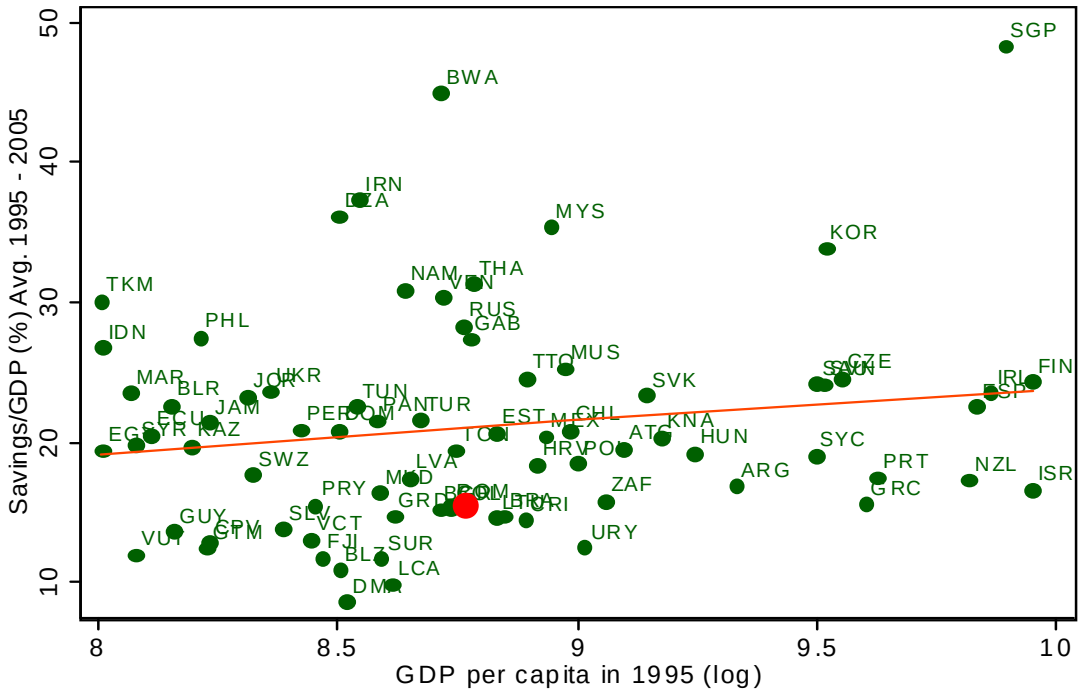
Our starting point is the analysis in HRV on Brazil. HRV point out that Brazil's growth performance moves *pari passu* with the tightness of the external constraint. HRV see the Brazilian case as a prototype example of a savings constrained country; they argue that ameliorating a number of other problems that harm the Brazilian economy, such as a more-business fiscal stance such as lowering taxes, will at best be innocuous and at worst further depress overall savings and consequently growth. In what follows we revisit these issues with the benefit of writing after the Brazilian economy adjusted to the 2002-03 political transition, international liquidity expanded significantly, and the national accounts revision improved the quality of savings and investment statistics.

(a.1) Are aggregate savings low?

As it can be seen in Figure 4.7, Brazil's saving rate over the last ten years has been significantly below its expected level, given its level of development. In particular, while gross national savings only represented an average of just 14.7% of GDP, countries with similar levels of development in East Asia like Malaysia, Thailand or Korea, saved on average a fraction of over 30% of its GDP.[75] Thus, Brazil ranks low regarding domestic savings. However, this does not necessarily imply that low domestic savings is currently a binding constraint to investment in Brazil. In order to shed some light on this later issue, it is informative to analyze the evolution over time of savings and investment in the economy.

[75] While Brazil compares better when compared to countries in Latin America, Figure 5 clearly shows that countries in the region in general exhibit low domestic savings, except for Venezuela.

Figure 4.7: Savings/GDP Average 1995 – 2005 vs. GDP per capita



In Figure 4.8 and Table 4.3, we present the historical evolution of savings and investment as a fraction of GDP from 1947 to 2006. Until the end of the 1960's savings and investment rates moved very closely together.[76] This comes to no surprise, given that Brazil was basically a closed capital account economy and therefore national savings had to equal investment. A manifestation of this fact is that over this period the average current account balance was just –0.4% of GDP.

Has Brazil been a high savings country during the period of high growth? Figure 4.8 and Table 4.3 show that in 1968-78, when GDP growth peaked at an average 9.1% per year, domestic savings accounted for 19.3% of GDP. Yet, this was also a period in which investment outstripped domestic savings, with Brazil recording an average current account deficit of 1.5% of GDP.

Ignoring the 1987-89 period, in which the statistic on the savings rate is likely inflated by measurement errors, we identify four different periods in the following years:[77]

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[76] The simple correlation coefficient between savings and investment for the period 1947 – 1967 is 0.89.

[77] Domestic savings are estimated deducting foreign savings from the rate of investment, whose vale between the mid-1980s until 1994 was estimated multiplying the changes in the 1985 rate by the changes in volume and price of

- During the period 1979-86, domestic savings fell, compared to 1968-78, by 1.3%, a drop more than compensated by the 1.9% of GDP rise in foreign savings. There was also a change in composition: public savings declined 4.6% of GDP, whereas private savings went up 3.3% of GDP. Both changes were largely explained by the jump in interest payments on the public debt, to a large extent owed to foreign creditors, and the acceleration of inflation.
- In the next period (1990-94), foreign savings contracted and public savings recovered strongly, to some extent crowding out private savings. This was accomplished through a rise in the tax burden, inflation tax collections and a decline in effective interest payments on the public debt, through partial defaults facilitated by heterodox stabilization plans. The remarkable fact, though, was the 8% of GDP rise in public consumption, in the wake of the 1988 constitution.
- In 1995-2002 Brazil generated a large current account deficit, recorded negative public savings, despite the additional rise in the tax burden, and lowered private savings, as private consumption boomed with the expansion in consumer credit. Public consumption also inched up some more, reaching an average 20% of GDP.
- Finally, in recent years (2003-06), there has been a substitution of private for foreign savings, in the amount of 4.5% of GDP.

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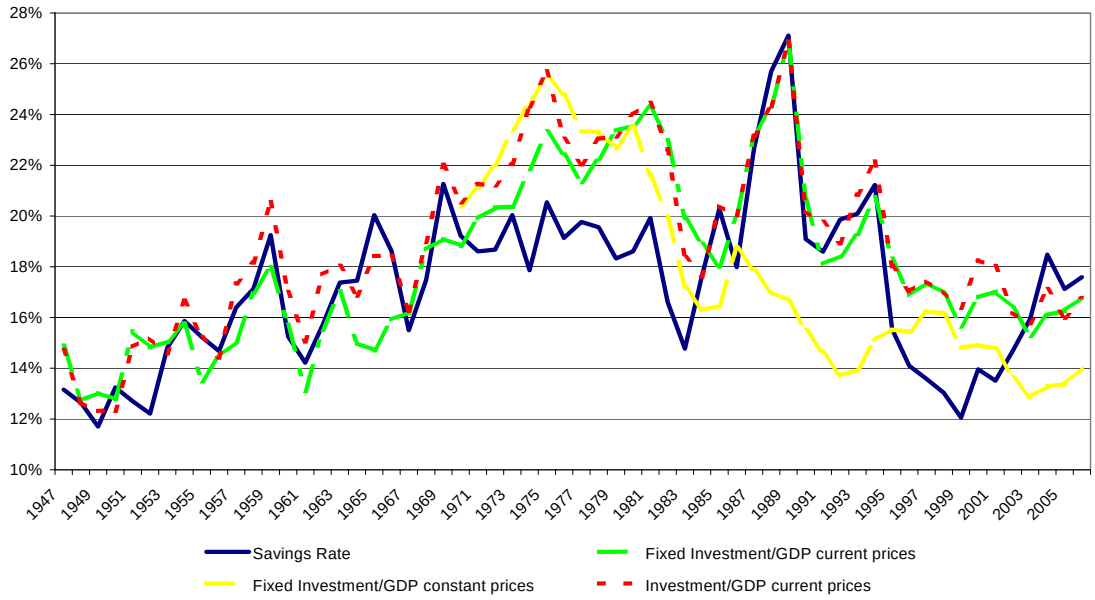
investment and dividing by the change in nominal GDP. The price indices used for that purpose apparently mismeasured the actual changes in the prices of investment goods during the high inflation period. As noted by Bacha and Bonelli (2005), "The deviant behavior of the domestic saving rate in 1987-89 seems at odds with the economic realities of this turbulent period: a time during which government savings contracted and inflation accelerated. It is difficult to believe that under such circumstances the domestic saving rate would have increased to 27% of GDP in 1989 from the relatively stable 19% observed from 1970 through 1986, only to fall back to the same relatively stable 19% in the following 1990-93 period! An error of measurement of nominal savings in 1987-89 is suggested by this behavior."

Figure 4.8: Savings and Investment Time Series Evidence



Contrasting the 1968-78 and 1995-2002 periods, we see that the main factors behind the 4.3% of GDP decline in domestic savings are the rising share of total income accruing to the public sector, its very low and even negative savings rate, and the increasing value of pension payments. Thus, in 2003-06, the tax burden amounted to a third of GDP (up from a fourth in 1968-78). Total public revenues, which take into account non-tax revenues, were even higher, closer to 40% of GDP (see Afonso and Araújo, 2005). Yet, the government saves and invests very little (Figure 4.9). While its rates of consumption and transfers, as a percent of GDP, are similar to the average OECD country, its rate of investment is less than half its OECD equivalent (Afonso, Schuknecth and Tanzi, 2003 and 2006; and Afonso, Biasoto and Freire, 2007). Furthermore, an increasing share of transfers is being directed to the payment of pensions, which in 2003-06 amounted to 10.4% of GDP, not much the less than the average 11.1% of GDP for the OECD (data for 2001). In this way, the government taxes high-savings firms to transfer an increasing amount of resources to low-savings pensioners.[78]

[78] Indeed, in 2003-03 households saved a mere 8.4% of their disposable income.

Table 4.3: Savings breakdown (percent of GDP)

	1947-67	1968-78	1979-86	1987-89	1990-94	1995-02	2003-06
Domestic savings	15.4	19.3	18.0	25.2	19.8	13.8	17.4
Public savings [1]	2.0	4.9	0.3	-1.1	3.6	-0.3	-0.3
Private savings	13.4	14.4	17.7	26.3	16.2	14.1	17.7
Foreign savings	-0.4	1.5	3.4	-0.4	-0.4	3.5	-1.0
Memo							
GDP growth (average)	6.5	9.1	3.8	2.2	1.3	2.3	3.4
Public consumption	11.3	10.4	10.0	13.9	18.0	20.2	19.6
Tax burden	16.6	25.4	25.2	23.8	26.5	28.9	33.3
Pensions							
Private sector[2]				2.6	4.2	5.3	6.7
Civil servants							
Federal [1,3]					1.4	2.0	2.0
State[1]						1.7	1.5
Municipal[1]						0.3	0.2

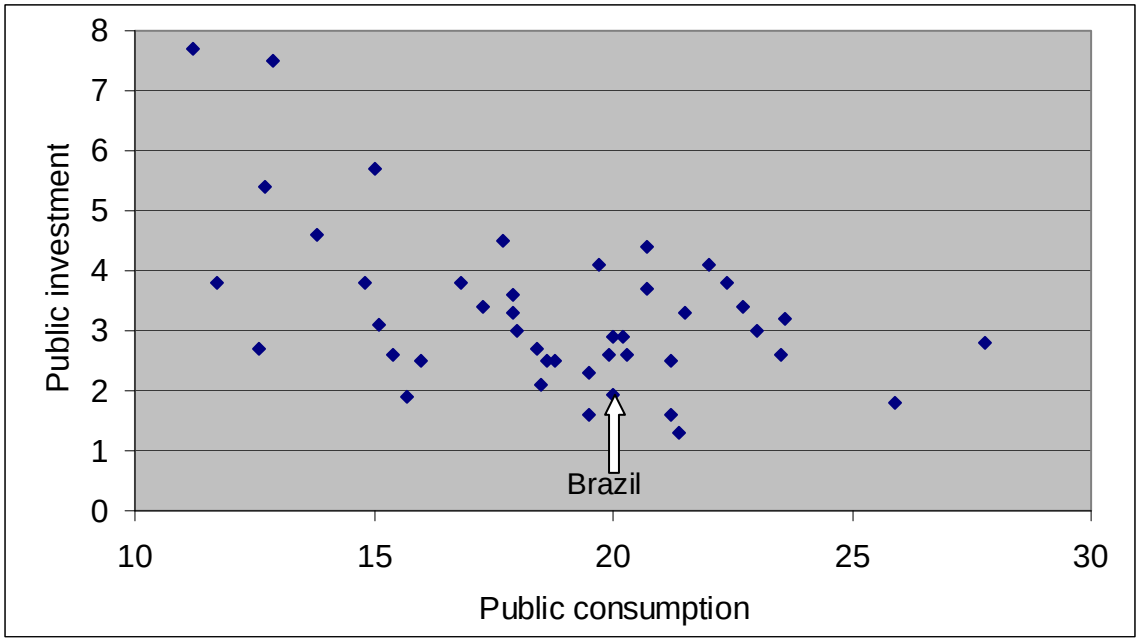
Sources: IBGE, IPEADATA, Giambiagi (2006) and Ministry of Finance. Notes: 1/ Figure in last column refers to 2003-05; for 1981-2006, public savings obtained from sum of operational balance to public investment. 2/ Figure in fourth column refers to 1988-89. 3/ Figure in fifth column refers to 1991-94.

These results are in line with HRV, who assert that high taxation (which reduces disposable income) and a low level of public savings explain the low overall level of savings. The high taxation and the negative public savings, in turn, reflect the existence of a very high degree of entitlements, social programs and/or waste in the public sector and a high level of inherited debt. So the problem is that too heavy a burden of transfers and too high an inherited stock of public debt mean that a very large part of national income gets taxed away, depressing national savings.

Although there is plenty of evidence that Brazil continues to be a low savings country for the reasons raised by HRV, the same is not true of their contention that the country's growth

performance is bound by its low availability of savings. A clear indication that low savings is currently not binding is present in Figure 4.8 and Table 4.3 above. From 1999 to 2006, the savings rate increased from a mere 12% of GDP to 17.6%, mainly due to a rise in private savings. In addition, fixed investment has increased by merely a percentage point to 16.8% in 2006. Therefore, currently Brazil has excess national savings that are being invested abroad. We will now turn to considerations regarding the access to financial markets and discuss this issue in more detail.

Figure 4.9: Public investment and consumption in selected (mostly OECD) countries – average for 1998-2003 (% of GDP)



(a.2) Access to International Finance

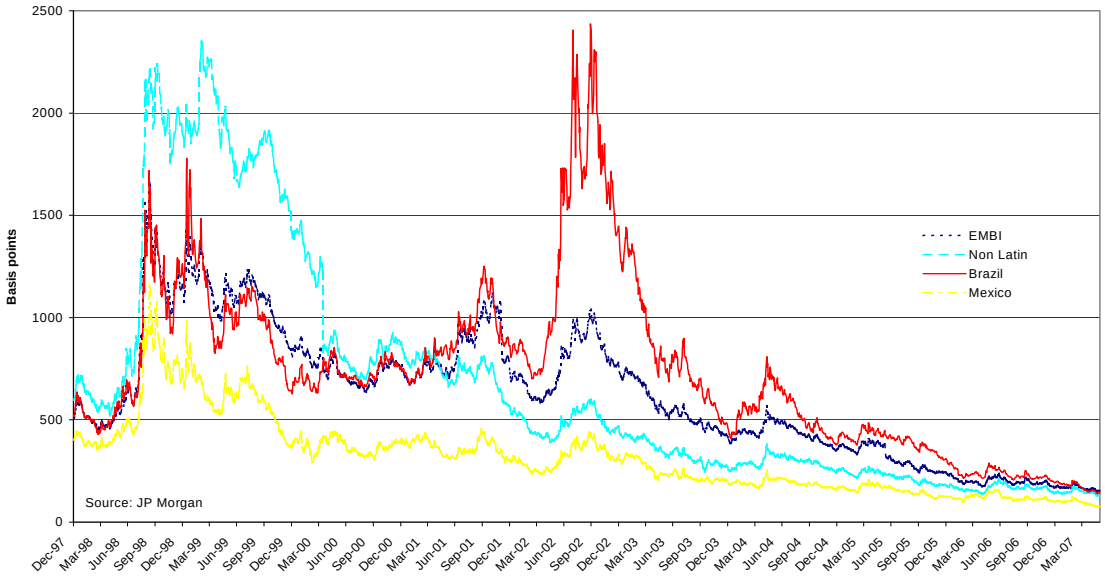
In theory, access to international capital markets is very important for developing countries, given that external financing allows the country to allocate resources to investment without necessarily inflicting the pain of reducing current consumption to induce savings to internally finance these investments. This means that if a country has full access to international capital markets, saving and investment decisions are independent from each other. Given that Brazil is currently exporting capital, despite its low level of overall investment, it must be the case that

returns are low or that the financial sector is incapable of absorbing these additional savings and channel them efficiently to the firm's with the most profitable investment projects.

Even if domestic savings were not excessive, they could be a binding constraint on investment only in the presence of impediments to tapping foreign savings. In an open-economy context, the domestic saving rate determines the equilibrium value of the real exchange rate, given the external real interest rate facing the country. For any given real interest rate, there is a real exchange rate that makes that level of the real interest rate consistent with goods-market equilibrium at full employment. Holding real output constant at its potential level, a sustained reduction in domestic saving must give rise to a more appreciated real exchange rate so as to sustain goods market equilibrium. Viewed from a saving-investment perspective, the key point is that the real exchange rate appreciation generates exactly as much foreign saving (through an increased current account deficit) as required to offset the reduction in domestic saving. From an open-economy perspective, then, the issue is not so much the quantity of domestic saving, but the terms on which the world is willing to finance domestic investment.

Therefore an indication that domestic savings are not a constraint on investment is that Brazil currently has ample access to international finance markets at low spreads. In this sense, Figure 4.10 shows that spreads on sovereign debt have declined since the 2002 crisis from above 2000 bps to around 150 bps in 2007. Although spreads are still above those of investment grade countries in the region, like Mexico (76 bps), current rates are historically the best conditions Brazil has faced in credit markets in recent times. While the current general reduction in financing costs across emerging markets is partially caused by high levels of liquidity and lower investors' risk aversion, investors also perceive a steady improvement in economic fundamentals in Brazil over the past years. For example, S&P ratings increased from B+ with a negative outlook in July 2002 to BB+ with a positive outlook in May 2007.

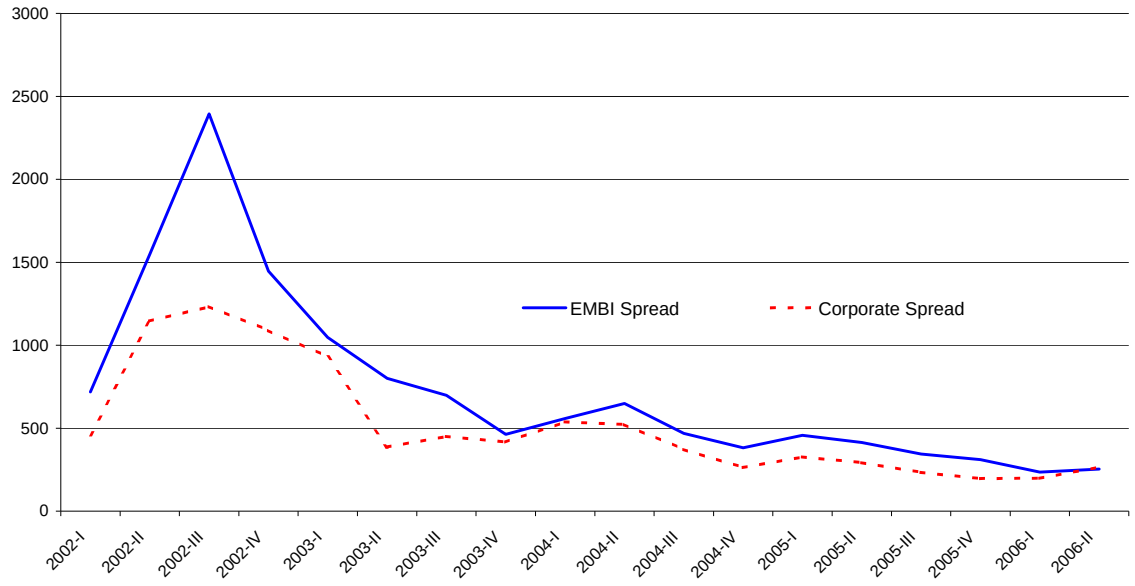
Figure 4.10: Comparison of Sovereign Spreads



Low sovereign spreads suggest that Brazil's public sector has ample room for borrowing if investment demand exist. Furthermore, conditions for portfolio investment or FDI in private firms are also very positive. Figure 4.11 shows that Brazilian firms also have been able to issue debt in international markets at more favorable conditions – even better than the Brazilian government – as the low corporate spreads show.[79]

[79] Corporate spreads are Option-Adjusted Spreads from Bloomberg compiled by Cavallo and Valenzuela (2007). We use the amount issued to construct the weights to compute the average. A simple average of the spreads yields almost identical results. Obviously, the type of firms that are able to access international capital markets are not representative of the majority of small and medium firms which do not have this type of direct access.

Figure 4.11: Brazilian Corporate and Sovereign Spreads (quarterly data)



Source: Own calculations based on Cavallo and Valenzuela (2007)

Clearly, the preceding discussion does not imply that Brazil is immune to international capital market shocks or that in the future market access will not be a constraint. For example, the confidence crisis around the 2002 election showed that Brazil has probably still much room of improvement in terms of gaining credibility and confidence in international capital markets. Despite the fact that the current fiscal position in terms of the primary surplus, the overall fiscal balance and external debt, has turned more solid in the recent period (see Table 4.4), the overall debt burden is still high compared to international standards and therefore Brazil remains in a vulnerable position, especially because of the short-term maturity and duration of its domestic debt. Nevertheless, the current situation shows clearly that access to international finance is currently not a binding constraint to economic growth.

That said, there are reasons for concern that if other constraints on investment are lifted, low savings may become again a binding constraint: with a domestic savings rate of less than 17% of GDP, there is little room for Brazil to significantly expand investment without running a large current account deficit and risking another external crisis in the future and suffer the loss of access to external financing. Moreover, although there are reasons to expect that an improved economic performance may contribute to expand savings, there are also factors that can further

reduce the country's savings rate in the future (for example a rising share of elder citizens in the population and a higher degree of urbanization).

Table 4.4: Evolution of Fiscal Fundamentals

	Fiscal Balance (% of GDP)	Pub. Sector Borrowing Requirements (% GDP)	Primary Fiscal Balance Balance (% GDP)	Gross Sovereign Domestic Debt (% GDP)	Gross Sovereign External Debt (% GDP)	Gross Sovereign Debt (% GDP)
1995	-7.28	0.19	0.24	14.50	11.87	26.36
1996	-5.88	1.30	-0.09	20.19	10.52	30.72
1997	-6.11	6.61	-0.89	26.29	9.18	35.47
1998	-4.90	13.35	0.01	31.63	10.90	42.53
1999	-5.78	15.46	2.92	39.12	16.60	55.72
2000	-3.61	21.83	3.24	40.31	14.33	54.64
2001	-3.57	9.04	3.35	47.33	16.84	64.16
2002	-4.56	10.93	3.56	38.49	21.89	60.38
2003	-4.65	14.02	3.89	49.23	21.64	70.86
2004	-2.43	18.16	4.18	47.56	17.28	64.84
2005	-2.96	17.32	4.35	54.03	11.00	65.03
2006	-3.01	11.46	3.91	50.61	7.13	57.73

Source: JP Morgan

(b) Poor Financial Intermediation

To the extent that there are segments of investment with inadequate access to financing, it is important to analyze the efficiency of financial intermediation in Brazil. In what follows we focus on financial intermediation costs in credit markets, especially lending by commercial banks. We distinguish between costs associated with attracting savings on account of risks to savers (i.e. the deposit rate) and banking costs (i.e. the lending-deposit rate spread).

(b.1) Risks to Savers

Figure 4.12 at the beginning of this section shows the evolution of the cost of funding rate for commercial banks in local currency (TBF) and the monetary policy rate (SELIC) which is also the floating rate at which a significant fraction of the public debt is contracted.[80] Currently, the real ex-ante cost of funding is around 8% per annum, which is also very close to the SELIC rate. In Figure 4.13, we show that Brazil is not only an outlier regarding the high level of its lending rate, but its deposit rate is also very high in real terms (although the difference with other countries in the region is not as large as for the case of lending rates). Several explanations have been advanced to explain the anomalously high real money market interest rates in Brazil in terms of risks to savers, to which we now turn. These explanations include fiscal and monetary

[80] The TBF rate (Taxa Basica Financeira) is the average rate paid on deposits by the 30 major private banks. This rate is very similar to the alternative CDI rate.

policy in the context of weak economic fundamentals, jurisdictional uncertainty, and a trade-off between financial de-dollarization and real interest rates.

Figure 4.12: Ex-ante Real Funding and Monetary Policy Rates

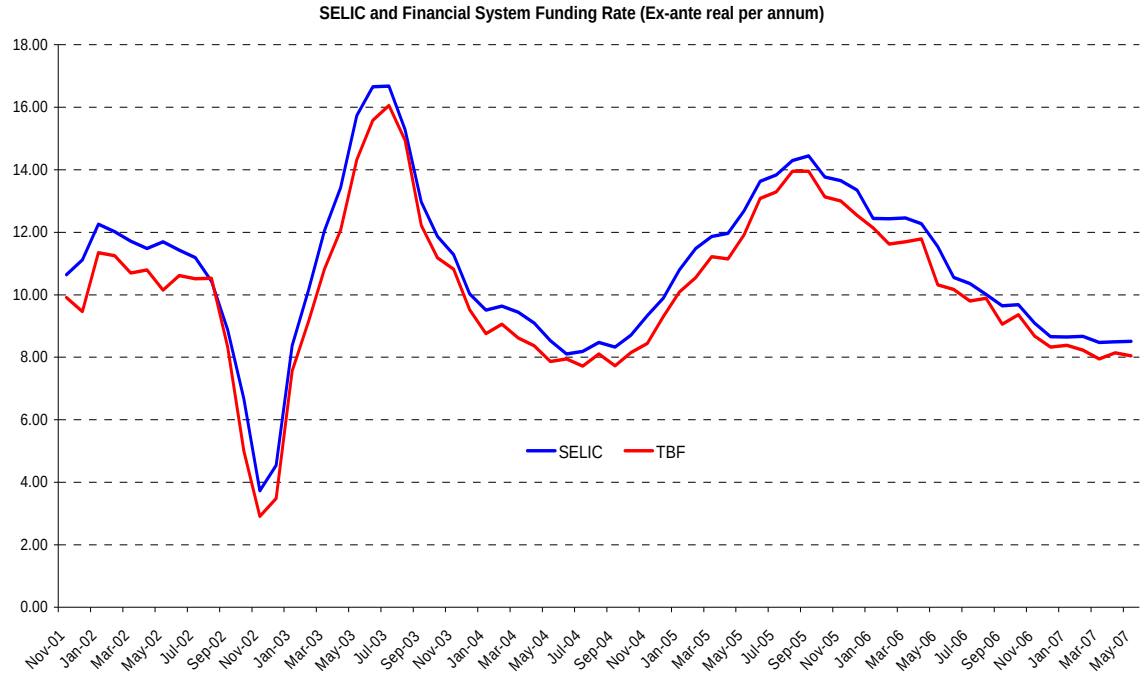
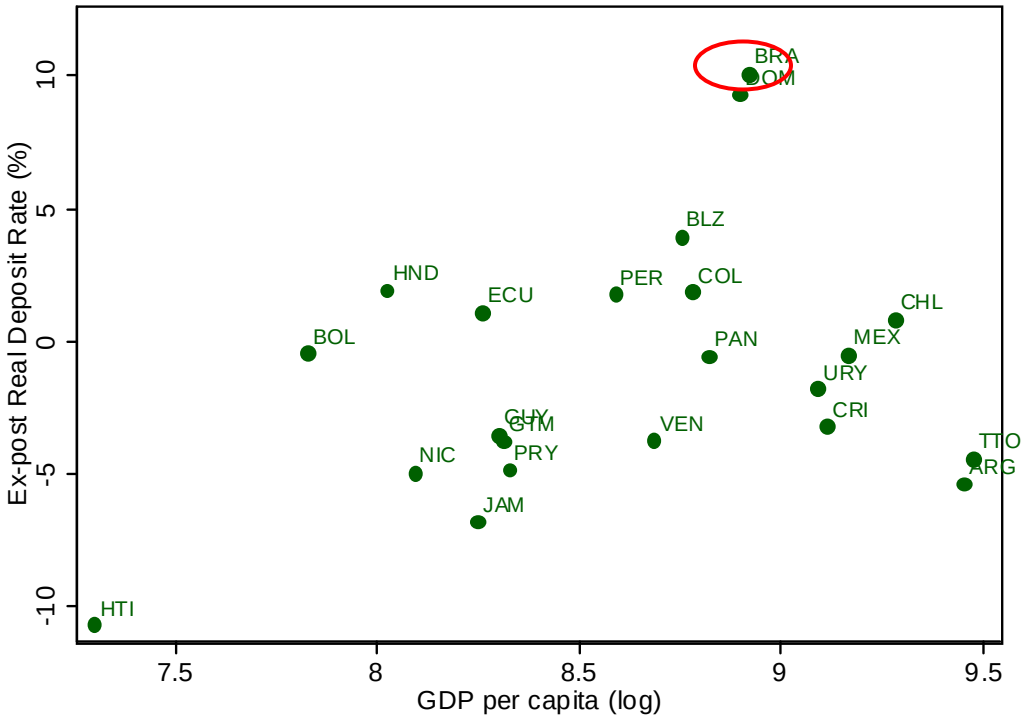


Figure 4.13: Ex-Post Deposit Rates in Latin America and the Caribbean 2005



We reject explanations based on weak fiscal and monetary macroeconomic policies. While fiscal solvency might still be a challenge for the Brazilian economy, among other reasons because of the risk associated with a high level of public debt, there is no reason why these weaknesses in fiscal fundamentals ought to induce an extraordinary high domestic currency interest rate while the interest rate it pays on dollar denominated debt is in line with other emerging market economies of similar characteristics and risk. The quality of fiscal fundamentals should be a common factor for both types of debt, and we therefore reject this explanation of Brazil's anomaly. Similarly, the multiple equilibria hypothesis essentially attributes high real interest rates to how monetary policy is conducted in Brazil: because the country's public debt is high, and more importantly, because its debt is characterized by short duration (i.e., it is either of short maturity debt or contracted at floating rates), high domestic interest rates increase the risk associated with public debt. But as the riskiness of the public debt increases, a high interest rate is required for this debt to be willingly rolled over. However, if the country is trapped in the "bad" equilibrium, this should also show up in the spread Brazil pays on its external debt, so we also discard this explanation.

With respect to jurisdictional uncertainty, Arida, Bacha and Lara-Resende (2004) interpret the persistence of high real interest rates in Brazil as symptomatic of a deep-seated institutional malady that induces uncertainty associated with the settlement of financial contracts in Brazil. This arises from a deeply ingrained anti-creditor bias which has resulted in a number of policy actions that have adversely affected the interests of creditors in the past. In their view, this situation helps to explain the simultaneous absence of long-term credit in the country (either in *reais* or dollars) and the existence of high short-term real interest rates. To quantify the importance of this jurisdictional risk, we compare the yields of recently issued nominal bonds of similar characteristics (maturity, structure, etc) in domestic currency in global and in domestic markets. Our estimate of jurisdictional risk spread currently is around 167 bps.[81] This magnitude is large compared to the sovereign spread on external debt (around 140 bps currently) and that of other countries (e.g. for Colombia we obtain a jurisdictional spread of 69 bps), but represents only a small fraction of the domestic real interest rate and does not seem to be therefore the , certainly not the only, determinant of excessively high deposit rates.[82]

Finally, an interesting explanation for the high real domestic interest rates has recently been given by Bacha, Holland and Gonçalves (2007). These authors argue – based on a simple mean-variance portfolio model of financial dollarization - that there is a trade-off between financial dollarization and the real domestic interest rate. In particular, countries that push dedollarization and develop a large domestic-currency financial market, given their fundamental risks, will face higher real domestic interest rates. A currency premium would be needed to attract additional savings in local currency. The authors present empirical evidence consistent with this hypothesis for the case of Brazil.

As an illustration, in terms of the difference between the risk-free rate in dollars and the money market rate in reais, a simple decomposition of the current levels can be performed in the following way. As of August 2007, the overnight money market rate in the US money market was around 5.25% while the SELIC rate was 11.50%. If a similar dollar-denominated asset were issued by the Brazilian government in the international capital market, this asset would have to pay a sovereign spread. While it is not clear that this premium should be the same as the one on

[81] The bonds used to compute this jurisdictional spread are the Global2022 and the NTN, serie F.

[82] Using econometric panel estimates to quantify the effects of institutional proxy variables for jurisdictional uncertainty on real interest rates, Gonçalves, Holland, and Spacov (2005) reject the hypothesis that jurisdictional uncertainty is the main culprit for high real interest rates in Brazil.

long-term dollar bonds, we will make the simplifying assumption that the sovereign risk premium is identical across different maturities. This would add around 150 bps. If we now consider that the instrument were issued in the Brazilian market, we have to add the jurisdictional risk, estimated above at around 167 bps. The remaining residual (around 308 bps) between the SELIC rate and the risk-free dollar rate is a combination of the expected depreciation (which should be zero on average across time) and the portfolio premium for holding excess assets in domestic currency. While to some extent the currency premium that would accompany de-dollarization policies is well justified (see Fernandez-Arias 2006), Brazil's widespread antidollarization regulation may lead to an extremely high premium matching the extent of the repression of financial dollarization, perhaps beyond the optimal point.

(b.2) Financial Intermediation Costs

The discussion so far indicates that deposit rates in Brazil are high, but as we will discuss next their contribution to lending rates is minor compared with the intermediation spread. It is worth noting that while the marginal cost of funds for banks has been decreasing from a maximum of around 16 percent in mid 2003 to almost 8 percent in May 2007 along with lending rates (as shown in Figures 4.3 and 4.12), the implied spreads – defined as the difference between the lending and the deposit rate – have remained fairly stable, around 25 percent. The main proximate cause of high lending rates by commercial banks is large intermediation spreads. In Figure 4.14, we compare Brazil's extremely high ex-post real spreads with those from other countries in Latin America and the Caribbean.

According to World Bank (2006), banking spreads are high mainly because the domestic money market rate is high and its effect on the lending rate is more than proportional.[83] In fact, a simple inspection of the scatter diagram in Figure 4.15 shows that the banking spread is correlated with the money market rate in Brazil, so the money market rate is "more than proportionately passed through" to the lending rate.

[83] There are many potential explanations for why a higher money market interest rate could have an impact on spreads. For example, higher lending rates induce adverse selection problem. In turn, a higher proportion of risky loans will result in a larger risk premium, which is reflected in the spread.

Figure 4.14: Ex-Post Real Spreads in Latin America and the Caribbean 2005

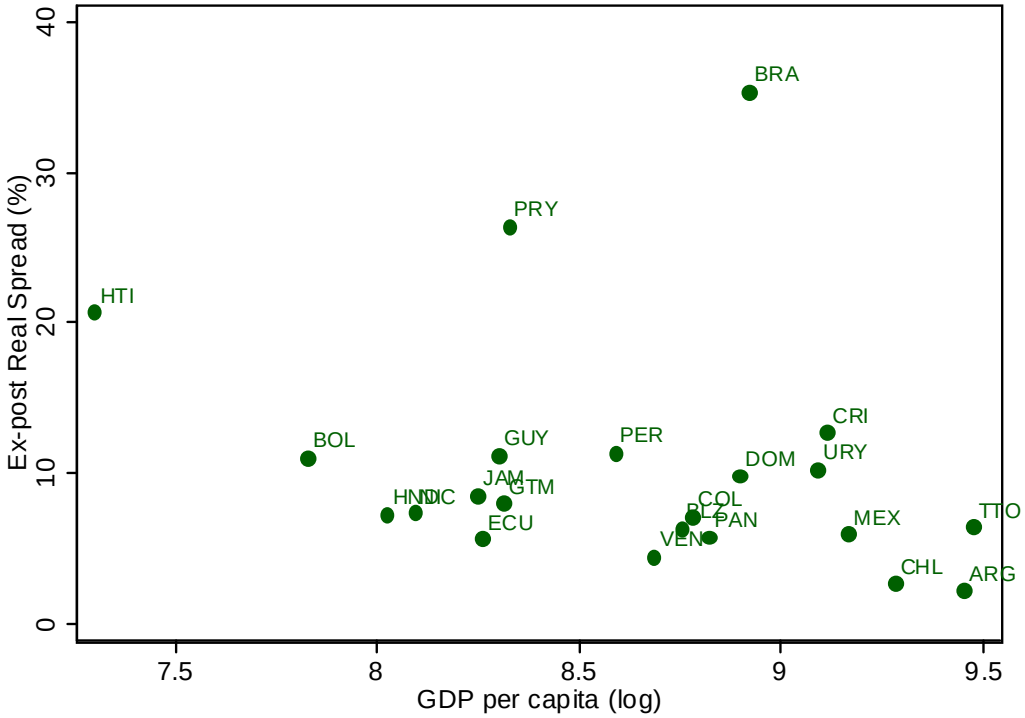
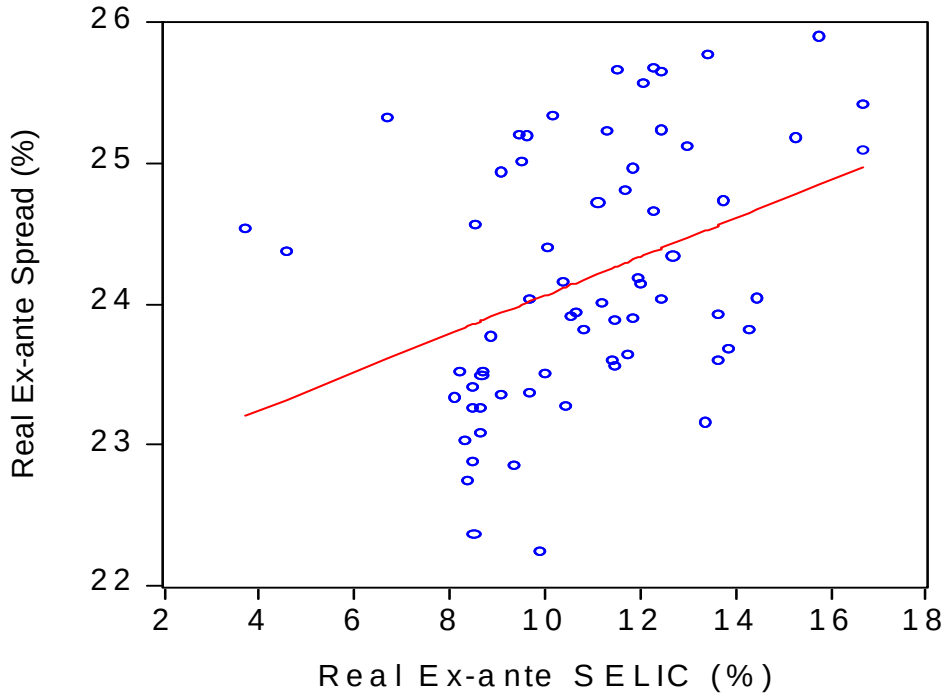


Figure 4.15: Real Intermediation Spread versus SELIC rate



However, a regression analysis shows that such explanation is misleading.[84] A simple regression of the spreads on the SELIC for data from November 2001 to May 2007 yields the result:[85]

$$Real\_spread = 22.70 + 0.14\ Real\_SELIC$$
$$(0.46) \quad (0.03)$$

R-squared = 0.14

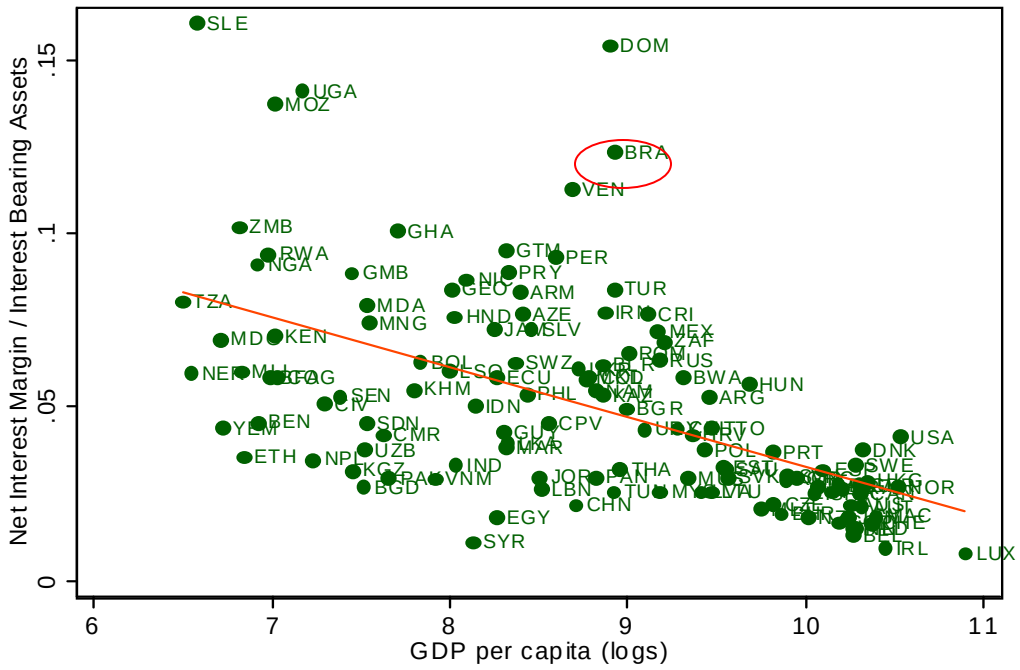
While this regression confirms the impression from the scatter plot that the spread and the money market rate are indeed systematically – and positively – related, the large constant term and the R^2 both suggest that the key is elsewhere.

A natural explanation for the high banking spreads would be imperfections in the competition in the financial sector that would allow all banks to charge excessively high rates and obtain extraordinary profits (or survive while incurring in extraordinary costs). Brazil – with 34 percent of banking assets corresponding to the three largest banks – has a relatively low concentration in the banking sector (and declining steadily from 0.43 in 2002) compared with other countries in the region as well as other emerging economies.[86] The conclusions are similar if concentration is measured with respect to deposits rather than assets. However, returns are relatively high. Thus, there does not seem to be a high level of competition in the banking sector despite the low level of concentration, even after the deregulation of the sector that allowed for foreign entry during the mid 1990's. An explanation for this lack of competition is that credit markets are segmented and therefore banks enjoy some monopolistic power (Pinheiro and Bonelli, 2005). According to these authors, this problem is reinforced by an inadequate anti-trust regulation and regulation that increase switching costs for clients.

[84] We thank Peter Montiel for pointing this out to us.
[85] Standard errors are in parenthesis.
[86] Compared to developed countries, while this concentration indicator is much higher than that of the USA (0.14), it is very close to that of the U.K. (0.35), Japan (0.36) and Germany (0.39).

However, traditional efficiency indicators, like net interest margins over total assets or overhead costs, are high compared with other countries (see Figures 4.16 and 4.17).[87] For this indicator of profitability, the observed value for Brazil is 12.3%, while the predicted value given its GDP per capita is almost three times smaller, around 4.8%.[88] It is important to point out that the advantage of focusing on interest margins instead of spreads – which are extremely high in Brazil, as pointed out above – is that net interest margins are ex-post measures of efficiency in the banking sector, while spreads include ex-ante risks which might obscure the analysis to assess the quality of intermediation *per se*. Also in the case of overhead costs, Brazil is less efficient than expected. In particular, while the observed value is 8.7%, the expected value is 4 percentage points below.[89]

Figure 4.16: Net Interest Margins vs. GDP per capita

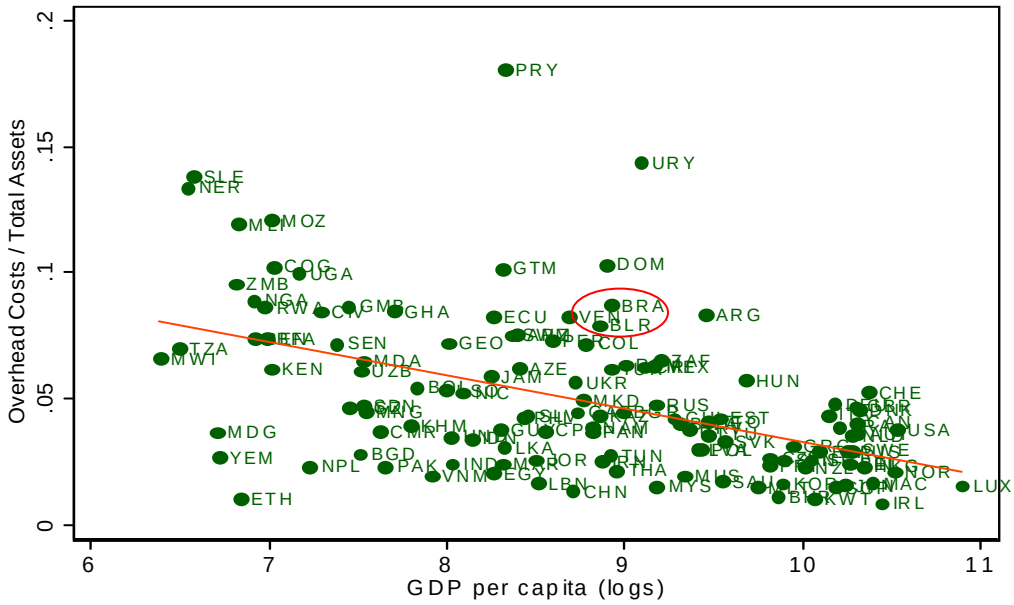


[87] Both indicators are from Beck, Demigrüç-Kunt and Levine (2000) updated database for 2005. Net interest margins are computed as a share of the bank's interest bearing total assets net, while overhead costs are expressed as a share of total assets. The primary source of information are banks' balance sheets from Fitch's Bankscope database.

[88] It is important to point out that this difference between the observed and predicted values is statistically significant at conventional levels of confidence using robust errors. The use of robust errors is clearly justified by the heteroscedasticity in the data.

[89] Again, this difference is statistically significant.

Figure 4.17: Overhead Costs vs. GDP per capita



In Table 4.5, we present the decomposition of intermediation spreads by Costa and Nakane (2004) for the whole banking system and a breakdown by public and private institutions. According to these figures, provision for losses, administrative costs and profit margins are the main drivers of spreads. The differences between private and public banks shed some light on the previous discussion. For example, administrative costs are a larger component of spreads in the case of public banks compared to private institutions, while profits represent almost 30 percent of the spread for private banks compared with only a 12 percent for public institutions. Also, the incidence of default costs is larger for public banks.

Table 4.3: Decomposition of Intermediation Spreads

	Total	Private Banks	Public Banks
Deposit Insurance (FGC) cost	0.2	0.3	0.3
Overhead Adm. Costs	28.3	22.5	38.3
Reserve requirement cost	8.3	9.8	7.2
Taxes	12.3	12.8	11.8
Losses due to default	27.3	25.4	30.4
Net Interest margin	23.5	29.4	12.0
Total	100.0	100.0	100.0

Source: Costa and Nakane (2004)

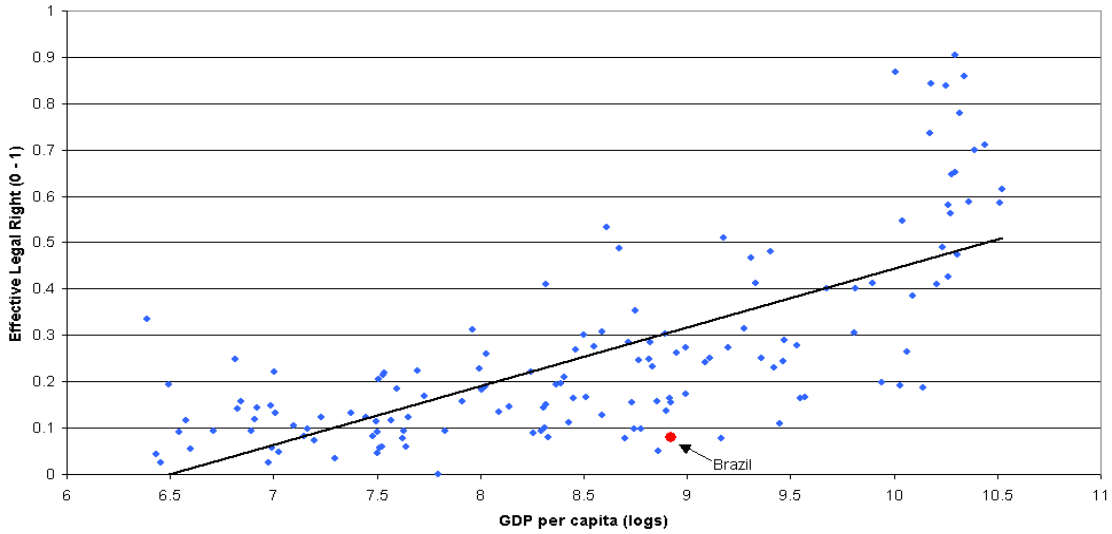
In line with these results, Pinheiro and Bonelli (2005) argue that default rates are very high in Brazil, around 3.6% for firms and 13.2% for individuals in 2004. These high default rates, in turn, are caused by high real interest rates (a reinforcing mechanism), poor information and weak creditor rights. In this sense, Pinheiro and Cabral (2001) present evidence across states that private credit markets are larger in states where creditor rights are better enforced. In Figure 4.18, we present an index of effective legal credit rights. This index results from the product of the 2005 rule of law indicator from the World Bank's *Governance Indicators* and the Legal credit right index from the *Doing Business* database. This later captures the extent to which legislation regarding bankruptcy procedures and collateral make lending easier. Both indexes are re-scaled to 0 – 1 and then multiplied, so that higher values of the resulting index represent better effective legal rights in credit markets. As it can be seen in the graph, there is a strong positive correlation between this index and GDP per capita, with a simple correlation coefficient of 0.72. In addition, it can also be seen that Brazil's level of effective rights is well below its expected value. While the observed index is around 0.08, the expected value is 0.306.

It is important to point out that in 2005 Brazil approved a new legal framework for bankruptcy procedures that addresses several of the main problems of a weak legal environment. Among the important changes are changes in the seniority of collateralized credit and some unsecured credits over tax debt and limitations on labor credit. Also a reorganization procedure in the spirit of the U.S Chapter 11 of the Bankruptcy Code has been approved giving creditors a

much more important role in the restructuring process. Also an extrajudicial process has been created. As Araujo and Funchal (2005) point out this "... is very important in Brazil since it saves the high court costs." However, as Araujo and Funchal (2005) also point out, the enforcement of the law and therefore the overall quality and efficiency of the judiciary remains a critical factor if these changes in the regulatory framework are to have the desired effect of reducing the cost of credit and increasing the supply of funds to finance investment.[90] Unfortunately the changes in the regulatory framework are too recent to be evaluated here with only one year of data. Although there are some indications that credit has increased in segments where the reform is supposed to have a great impact (e.g. consumer durables), it is difficult to isolate the long-run impact of this reform from cyclical considerations.

[90] See Araujo and Funchal (2005) for more details on these issues.

FIGURE 4.18: Effective Legal Credit Rights and GDP per capita

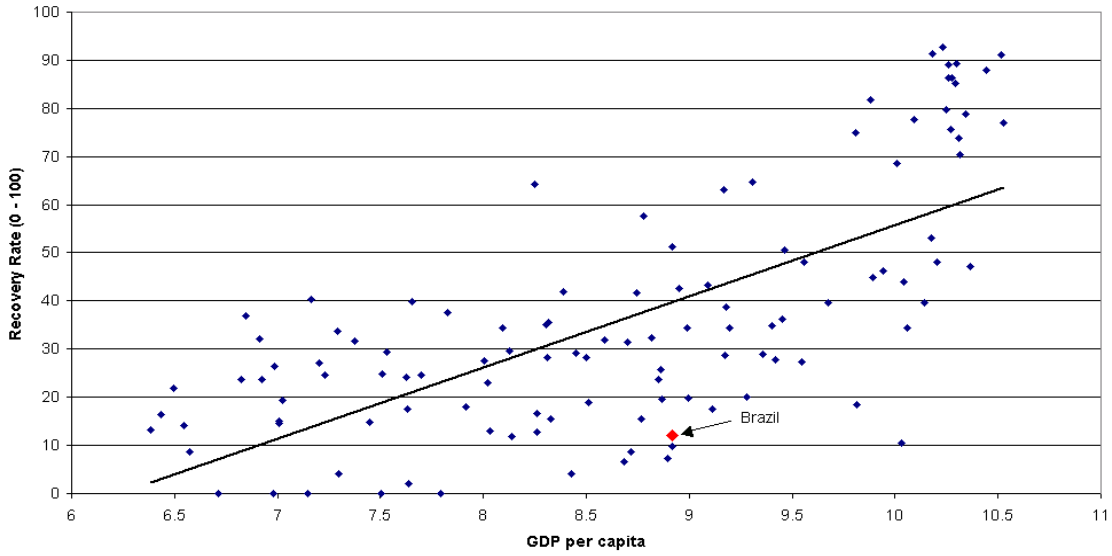


A further indicator of these weak creditor rights is the expected recovery rate under bankruptcy.[91] Figure 4.19 shows that Brazil is an outlier given its level of development with respect to this indicator. In particular, while creditors can only expect to recover 12 cents per dollar in the event of bankruptcy versus a predicted value of around 40 cents. Thus, clearly creditor rights and their enforcement are particularly weak in Brazil.

With respect to the enforcement of contracts, as discussed in the section of business environment, Brazil is still an underperformer with contracts taking almost twice the time (616 days versus 351 days) than OECD countries. Brazil ranks below the median in this dimension of governance. Moreover, its ranking has dropped 16 percentage points from the 59th percentile of the distribution in 1998 to the 43rd percentile in 2005. This does not imply that Brazil's rule of law deteriorates or improved, but rather that if progress occurred it has been at a much lower pace than in the rest of the world.

[91] This information comes from the World Bank's *Doing Business* database available at www.doingbusiness.org

FIGURE 4.19: Recovery Rates under Bankruptcy and GDP per capita



As Pinheiro (2001; 2003) shows in his studies on the Brazilian judiciary, entrepreneurs evaluate the judiciary as highly inefficient and unpredictable. In addition, when asked which criterion they would apply in the case of conflict between two parties; whether compliance with the contract or to favor the weaker party, over 80 percent choose the later. Thus, there is clearly an unfavorable climate for credit. In addition, uncertainty regarding the outcome of judicial processes therefore might induce a much higher jurisdictional risk premium for the case of bank loans than for the case of sovereign debt, given the fixed cost nature of some components in dispute adjudication.

Our analysis shows that financing costs can be extremely high in Brazil for certain segments of firms. The high lending rates observed in commercial banks are mainly driven by a high intermediation spread in the banking system. The explanation of these high spreads is a combination of factors that include lack of competition and low efficiency, as well as weak information and enforcement of creditor rights.

5. Conclusions: from symptoms to syndromes

We started this paper by showing that in the last quarter century Brazil experienced a severe drop in economic growth, after an excellent performance in the previous five decades. Leaving aside the lost decade of the debt crisis of the 1980s and its aftermath, a supply-side growth decomposition revealed that the main difference between economic performance in the post-price stabilization period (1995-2006) and the previous high-growth era has been the much slower pace of capital accumulation.

In the previous two sections we have analyzed extensively various potential constraints to investment that could explain slow economic growth in Brazil. The exercise reveals the complexity of performing an in-depth GDM because the available evidence is not always indicative of the relative importance of a particular constraint vis-à-vis other problems identified in the analysis. This study of the Brazilian case does not point towards a "smoking gun" which to blame as the sole culprit of Brazil's poor growth performance. Nevertheless , the analysis sheds light on the severity of the various problems and therefore allows for a tentative ordering of the constraints.

We have found strong evidence that human capital as well as high and inefficient taxation are currently the most severe constraints to growth, for they significantly reduce the returns on investment and thus hold back growth. There is a second group of problems identified in our analysis as potentially strong constraints, which may become binding over time. This includes infrastructure (especially in electricity and transportation) and financing: domestic savings may be too low to sustain higher growth and may choke investment if access to international financial markets deteriorates. There is also evidence that Brazil has poor bank intermediation that impedes certain investment activities, is still fragile regarding macroeconomic stability and access to international capital markets, is lagging behind in its business environment, , and is burdened by a large informal economy. While these factors are relevant , they seem to be milder constraints currently. Finally, although we have detected that there is ample room for improvement in the areas of innovation and structural transformation, we have concluded that these factors do not appear to be currently binding constraints to economic growth[92]The analysis

[92] We also discarded that low investment is caused by high investment prices.

has also shown that the most binding constraints exhibit common features, which points towards a main syndrome: an Overspending State. This syndrome is consistent with the timing of the Brazilian economic slowdown, if we ascribe the drop in growth rates in the early 1980s to the debt crisis and with the fact that growth has been mainly hindered by a failure to resume rapid capital accumulation. From our analysis, the main picture that emerges is that of a public sector that has been increasing taxation on the private sector at a fast speed to finance ever expanding current expenditures, especially social security outlays, and underinvesting in public infrastructure and education (human capital) for a long time. As coined by Pinheiro et al (2007) the Brazilian state can be characterized as a "dysfunctional" state, in the sense that the quality and quantity of public goods it provides is not commensurate with the size (and complexity) of the tax burden it imposes on its citizens.

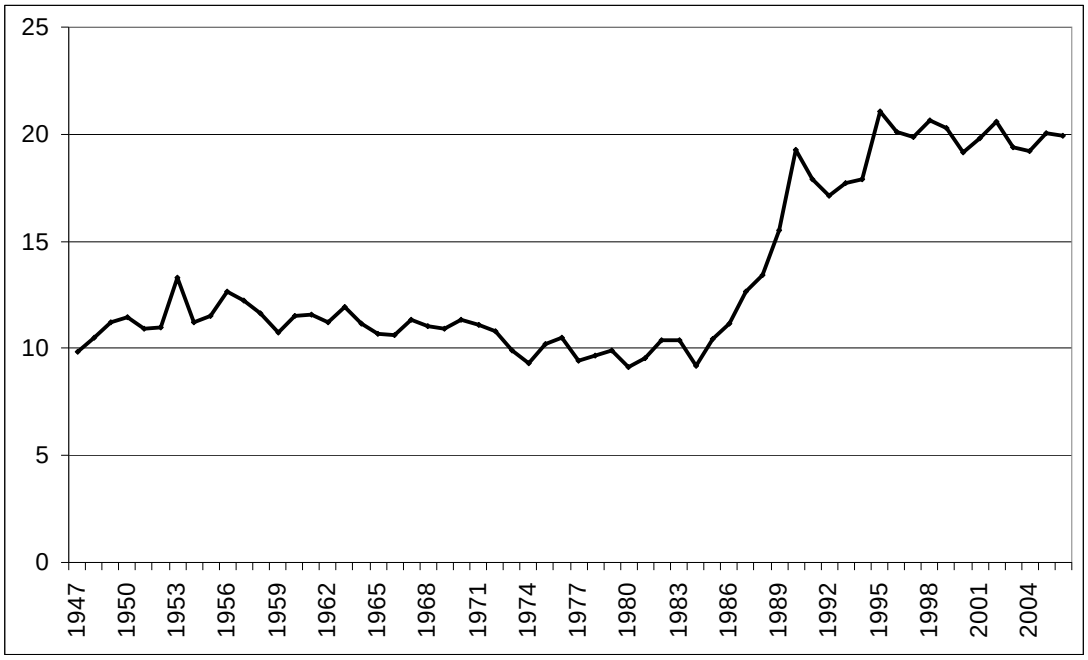
The sharp increase in public expenditure, as shown in Figure 5.1, coincides with the 1988 new constitution, which established large entitlements of publicly guaranteed services and rights (especially more generous public and rural pension schemes), without providing an answer to how they would be financed. In addition, the call for more decentralization implied that the responsibility of providing education, health and transportation shifted to the states and municipalities, while the federal government remained responsible for financing them. As Figure 5.1 shows, this implied a very fast increase of public consumption as a share of GDP from a long-run average of around 11% of GDP for the period 1947 to 1980 to around 20% for 1995 – 2006.[93]

It is clear that such an increase in current expenditures had to create a major disruption in the economy. During the 1980's Brazil was basically excluded from international credit markets, following the debt crisis, so that the government resorted primarily to inflation to finance the increase in expenditures. Thus, the symptoms of the Overspending State syndrome during the 1980's basically were macroeconomic instability. After several failed attempts, the Plan Real was successful in reducing inflation. However, the expansion in expenditures required an important increase in the tax burden as well as debt financing. Debt dynamics were increasingly regarded as unsustainable and the inconsistency behind the exchange rate regime and fiscal

[93] It should be taken into account that considering all levels of government and expenditures, the total public expenditure in Brazil for 2006 amounts to around 42.5% of GDP in 2006.

policy implied the collapse of the pegged exchange rate regime in early 1999. Again, macroeconomic instability – especially fiscal unsustainability - turned out to be the main constraint during these years. In addition, the increase in current public expenditure, and the consequent drop in public savings, was so large that it could only be accommodated by reducing public investment, creating potentially important bottlenecks in the energy sector and road infrastructure that were not remediated by privatizations.

Figure 5.1: Public Consumption (% of GDP)



Source: IPEA based on BCB.

During the 2000/2003 period, access to international financial markets was limited due to market concerns regarding the sustainability of debt and, therefore, investment was limited by domestic savings. In turn, domestic savings were low, indeed lower than in the past and than in most of the region, probably because of the high tax burden and negative public savings.. The result was low investment constrained bye to the exclusion from international capital markets. Moreover, Brazil misallocated investment by underinvesting in areas in which social returns tend to exceed private returns, such as infrastructure (notably roads) and basic education, which

further constrained growth. Finally, over the past few years, the government has been trying to attain fiscal sustainability by reducing the debt burden. However, the consistently positive and high fiscal surpluses attained were produced by increasing the tax burden even more, rather than adjusting expenditures, which aggravated the high tax distortion.

Thus, currently the Overspending State syndrome is reflected primarily in a very high and complex tax burden that limits the private returns on investment. Meanwhile, there is little fiscal space to finance important investments in infrastructure and education due to the continued rise in current expenditure, especially social security. To put this into perspective, while coverage is low and demographics are very favorable (the population is still very young, compared to OECD countries), Brazil currently spends a similar fraction on social security as developed countries with older populations and almost universal coverage. There will be little space to catch up and grow at a faster steady state rate, without a resolution of these underlying problems that keep pressuring for an unsustainable increase in current expenditure. Long-run growth in Brazil will benefit from the dismantling of the Overspending State, which will require drastic pension reform.

Finally, this in-depth GDM exercise also produced some methodological lessons. One is the need to start with a level zero tree that helps to identify which growth factor is hindering growth, which may not be private investment as implicitly assumed by HRV. A typical Solow decomposition can provide the findings for this prior analysis. In fact, other growth factors such as public investment, or human capital accumulation, or productivity (TFP) may substantially impact growth directly not well captured through their effects on the return of private investment. In turn, a tree-like analysis similar to the one proposed by HRV can be used to study what is hindering the contribution to growth for each of the factors with important additional contributions.

Another lesson is the need to set benchmarks for prices or coefficients to ascertain when an indicator is out of line and revealing that a constraint is binding. Being an analysis of evidence, the GDM updates the researcher's priors on the relevance of the various constraints.[94] Because the priors and the updating process vary widely across researchers, the GDM exercise tends to leave too much room for subjectivity in assessing which are the binding constrains to

[94] This point was forcefully made by Ricardo Hausmann in a IADB seminar

growth in each country and would benefit from the establishment of more objective criteria for gauging the weight of each constraint. It also seems useful to distinguish between structural constraints, for which public policy recommendations appear to be a natural follow up, from episodic or more fleeting constraints for which it might be wiser to analyze how markets may react by themselves. At the same time, it would be useful to spot virtual binding constraints, which are likely to become binding constraints over time but may fail to be detected by the GDM as is. It would be important to establish a structured data set to keep the information available from GDM studies in a friendly format for future researchers in order to bring clarification on these issues as evidence accumulates.

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