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Brazil's Long-Term Growth Performance—Trying to Explain the Puzzle

Ricardo Adrogué, Martin Cerisola, and Gaston Gelos

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Brazil's Long-Term Growth Performance—Trying to Explain the Puzzle

Prepared by Ricardo Adrogué, Martin Cerisola, and Gaston Gelos[1]

Authorized for distribution by Timothy Lane

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Abstract

This paper assesses Brazil's growth performance from a long-term perspective, using cross-country and panel estimation techniques, building on the vast empirical literature on growth. The empirical evidence presented in this paper confirms that macroeconomic stability and several reforms have helped raise per capita growth in Brazil since the mid-1990s. The results also show that some long-standing structural weaknesses continue to weigh negatively on per capita growth. Reducing the high level of government consumption would help lower the overall consumption level in the economy and lower its intertemporal price—the real interest rate—thus helping to foster investment and growth.

JEL Classification Numbers: C31, C33, E60, O40, O50, O57

Keywords: Brazil; Per capita growth; cross country analysis

Authors' E-Mail Address: radrogue@wellington.com; mcerisola@imf.org; rgelos@imf.org

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I. Introduction

Brazil's growth performance over the past 25 years has been lackluster (Table 1). During the 1960s and 1970s, Brazil's real GDP grew at impressive rates, averaging close to 7⅓ percent. But in the wake of the 1982 debt crisis, Brazil's growth performance deteriorated markedly, with annual growth over the next two decades reaching only one-third of the 1960–80 average. As noted by Lindauer and Pritchett (2002), in the 1970s Brazil was poised to become "the world's next economic power," but more than 20 years of stagnation since then has turned the Brazilian growth experience into a "mystery."

Table 1. Brazil. Sources of Growth, 1960-2003

	Brazil			Latin America			Industrial Countries			East Asia 1/		
	Output	Contribution of:		Output	Contribution of:		Output	Contribution of:		Output	Contribution of:	
	per worker	Capital 2/	TFP	per worker	Capital 2/	TFP	per worker	Capital 2/	TFP	per worker	Capital 2/	TFP
1960-70	2.9	1.1	1.8	2.8	1.1	1.6	4.0	1.7	2.3	3.7	2.2	1.5
1970-80	4.9	2.1	2.7	2.7	1.6	1.1	1.9	1.5	0.4	4.3	3.4	0.9
1980-90	-1.6	0.9	-2.5	-1.8	0.5	-2.3	1.7	0.9	0.8	4.4	3.1	1.3
1990-2003	0.5	0.5	0.0	0.3	0.5	-0.2	1.6	1.1	0.5	3.1	2.5	0.6
1960-2003	1.6	1.1	0.5	1.0	0.9	0.1	2.2	1.2	1.0	3.8	2.8	1.0

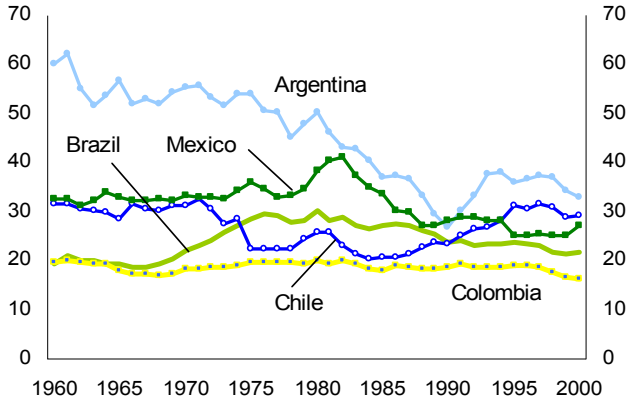
Source: Bosworth and Collins (2003); updated tables, The Brookings Institution.

1/ Excluding China

2/ Includes physical capital and education.

Various hypotheses have been advanced to explain Brazil's disappointing growth record. To some extent, Brazil's weaker growth performance after the 1970s mirrored a slowdown throughout the developing world and particularly in Latin America (Figure 1). Cole and others (2004) stress Latin America's persistent relative stagnation, contrasting it with other developing countries that have been more successful in catching up with advanced economies on the back of very strong growth in labor and capital accumulation, as well as total factor productivity growth. And in this sense, Brazil has fared no better than the rest of Latin America, experiencing a sharp decline in capital accumulation and total factor productivity (TFP) growth since the late 1970s (Table 1).

Figure 1. Per Capita GDP: 1960-2000
(Relative to the United States)



While Brazil's growth record remains well below that of the 1960–1980 period, it has improved in recent years. Real per capita GDP growth recovered to about 2¼ percent over 2001–04, well above the rates experienced during the 1980s and 1990s. Campos and others (2003) have stressed the importance of "supply-side" reforms carried during the 1990s, which reduced regulatory intervention and increased competition through privatization, deregulation, and trade liberalization, helping to lift productivity growth. Several reforms have also been implemented in more recent years, following the 1999 and 2002 crises, aimed at further consolidating macroeconomic stability and promoting better conditions for investment and higher productivity.

This paper assesses Brazil's growth performance from a long-term and cross-country perspective. It builds on the vast empirical literature on growth and its long-term determinants. First, it examines the robustness of several fundamental factors found to be related to growth, as presented by Sala-i-Martin, Doppelhofer, and Miller (2004), in explaining Brazil's growth performance during 1960–2000. The results show that the analysis based on Sala-i-Martin does not help to solve Brazil's growth puzzle, as it suggests that Brazil's growth performance was significantly *better on average* than predicted. The results reflect, to a large extent, the significant disparity in Brazil's growth performance before and after 1980, which is not captured by cross-sectional analysis based on conditions in 1960. Therefore, to better explore the dynamics of growth across time, the paper extends the dynamic panel model presented by Loayza, Fajnzylber, and Calderón (2005), by incorporating several growth fundamentals that may have had particular important influences on Brazil's growth performance since 1960. This model is used to assess the role played by different determinants across countries and over time, and their relative importance in explaining Brazil's low per capita growth of the past two decades.

II. Brazil's Long-Term Growth Performance in a Cross-Country Context

Several cross-country models are estimated in this paper to assess Brazil's average per capita growth performance during 1960–2000. These models are based on the vast empirical growth literature that has examined a variety of factors potentially giving rise to cross-country differences in long-run growth—although, given the nature of these models, the robustness of the results has frequently been a subject of controversy. These models build on the work of Sala-i-Martin, Doppelhofer, and Miller (2004), who addressed the robustness issue in a systematic way by using a Bayesian procedure involving millions of regressions to assess the predictive power of 67 variables for economic growth across 88 countries between 1960 and 1996.[2] Sala-i-Martin's framework may be extended to assess Brazil's growth

[2] Sala-i-Martin identifies 18 variables (the "deep" determinants) that are robustly significantly related to growth, and 3 others that are considered of marginal importance. The variables, which would be considered "state variables" in a dynamic optimization problem, are measured as closely as possible to the beginning of the sample period (1960).

performance by including additional variables that would seem to be of particular relevance in Brazil. Specifically, two sets of cross-country regressions are estimated for average per capita growth in 1960–2000. The first set of regressions is based on the 18 variables identified by Sala-i-Martin, excluding regional and religious dummies.[3] The second set of regressions is based on an extended set of determinants, including financial development, terms of trade growth, and income distribution.

These models explain average per capita growth relatively well across countries, but they do not explain as much of Brazil's growth performance (see Table 2). Specifically:

- *Initial conditions matter for cross-country growth.* Based on conditions in 1960 for income, education, the fraction of tropical area, the density of population in coastal areas, the share of mining in GDP, and the years an economy has been open, the models explain around 55 percent of average cross-country growth over 1960–2000.

- *Brazil's average growth performance was significantly better than predicted by the models.* The Brazil dummy is positive and statistically significant across regressions. Given the conditions existing in 1960, Brazil's average growth performance was significantly *better on average* than predicted. Brazil's average per capita growth rate was 2.8 percent in this period, of which the models explain only 25−50 percent depending on the specification.

- *Adding other potential growth determinants does not improve the fit for Brazil, although they may nevertheless have played an important and varying role over time.* Sala-i-Martin's approach ruled out several variables that may have had some relevance for Brazil at different times during 1960–2000. The extended regressions suggest that the initial level of financial development was an important determinant across countries, while external trade and financing volatility seem to have played a more significant role than fiscal policy volatility across countries. In contrast to the results in Mody and Schindler (2004), once the volatility of terms of trade shocks is allowed for, fiscal policy volatility does not appear to be a robust determinant. Shocks to the proxy for international liquidity conditions appear to be positively correlated with growth.

[3] The latter tend to serve as substitutes for regional dummies, see Appendix I for a full list of variables.

Table 2. Brazil: Cross Country Growth Equations: 1960--2000

	Regression Models										
	Based on Sala-i-Martin Top 18			With Expanded Set of Growth Determinants							
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)
Initial GDP	-1.215	-1.169	-1.141	-1.579	-1.271	-1.356	-1.302	-1.319	-1.345	-1.448	-1.455
	(0.000)***	(0.000)***	(0.000)***	(0.000)***	(0.000)***	(0.000)***	(0.000)***	(0.000)***	(0.000)***	(0.001)***	(0.000)***
Primary Education	2.084	2.307	2.238	3.06	2.972	2.739	2.813	2.709	2.601	2.917	2.895
	(0.002)***	(0.000)***	(0.000)***	(0.000)***	(0.000)***	(0.003)***	(0.000)***	(0.002)***	(0.000)***	(0.000)***	(0.000)***
Initial Investment	-0.692	-0.615	-0.532	...	...	...	...	...	...	...	...
Price	(0.144)	(0.174)	(0.227)	...	...	...	...	...	...	...	...
Tropical Density	-1.145	-1.212	-1.292	-1.697	-1.592	-1.056	-1.281	-0.5362	-0.687	-1.5521	-0.639
	(0.016)**	(0.004)***	(0.002)***	(0.000)***	(0.000)***	(0.064)*	(0.000)***	(0.381)	(0.123)	(0.020)**	(0.326)
Density of	1.064	1.201	1.252	0.752	0.849	1.346	1.182	1.148	1.153	2.004	1.328
Coastal Pop.	(0.001)***	(0.001)***	(0.001)***	(0.057)*	(0.004)***	(0.028)**	(0.006)***	(0.025)**	(0.000)***	(0.03)**	(0.020)***
Share of Mining	5.114	4.911	5.397	-5.162	5.519	1.102	4.931	6.352	6.712	7.250	5.641
	(0.029)**	(0.045)**	(0.025)**	(0.010)***	(0.026)**	(0.734)	(0.013)**	(0.168)	(0.000)***	(0.001)***	(0.153)
Years Open	1.896	1.86	1.916	1.968	1.938	1.369	1.354	5.2295	0.846	2.185	0.987
	(0.000)***	(0.000)***	(0.000)***	(0.000)***	(0.000)***	(0.032)**	(0.045)**	(0.478)	(0.099)*	(0.097)*	(0.098)*
Ethnolinguistic	-0.007	...	...	...	...	...	...	...	...	...	...
Fractionalization	(0.277)	...	...	...	...	...	...	...	...	...	...
Initial Government	0.426	0.41	...	...	...	...	...	...	...	...	...
Consumption	(0.149)	(0.162)	...	...	...	...	...	...	...	...	...
Brazil Dummy	1.378	1.649	1.822	1.614	2.043	1.788	1.978	1.359	1.537	2.070	1.391
	(0.009)***	(0.000)***	(0.000)***	(0.004)***	(0.000)***	(0.000)***	(0.000)***	(0.005)***	(0.000)***	(0.007)***	(0.003)***
Fiscal volatility	...	...	...	...	...	...	...	-0.7620	-0.834	2.460	...
	...	...	...	...	...	...	...	(0.274)	(0.042)**	(0.188)	...
Terms of Trade	...	...	...	...	...	...	...	-0.811	-0.578	-2.187	-1.295
Volatility	...	...	...	...	...	...	...	(0.138)	(0.013)**	(0.029)**	(0.038)**
Gini Coefficient	...	...	...	...	-0.009	...	...	...	...	...	...
	...	...	...	...	(0.433)	...	...	...	...	...	...
M2 to GDP	...	...	...	...	...	0.022	...	0.00857	...	...	0.014
	...	...	...	...	...	(0.096)*	...	(0.545)	...	...	(0.233)
External Liquidity	...	...	...	...	...	...	0.249	...	...	0.073	...
(std. dev. of	...	...	...	...	...	...	(.061)*	...	...	(.571)	...
Liquidity ratio)											
Political Constraints	...	...	...	0.161	...	...	...	...	...	...	...
	...	...	...	(0.732)	...	...	...	...	...	...	...
Observations	84	86	86	62	80	57	60	55	84	53	56
Adjusted R-squared	0.564	0.557	0.553	0.743	0.658	0.474	0.6129	0.5804	0.615	0.2414	0.524

Source: Fund staff estimates. Most variables are defined as of the existing level in 1960.
Robust p values in parentheses
* significant at 10%; ** significant at 5%; *** significant at 1%

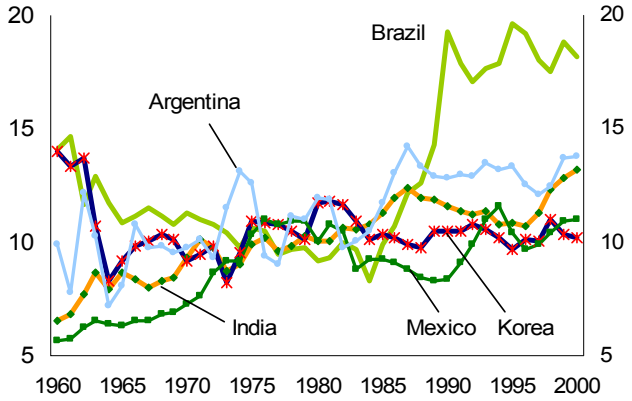
The cross-country analysis following Sala-i-Martin's approach does not come to grips with the significant disparity in Brazil's growth performance before and after 1980. Brazil's strong average growth performance relative to the models reflects the remarkable performance in the 1960s and 1970s.[4] At the same time, the slower growth of the later period may well reflect factors that changed between the two subperiods, and are thus not well captured by the prevailing conditions in 1960. It is therefore desirable to move to an estimation method that can potentially capture the dynamics of growth and its determinants across time.

III. Assessing Brazil's Growth Performance in a Dynamic Panel Model

A closer look at some of the traditional growth determinants reveals some interesting stylized facts for Brazil that may help to explain Brazil's growth slowdown since 1980:

- *A sharp increase in government consumption since 1980.* As noted by several papers, including Sala-i-Martin, Doppelhofer, and Miller (2004), and Loayza (2005), government consumption tends to be associated with low-efficiency expenditures and a larger tax burden on the private sector. While Brazil's ratio of government consumption to GDP did not differ markedly from other countries during 1960–80, it has increased sharply over the last two decades (Figure 2). Giambiagi, and Ronci (2004) note the steady rise in federal government real spending during most of the 1990s, with the sharp fiscal adjustment in 1999 largely based on increased revenues. Lisboa (2002) also highlights the need for macroeconomic policies in Brazil to be geared toward reducing current public spending in order to accommodate higher public investment, while Glomm (2005) also stresses the adverse impact of rising public pensions on public investment and growth in Brazil.

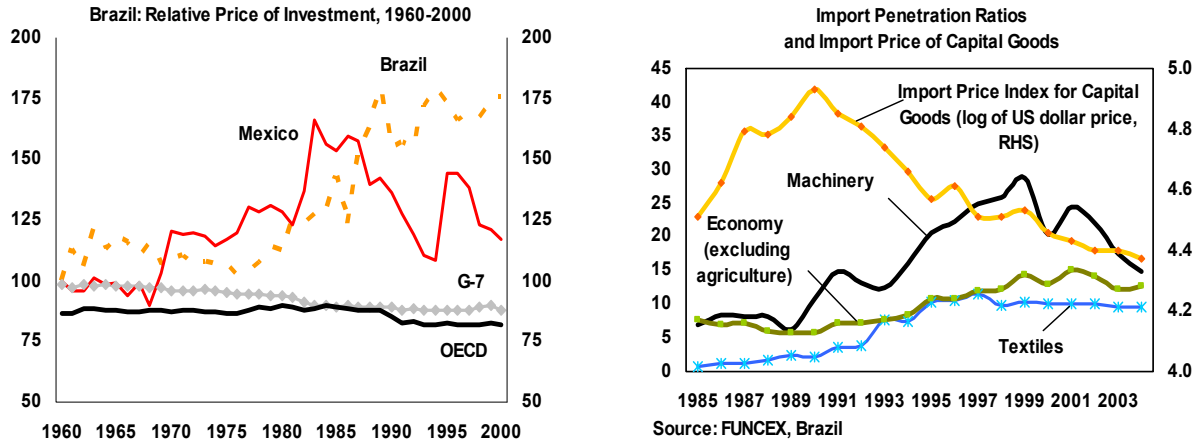
Figure 2. Government Burden: 1960-2000
(General government consumption, in percent of GDP)



[4] When running the cross-sectional regression for the two subperiods 1960–80 and 1980–2000, the dummy falls from 3.1 to 0.7 from the first to the second period, with average per capita growth being 3.8 percent and -0.5 percent, respectively.

- *A sharp increase in the relative price of investment since 1980.*[5] Bacha and Bonelli (2004) emphasize that Brazil's post-1980 growth slump was accompanied by a sharp drop in real capital formation, possibly reflecting the demise of the postwar import-substitution development strategy pursued by Brazil, following the large oil shocks in the 1970s. They show that the collapse in capital formation was the result of a decline in domestic and foreign savings, a sharp increase in the relative price of investment, and a steady decline in the output to capital-in-use ratio. Bacha and Bonelli suggest that the rise in the relative price of investment in Brazil was possibly related to several factors, including oligopolistic power in domestic industries producing capital goods and an increasing proportion of domestically produced capital goods previously imported (mainly until the early 1980s), as well as higher demand for durable goods as a refuge from high inflation (in the 1980s; Figure 3). Pinheiro (2004) notes that while trade liberalization has helped reduce the cost of investment in machinery and equipment, the real exchange rate depreciation since 1999 has also pushed this cost up.[6]

Figure 3. Relative Price of Investment and Other Indicators of Cost of Capital Goods

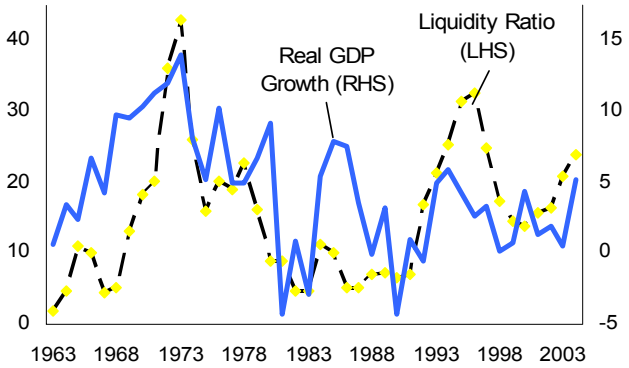


[5] The relative price of investment is one component of the user cost of capital, which is also determined by the real interest rate and the depreciation rate. Pelgrin (2002) presents evidence supporting the view that the cost of capital (including a proxy for real interest rates) has had a significantly negative impact on investment and growth across OECD countries. Sala-i-Martin, Doppelhofer, and Miller (2004) and Mody and Schindler (2005) have also presented empirical evidence demonstrating the negative impact of a high relative price of investment on growth across several countries and in Argentina, respectively.

[6] Despite the low inflation and the liberalization of external trade in the 1990s, the relative price of investment goods has not declined, even when the dollar price of imported capital goods has experienced a steady decline since the early 1990s in Brazil and worldwide. As noted by Bacha and Bonelli (2004), measurement problems cannot be ruled out.

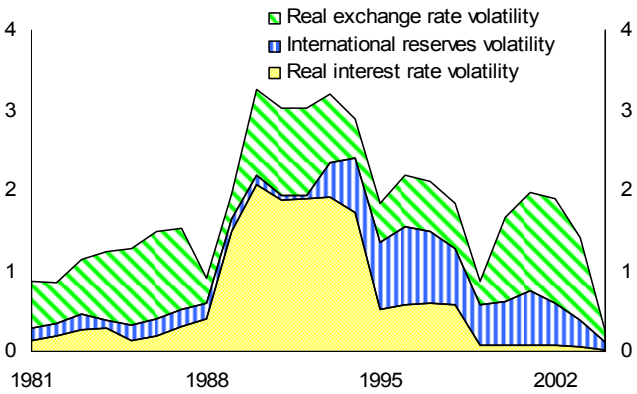
- *High vulnerability to international liquidity or external conditions.* The financial crises in emerging markets of the 1980s and 1990s brought to the fore the links between international financial market conditions and growth (Figure 4). In general, external vulnerabilities tend to affect country risk spreads and financing costs and bring greater uncertainty to future macroeconomic conditions, irrespective of whether external financial crises materialize, with adverse consequences for investment and growth. Rodrik and Velasco (1999) find that almost all countries affected by the financial turmoil of the 1990s had low ratios of international reserves to short-term foreign debt prior to the crisis, leaving them extremely vulnerable to a sudden and persistent deterioration in investor confidence and reversal of capital flows, with adverse consequences for growth. Brazil has not been immune to these developments (Figure 5). Barbosa Filho (2001) shows that changes in international financial conditions—as proxied by the ratio of international reserves to external debt—have tended to lead and be positively correlated with Brazil's growth rate since the late 1960s. In the same vein, Eichengreen (1996) shows that countries experiencing balance of payment pressures, whether related to current or capital account crises, have tended to respond through a combination of real exchange rate depreciation, higher real interest rates, and official reserve loss, with adverse consequences for growth.

Figure 4. Liquidity Ratio 1963-2004
(International reserves to total external debt, in percent)



Source: IFS

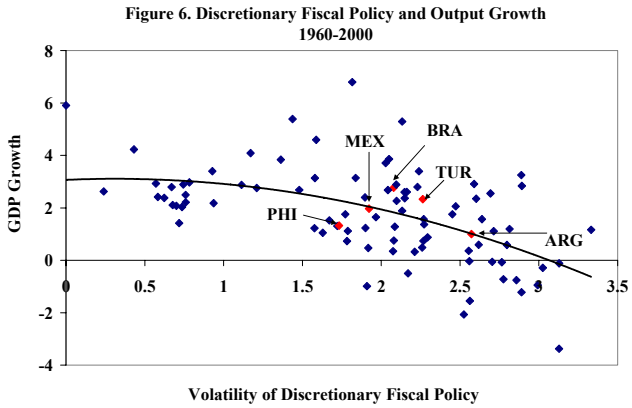
Figure 5. Proxy for Balance of Payments Pressure in Brazil



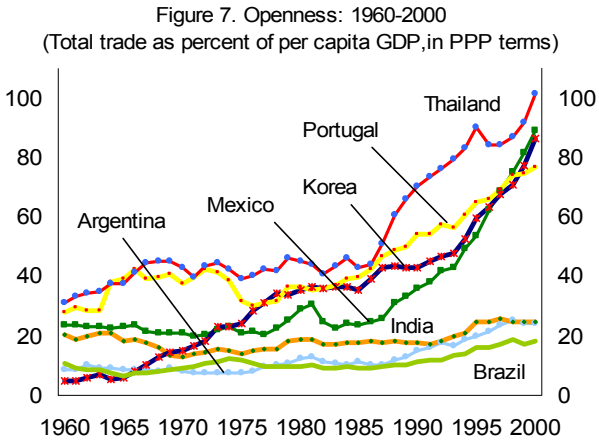
Other factors, often cited in the literature, have been less relevant to Brazil since the 1960s:

- *Limited volatility of discretionary fiscal policy.* Fatás and Mihov (2003) and Mody and Schindler (2004) noted that high fiscal policy volatility has been consistent with

low per capita growth in a cross-section of countries.[7] In the case of Brazil, and despite difficulties experienced during the 1980s and 1990s, the volatility of discretionary fiscal policy has not been high compared with other countries with protracted fiscal difficulties, like Argentina, the Philippines, and Turkey (Figure 6).



- *Limited degree of trade openness*. The ratio of total external trade to GDP has been relatively low in Brazil since 1960 (Figure 7). This partly reflects the import-substitution development strategy, as Brazil's openness did not keep pace with the increased openness observed in the rest of the world. While reforms since 1990 have helped open the economy, it remains less open than other regions.



- *Limited financial sector development.* The ratio of private sector credit to GDP has been at somewhat similar levels than in Latin America, but has lagged sharply East Asia and the OECD (Table 3). Continued macroeconomic stability and recent reforms in credit markets have led to a marked increase in the ratio of private sector credit to GDP in more recent years, but Brazil still lags far behind other parts of the world outside Latin America.

[7] Mody and Schindler construct a measure of the volatility of discretionary fiscal policy, following Fatás and Mihov, as the standard deviation of the residuals of a regression of government real expenditures on several control variables, including inflation. For further details see Mody and Schindler (2004).

Table 3. Private Sector Credit to GDP
(Annual average, in percent)

	1961-2000	1961-70	1971-80	1981-90	1991-2000
Brazil	27.3	...	25.7	23.3	31.5
Latin America (excluding Brazil)	23.2	15.2	22.0	27.3	29.5
East Asia (excl. Japan)	64.5	18.4	27.7	50.7	98.7
Middle-East and Central Asia	38.7	24.5	37.9	43.3	47.2
North America (US and Canada)	70.4	44.9	64.7	76.3	95.8
South-Asia	17.5	10.1	15.4	20.4	21.2
Sub Saharan Africa	20.9	19.6	22.3	22.7	25.0
Western Europe	68.8	49.3	55.0	74.4	90.7

Source: Bosworth and Collins (2004)

A dynamic panel model of per capita real GDP growth was estimated to assess the relative importance and impact over time of several growth determinants. The reduced-form equation builds on the work by Loayza, Fajnzylber, and Calderón (2005) that adds the time dimension to Sala-i-Martin's cross-country work. In the specification presented in this paper, the set of variables used by Loayza is modified by including variables that may be more relevant for Brazil, or that have been cited in the Brazil-specific literature, and by eliminating others found to have limited statistical significance and predictive power (Appendix II). The estimated regression is based on the following specification:

$$y_{it} - y_{i,t-1} = \alpha y_{i,t-1} + \beta X_{i,t\,t} + \eta_i + \varepsilon_{i,t}\,,$$

where $y_{it} - y_{i,t\text{-}1}$ is the average per capita growth rate, X_{it} is a set of variables representing growth determinants, η_i represents the fixed effects estimator, and $\varepsilon_{i,t}$ is the regression residual. The reduced-form equation is estimated initially for 79 countries over the 1961–99 period, with all variables defined as five-year averages.8 These equations are estimated using ordinary least squares (OLS) and generalized method of moments (GMM) methods developed by Arellano and Bond (1991) and Arellano and Bover (1996), to address potential endogeneity problems.

The extended econometric models help to explain Brazil's weaker growth performance since 1970 (Table 4)**.** Incorporating the relative price of investment and proxies for international financial conditions (such as the liquidity ratio and the proxy for balance of

[8] Sample period was extended back to 1970 for Brazil.

Table 4. Brazil: Per Capita Economic Growth Regressions: A Dynamic Panel Estimation: 1960-1999

	Basic Model 1/		Extended Models	
			Intl. Liquidity Proxy	BOP Pressure
	OLS Fixed Effects	GMM-IV system	OLS Fixed Effects	OLS Fixed Effects
Initial GDP per capita	-0.044	-0.008	-0.06	-0.05
	(7.20)***	-0.500	(7.29)***	(4.14)***
Population growth	-0.170	-1.519	0.60	0.04
	-0.690	(2.21)**	(1.80)*	-0.09
Structural Factors				
Trade Openness	0.013	-0.001	0.008	0.030
	(2.86)***	(0.06)	-1.440	(2.79)***
Government burden (govt. consumption to GDP)	-0.019	-0.038	-0.012	-0.022
	(3.29)***	(2.82)***	(-1.60)	(1.78)*
Public Infrastructure (main telephone lines per capita)	0.006	-0.003	0.01	0.002
	(2.63)***	-0.460	(3.27)***	(-0.4)
Cost of Capital (relative price of investment)	...	...	-0.006	-0.001
			(-1.46)	(0.13)
Macroeconomic policies				
Lack of Price Stability	-0.014	-0.013	-0.007	-0.0018
	(4.36)***	(3.87)***	(2.18)**	(-0.46)
Real exchange rate misalignment	-0.010	-0.016	-0.020	0.000
	(3.31)***	(1.90)*	(3.60)***	-0.020
Systemic banking crises (frequency of years under crisis:0-1)	-0.02	-0.04	-0.015	-0.018
	(4.02)***	(2.42)**	(2.58)**	(2.71)***
External Conditions				
Terms of Trade shocks (growth rate)	0.044	0.033	0.031	0.044
	(1.88)*	(1.55)	(1.34)	(0.97)
International Liquidity	...	...	0.006	...
			(4.29)***	
BOP Pressure	...	...	...	-0.008
				(3.65)***
Constant	0.417	0.306	0.466	0.426
	(10.20)***	(2.19)**	(7.33)***	(4.07)***
Summary statistics				
Adjusted R-squared	0.5461	...	0.46	0.54
Number of countries	79	79	62	40
Number of observations	516	516	345	178

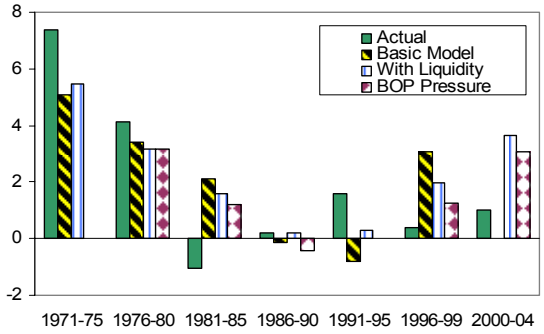
Source: Fund staff estimates, and World Bank.
1/ Based on Loayza and others (2004). Estimates differ slightly, as are not adjusted like in their estimation.

payments pressures) improves the fit of the model. In particular, they help explain Brazil's per capita growth deceleration since the 1970s, the relatively low per capita growth rates since 1980, and changes in per capita growth during the 1990s (Figure 8).[9] Several factors,

[9] The basic model, which is based on Loayza's, helps to explain the deterioration in growth performance since the mid-1970s. However, the model's fit weakens in the 1980s and 1990s. The extended models incorporate other growth determinant factors to assess whether these have significantly contributed to Brazil's weaker per capita growth performance since 1980.

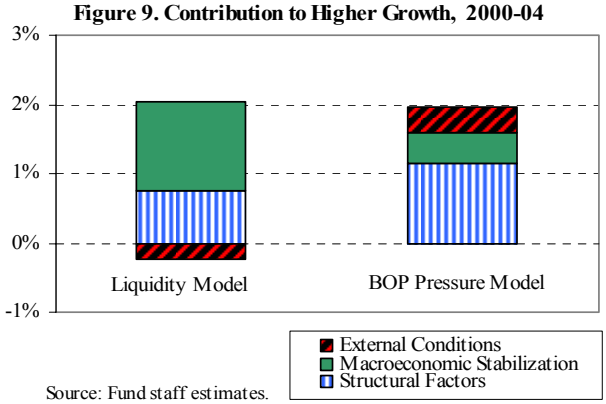
including increased macroeconomic instability, higher government consumption and relative price of investment, as well as adverse external conditions account for a significant part of the deceleration in growth during the 1980s, but fall short of fully explaining the five-year changes in per capita growth over time.[10]

Figure 8. Actual and Predicted Per-Capita Growth Rate



The models also shed light on some factors behind the acceleration of growth during 2000–04. The estimated models were used to project Brazil's per capita growth during 2000–04, based on the estimated coefficients and the actual values of the explanatory variables. Based on the extended models, Brazil's per capita growth rate is predicted to have accelerated by around 1½–1¾ percent during 2000–04, compared to 1996–99 (Table 5). Most of this acceleration reflects progress in macroeconomic stabilization and improved structural conditions, due to sustained price and financial sector stability, as well as increased trade openness and improved public infrastructure (as proxied by the model, see Figure 9 and further discussion below). However, adverse external conditions, particularly during the 2002 crisis, continued to constrain growth, although the impact estimated by the liquidity model seems to be modest. In addition, the balance of payments pressure model also suggests that balance of payment pressures continued to weigh negatively on growth, but the steady decline in the volatility of real interest rates, the real exchange rate, and international reserves, since the late 1980s has made a positive contribution to Brazil's growth performance during this period.

Figure 9. Contribution to Higher Growth, 2000-04



Source: Fund staff estimates.

Table 5. Accounting for Brazil's Growth Performance Out of Sample Forecast

	Actual	Basic Model	Extended Models 1/	
Period			Int. Liquidity	BOP Pressure
1996-99	0.4	3.0	1.9	1.3
2000-04	2.8	…	3.6	3.1

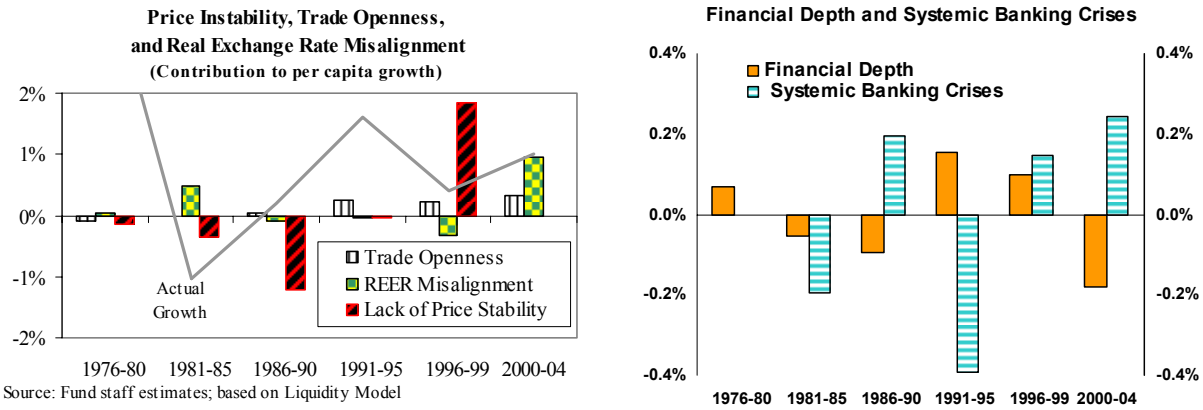
Source: Authors' estimates. Actual for 2000-04 based on IMF WEO.
2/ Based on OLS estimates.

[10] Several equations, including the proxy for fiscal policy volatility and other proxies for public infrastructure, financial development, and the cost of capital, were also estimated; however, in most cases they were not significant or did not improve the estimated per capita growth for Brazil.

IV. Dissecting Brazil's Growth Determinants

The results of these extended models support the notion that macroeconomic stability and several structural factors have become "growth supportive" since the mid-1990s. The implementation of the *Real* Plan in 1994 and the subsequent adoption of inflation targeting and the flexible exchange rate regime in 1999, along with extensive fiscal reforms, have restored price stability, while also minimizing the risks of exchange rate overvaluation. Increased price stability and reduced exchange rate misalignment have contributed positively to growth, especially since the late 1990s (Figure 10). The results also support the view that the combination of trade liberalization reforms in the early 1990s and a flexible exchange rate have also led to a significant increase in the degree of openness in the economy, particularly since 2000, with significant impact on per capita growth. Improvements in the prudential and supervisory framework for the financial system, along with reforms in publicly owned banks implemented since the mid-1990s, have also promoted increased stability in the financial sector, thus helping to increase financial intermediation (Figure 10).[11] More important, the improvements in the macroeconomic policy framework have resulted in a significant decline in the volatility of real interest and exchange rates, particularly relative to the 1980s and 1990s, which bodes well for growth.

Figure 10. Macroeconomic Factors and Growth

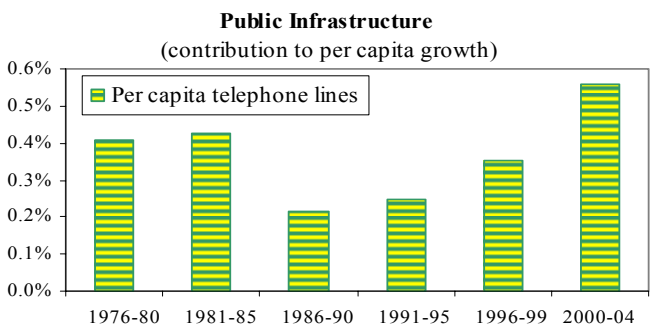


The impact of infrastructure on per capita growth has been positive. Based on the results of the extended model, infrastructure, as proxied by main telephone lines per capita, has contributed positively to per capita growth in Brazil (Figure 11). This proxy tends to be positively correlated with others like energy consumption or kilometers of paved roads per capita) across countries. In the case of Brazil, these indicators have also increased significantly during the 1990s, and including them in the regressions did not alter the results

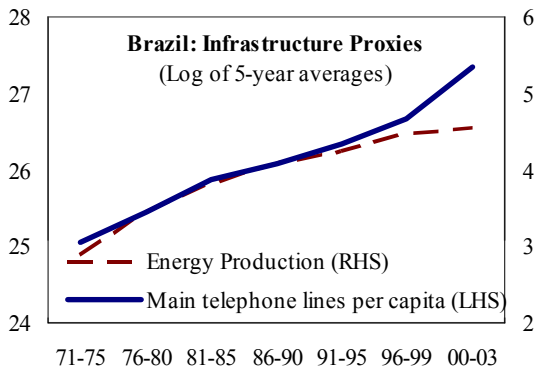
[11] Financial intermediation, as proxied by the ratio of private sector credit to GDP, was not statistically significant in the panel estimation.

significantly. Nevertheless, in more recent years, the persistent decline in public investment may have constrained public infrastructure and growth, as reflected by the severe energy crisis in 2001 and reportedly pressing transportation constraints, for example, in roads and port facilities. This would suggest that public infrastructure is becoming an increasing constraint on growth.

Figure 11. Structural Factors and Growth



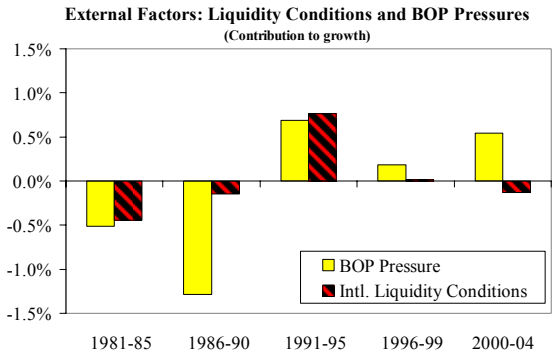
Source: Fund staff estimates; based on Liquidity Model



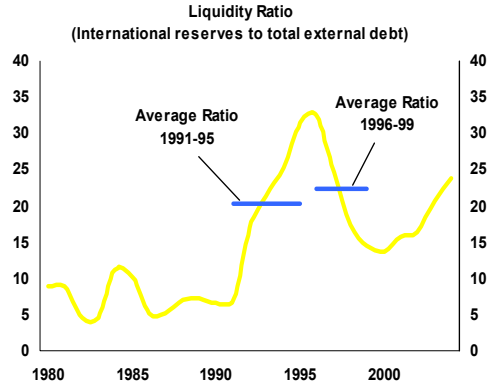
Source: World Development Indicators

External financial conditions have weighed negatively on Brazil's growth performance (Figure 12). The proxies used to represent external financial conditions—the international liquidity ratio and the balance of payment pressure—help to capture the adverse impact on Brazil's growth associated with the oil price shock in the late 1970s and the Mexican debt crisis in 1982s, which led to a significant decline in per capita growth in Brazil through the 1980s. In the same vein, these proxies show the impact of supportive external conditions for growth following the Brady debt restructuring in the early 1990s, when most emerging markets, including Brazil, regained financing access to private market financing. However, the increased access to global capital markets was accompanied by increased volatility, contagion, and financial crises in emerging markets, with Brazil experiencing crises in 1999 and 2002. Changes in international liquidity tend to track these trends reasonably well, with positive contributions to per capita growth in the early 1990s, but less so during 1996–99, when its impact is almost insignificant and positive, in sharp contrast to the observed deceleration in Brazil's growth. This proxy, which is calculated as a 5-year average, does not fully capture the dynamics of external conditions, particularly the sharp deterioration in external financing conditions following the Asian crisis. In addition, the results from the model using a proxy for balance of payment pressure show that, while such pressures continued to weigh negatively on growth (the proxy enters the estimated model with a negative coefficient), the pressures became less severe in terms of volatility during the 1990s—especially when compared with the 1980s—with a diminishing negative impact on growth, even during 2000–04.

Figure 12. External Conditions and Growth

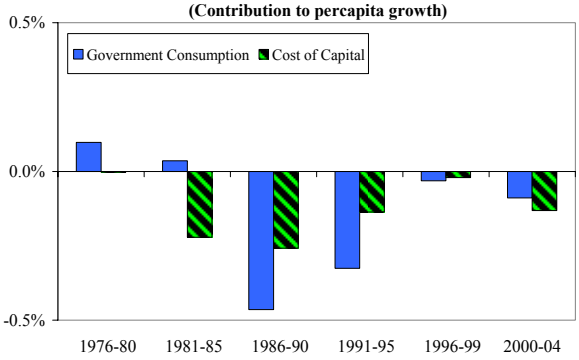


Source: Fund staff estimates; based on Liquidity and BOP Pressure Models.



Other long-standing structural weaknesses have also impinged negatively on growth (Figure 13). The extended models show that the steady rise in government consumption since the mid-1980s has had a persistently negative impact on per capita growth. Another important growth-constraining factor has been the rising relative price of investment—since proxy for the user cost of capital—during the 1980s and to a lesser extent, the 1990s. This impact may be underestimated, as the proxy used in the model does not reflect the high level of real interest rates during the past two decades.[12]

Figure 13. Public Consumption and Cost of Capital
(Contribution to percapita growth)



Source: Fund staff estimates; based on Liquidity

V. Conclusions

The empirical evidence presented in this paper confirms that macroeconomic stability and reforms have helped raise per capita growth in Brazil since the mid-1990s. Inflation targeting and the flexible exchange rate regime since 1999, along with important fiscal reforms, have helped restore price stability, while also minimizing the risks of exchange rate overvaluation, providing an important stimulus to per capita growth. The macroeconomic policy framework, along with the trade liberalization in the early 1990s, have contributed to increase the degree of openness in the economy, also boosting growth. The estimated models also confirm the

[12] Under the GMM estimation, the relative price of investment is statistically significant at the 1.4 percent level under the liquidity model. The lack of statistical significance under the OLS estimation is consistent with the findings by Caballero (1994) that OLS estimates have a nonnegligible downward bias in small samples. Other regressions were estimated using the proxy for the cost of capital, as in Pelgrin and others (2002), but this proxy was not statistically significant.

important contribution to growth from reforms to promote increased stability in the financial sector, which have lessened the risks of systemic banking crises and are helping to increase financial intermediation. The models also demonstrate the importance of external financial conditions. Significant declines in real interest and exchange rate volatility and in external vulnerabilities have also helped create more propitious conditions for investment. All these conditions bode well for growth.

Furthermore, the empirical evidence shows that some long-standing structural weaknesses continue to weigh negatively on per capita growth. Reducing the high level of government consumption would help lower the overall consumption level in the economy and lower its intertemporal price—the real interest rate—thus helping to foster investment and growth.

Further research is needed to improve the understanding of Brazil's growth performance. This paper presents a cross-country panel data framework that provides a good basis for this purpose (Tables 4 and 5). However, the results also underscore the intrinsic limitations of cross-country panel estimations. The models do not fully capture many of the complex factors associated with Brazil's phenomenal growth performance in the 1960s and 1970s and the sharp deceleration in the 1980s, including the dynamics of the "debt overhang" and their impact on investment and growth. The role of other variables related to institutional development, education, labor market informality, and income inequality, could also be explored in future research.

APPENDICES

I. TABLE. SALA-I-MARTIN'S LIST OF 21 VARIABLES

Rank	Variable
1.	East Asian dummy
2.	Primary schooling 1960
3.	Investment price
4.	GDP 1960 (log)
5.	Fraction of tropical area
6.	Population density coastal 1960's
7.	Malaria prevalence in 1960's
8.	Life expectancy in 1960
9.	Fraction Confucian
10.	African dummy
11.	Latin American dummy
12.	Fraction GDP in mining
13.	Spanish Colony
14.	Years open
15.	Fraction Muslim
16.	Fraction Buddhist
17.	Ethnolinguistic fractionalization
18.	Government consumption share 1960's
19.	Population density 1960
20.	Real exchange rate distortions
21.	Fraction speaking foreign language

II. Data Definitions and Variables

Stabilization Policies

Lack of price stability, from Loayza. Measured as the natural logarithm of the average inflation rate for the 5-year period, expressed in percent.

Real exchange rate misalignment, from Loayza, following the Dollar(1992) methodology. Calculated as the difference between the bilateral real exchange rate against the U.S. dollar and a fitted line resulting from regressing the bilateral real exchange rate on per capita GDP, and regional and annual dummies.

Structural Policies and Institutions

Initial GDP per-capita, from Loayza. Measured as log of the GDP per capita of the year immediately preceding the 5-year period.

Population growth, from World Development Indicators.

Government burden, from Loayza. Measured as the natural logarithm of the ratio of government consumption to GDP.

Public infrastructure, from Loayza. Measured as the natural logarithm of the number of main telephone lines per capita.

Cost of capital, from Penn World Tables. Measured as the ratio of the deflator of investment goods over the GDP deflator, in natural logs.

Systemic banking crises, from Loayza. Measured by the fraction of years that a country undergoes as systemic banking crisis as identified in Caprio and Klingebiel (1999).

External Conditions

Terms of trade growth, from Loayza. Measured as percent change of the corresponding variable.

International liquidity. Measured as the ratio (in percent) of gross international reserves to total external debt.

BOP pressure. Weighted average of the 5-year standard deviations of changes in real exchange rates, real interest rates, and international reserves, using the standard deviation of the full sample of each one of these variables as respective weights. Methodology follows closely that of Kaminsky and Reinhart (1999).

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