

Brazilian Economic Growth, 1900–2000

Lessons and Policy Implications

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1 – INTRODUCTION

Brazil's growth record in the 20th century is unique in more than one way. Until 1980, Brazil was one of the fastest growing economies in the world (Maddison, 1995). Yet this growth was achieved with a mix of policies that are not well viewed by today's economic consensus: low regard for price stability, high protection against imports, and widespread state intervention in the economy. The same set of policies prevailed during most of the 1981–93 period, when Brazilian GDP growth was not only much lower, falling behind world and Latin American averages, but also more irregular than in the previous fifty years.

The Brazilian economy then underwent significant structural changes during the 1990s, changes which transformed Brazil from inward-oriented, inflation-prone, and crisis-vulnerable, to open, price-stable, and economically well managed. But Brazil's recent efforts to integrate itself into the world economy, establish macroeconomic stability, and rely on private enterprise in place of state planning as the engine of economic growth have met with limited success, if measured by GDP growth.

It is still an open question to what extent these reforms will be sufficient in the longer term to generate GDP growth rates comparable to those that Brazil enjoyed before 1980. Our hypothesis is that this will require further improvements, which are now open to Brazil in its new, more stable, environment. Indeed, some of these improvements—higher capital productivity associated with longer-term, more transaction-specific investments and greater innovation, greater investment in skills and training, and the reform of institutions governing business activity—have only been imaginable under the clearer ground rules that macro stabilization has brought. To achieve these improvements, further reforms are necessary in government, policies, and institutions. Naim (1994) calls this second stage of reforms that of *consolidation*, and notes that, in contrast to the first stage, when reforms are launched, technical and political complexities are higher, depending on a larger and more diverse set of actors. This underlies the need for political consensus on the necessity and on the content of these reforms, consensus which has clearly been lacking in Brazil recently.

In this sense, a reconciliation of the paradoxical features of Brazil's growth experience in the 20th century may aid not only policy formulation, but also the political support for its implementation. Any proposal for deepening the reform process in Brazil will not be widely accepted if it is not perceived to be a response to a credible account of how policies that are “wrong” in 2001 appeared “right,” and indeed seemed to work so well, for half of last century.

Against this background, the present paper addresses three overarching questions. First, how did Brazil manage to grow so rapidly from 1930 to 1980, following so many “wrong” policies? Second, why did Brazil then proceed to perform so poorly in the final two decades of the century? And third, considering developments in both the domestic and the international environments, how should priorities in public policy now be set to maximize Brazil's potential sustainable growth rate?

The paper contains four more sections. Next, we look at the aggregate performance of the Brazilian economy over the period 1930–2000, estimating its supply-side sources of growth and relating the results to the policy framework adopted in each period. Sections 3 and 4 examine micro-evidence from firms and from households, respectively, and examine whether these patterns are consistent with the macroeconomic observations in Section 2. A final section sums up the paper's main findings, and gives policy and political-economy implications.

2 – A LONG TERM VIEW FROM AGGREGATE INDICATORS

2.1 – General Set Up

Despite the slowdown in growth in the last two decades, the 20th century was a period of rapid change and exceptionally high growth in Brazil. As indicated in Table 2.1, both population and GDP growth accelerated after the inauguration of the Republic, in 1889, with respect to both the Colonial and Empire years. In particular, growth in per capita GDP trebled during the Oligarchic or Old Republic years in comparison to the Empire period, and showed a six-fold increase when compared to the 320 years of colonial rule.

Yet these favorable developments would be but a prelude to the remarkable growth of the following 50 years, starting with the 1930 Revolution and ending with the second oil shock and the debt crisis of the early eighties. In this period, population, GDP and per-capita GDP growth rates were higher than in any other phase of Brazilian development. The 1930–80 period was also unique in that Brazilian per-capita GDP increased as a proportion of US GDP. Brazil's GDP growth performance in this period is remarkable in comparison with other Latin American countries and with the world, and even with other 20th-century high-achievers, such as Japan and Korea (Table 2.2).

Table 2.1
GDP, Population, and Per-Capita GDP in the Main Phases of Brazilian History

Period	Characterization	Growth Rates		Per Capita GDP*	
		Population	GDP	Growth rate	% of US per capita GDP (end of period)**
1500-1820	Colony	0.47	0.62	0.15	51.4
1821-90	Empire	1.65	1.95	0.30	23.4
1891-1929	Oligarchic Republic	2.18	3.13	0.92	16.5
1930-80	<i>Desenvolvimentista</i> Era	2.62	5.72	3.03	28.0
1981-93	Very High Inflation Period	1.87	1.48	-0.39	20.8
1994-2000	Low Inflation/Adjustment Era	1.38	3.05	1.65	19.3
1500-2000		1.04	1.57	0.53	

Sources: Maddison (2001), IBGE and IMF.

* Measured in 1990 international (PPP) dollars.

** Maddison (2001) estimates that Brazil and the US had the same per capita GDP (\$400) in 1500.

This bright performance would come to an end in the early eighties, not to return in the following twenty years. In 1981–2000, Brazil performed poorly not only *vis-à-vis* its past, but also compared with the world and Latin America, and its GDP per capita fell back to a fifth of that of the USA (in PPP terms), as opposed to a ratio of 28 percent in 1980. This deterioration is usually attributed to the poor macro- and micro- management of the economy that characterized Brazil until the early nineties, with high inflation, large trade barriers, and widespread state intervention through ownership of commercial enterprises, public monopolies, restrictions to entry in a number of sectors and a myriad of norms, regulations and incentives aimed at directing private investment and activities. However, this description also describes the 1930–80 period, and therefore seems an incomplete explanation of the slowdown. Furthermore, since 1994, Brazil has experienced low inflation, trade liberalization, substantial privatization and an end to much of the regulation of private activity, and these have not been able to restore rapid growth (Tables 2.1 and 2.2).

Table 2.2
Comparison of GDP Growth Rates in 1930-2000

Country	1931-50*	1951-80	1981-93	1994-2000
Brazil	4.6	6.8	1.4	3.1
Argentina	2.9	3.4	1.0	2.6
Mexico	4.1	6.4	1.7	3.1
Chile	2.7	3.4	3.5	5.6
Colombia	3.9	5.2	3.2	2.2
Korea	0.6	7.5	7.2	5.3
Japan	1.6	7.9	3.3	1.1
USA	3.2	3.6	2.2	3.9
Latin America	3.6	5.2	1.7	3.1
World	1.8	4.5	2.6	3.4

Source: Maddison (1995, 2001) and IMF.

* 1930–50 for Latin America and world.

We look at this apparent paradox in two ways. Initially, we use a one-sector supply-side decomposition of GDP growth to examine the sources of growth in a number of more or less homogeneous periods of the 20th century. After that, we analyze the characteristics of growth and economic policy in those different periods, introducing increasing detail as we approach the end of the century, and using a conditional convergence model to test for a number of possible causes of (i) the slowdown in Brazil's growth in the last two decades and (ii) the apparently low impact of recent reforms. The analysis is carried out separately for the following periods:

1901–30. High period of the First, Old or Oligarchic Republic, was characterized by mostly orthodox policies and a primary export economy, with a relatively high degree of integration into the world economy;

1930–50. Unstructured import substitution (IS) in traditional manufactures with low participation of state-owned enterprise (SOEs) and high dependence on coffee exports.

1951–63. Structured process of IS in consumer durables, with increasing participation of SOEs and foreign direct investment (FDI), and a continued high dependence on coffee exports;

1964–80. Expansion of IS into intermediate and capital goods, rapid growth of manufactured exports, high FDI and continued growth of SOEs;

1981–93. An increase and then a decline in import protection and export subsidies, first steps on privatization, low FDI inflows and high macroeconomic instability;

1994–2000. Improved macroeconomic conditions, substantial increases in import penetration, a deepening of privatization, and the expansion of FDI.

2.2 – Growth Accounting

Tables 2.3 and 2.4 show that the acceleration in GDP growth from an average 4.3 percent in 1900–30 to 7.8 percent in 1964–80 occurred with a parallel increase in the growth rates of employment and, at least since the thirties, of physical and human capital.¹ The stock of machinery and equipment rose particularly fast, partly to offset its higher rate of depreciation. Table 2.3 illustrates once more the significant deceleration in GDP growth in the last two decades of the 20th century. It also shows that lower GDP growth was accompanied by equally substantial declines in the growth rate of employment and physical and human capital. The contrast between before and after the *Real Plan* is also evident: lower GDP growth and faster factor accumulation before, the opposite after, except for machinery and equipment, which actually declined in 1981–93, and experienced a boom after price stabilization.

¹ Rates of investment (constant prices) were similar in 1900–30 and 1930–50.

Table 2.3
Growth of GDP, Capital Stock, Labor Force and Schooling (percent per annum)

Period	GDP	Capital Stock				Employment	Human Capital (Years of Schooling)		
		Total	Constr.	Ma. & Equip.	Imported M.&Eq.		1981 PNAD	1998-99 PNADs	“Combination” ⁽³⁾
1901-30 ¹	4.33					1.51			
1931-50	5.14	5.30	5.87	3.74	8.29	1.84	1.67	1.67	
1951-63	6.88	8.67	9.08	7.14	3.64	2.81	1.75	2.49	
1964-80	7.79	8.96	8.83	9.49	4.00	3.25	2.14	2.69	
1981-93	1.64	2.60	3.55	-2.58	-4.59	2.17		0.52	
1994-00 ²	3.05	2.30	1.60	7.33	20.77	-0.35		0.41	

Source: See Appendix 1.

(1) 1934-50 for imported machinery and equipment. (2) 1994-99 for years of schooling. (3) Combination of 1981 and 1998-99 PNADs.

Table 2.5
Illiteracy Rates, Gross Enrollment in Secondary Education and Life Expectancy, 1900-98

Year	Illiteracy Rate (age 15 or over)	Gross Enrollment Rate in Secondary Education	Life Expectancy
1900	65.3		
1920	69.9	2.1	
1940	56.2	3.8	42.74
1950	50.0	5.8	45.90
1960	39.5	10.8	52.37
1970	33.1	26.0	52.67
1980	25.5	33.5	61.76
1981		33.2	62.76
1991	20.1	40.5	66.03
1993		42.8	66.63
1998*	13.8	45.0	68.55

Sources: Romanelli (1982), IBGE and GDN database (www.worldbank.org/research/growth).

* 2000 for life expectancy.

The reflection of those trends in output growth and factor accumulation on factor productivity is shown in Table 2.5. Substantial capital accumulation in 1931–80 caused a decline in capital productivity, but helped to foster a substantial rise in labor productivity, building on the already substantial increase recorded in 1901–30. The growth rate of human capital productivity also accelerated in 1931–80.

Table 2.5
Factor Productivity Growth (percent per annum)

Period	Physical Capital			Labor	Human Capital		
	Total	Constr.	Mach & Equip		1981 PNAD	1998-99 PNADs	“Combination”
1901-30				2.8			
1931-50	-0.2	-0.7	1.4	3.3	3.5		3.5
1951-63	-1.8	-2.2	-0.3	4.1	5.1	4.4	4.8
1964-80	-1.2	-1.0	-1.7	4.5	5.7	5.1	5.2
1981-93	-1.0	-1.9	4.2	-0.5		1.1	1.1
1994-00*	0.8	1.5	-4.3	3.4		2.6	2.6

Source: Table 2.3.

* 1994–99 for human capital.

In 1981–93, capital productivity continued to decline, while growth of labor productivity dropped five percentage points and that of human capital fell 4.1 percentage points. It was the only episode of a decline in labor productivity among the different periods considered here. Partial factor productivity of labor and physical and human capital all rose significantly in 1994–2000. This reveals that total factor productivity (TFP) growth was not only positive in this latter period, but that it was at least 1.5 percentage point higher than in 1981–93, a larger increment therefore than in output growth. The flip side of the coin is that it was (necessarily) the case that factor accumulation in 1994–2000 was negative.

In Table 2.6 we derive a Solow-style decomposition of output growth into factor accumulation and total factor productivity growth (or the Solow residual). Leaving aside for now the growth in human capital, we use a Cobb-Douglas production function with physical capital (K) and labor (L) of the form

$$Y = AK^\alpha L^{1-\alpha}$$

To solve for the growth rate of productivity, we take logs and time derivatives:

$$TFP = GdpGrowth - \alpha * CapGrowth - (1 - \alpha) * LaborForceGrowth$$

The key parameter for the growth decomposition exercise is then the capital elasticity α , for which the literature presents varying estimates. Typical cross-country exercises, including some in which Brazil is part of the sample, use values of α between 0.3 and 0.4.² Estimates from time-series regressions with Brazilian data point to a value of α close to 0.7.³ The National Accounts, in turn, suggest a value of α in between 0.48 and 0.55, depending on how the income of the self-employed, which includes a return to both labor and capital, is allocated (IBGE, 2000). Based on this, some of the previous growth decomposition exercises for Brazil have assumed equal shares of capital and labor (i.e., $\alpha=0.5$).⁴

Regardless of the value of α , it is clear from the figures in Table 2.6 that the decline in GDP growth after 1980 was due both to a lower rate of capital accumulation and to a decline in TFP growth, with the lower growth rate in employment playing a secondary role. The higher the value of α , the larger the contribution of capital to explain the high growth of GDP in 1930–80 and its subsequent decline, and the lower the contribution of TFP growth. For $\alpha=0.7$, growth in the stock of capital explains 80.0 percent of the expansion in GDP in 1930–80, and 72.4 percent of the decline in output growth from 1964–80 to 1981–93, while TFP accounts for 8.1 percent and 22.3 percent, respectively. For $\alpha=0.3$, capital accumulation accounts for 34.3 percent of GDP growth in 1930–50, for a contribution of 38.0 percent from TFP growth, and for 31.1 percent of the decline in output growth from 1964–80 to 1981–93, against a contribution of 56.7 percent of lower TFP.

Table 2.6 confirms that the acceleration of GDP growth after price stability in 1994 was entirely due to higher TFP growth. In fact, except for low values of α , TFP growth was higher in 1994–2000 than in any of the previous periods considered in Table 2.6. Indeed, the reason why low inflation and the nineties market reforms failed to bring output growth back to pre-1980 levels was the failure of those reforms to generate factor accumulation, with the contributions of both labor and capital to output growth actually declining in comparison to 1981–93.

² See, for instance, Mankiw (1995), McKinsey (1998) and De Gregorio and Lee (1999).

³ See Abreu and Verner (1997) and our own estimates in Appendix 2.

⁴ See, for instance, Bonelli and Fonseca (1998) and Bacha and Bonelli (2001).

Table 2.6
Growth Decomposition Using Solow's Model with Capital and Labor

Period	GDP	Brazilian Elasticities ($\alpha=0.7$)			Cross-Country Elasticities ($\alpha=0.3$)		
		Capital	Labor	TFP	Capital	Labor	TFP
1931-50	5.14	3.71	0.55	0.88	1.59	1.29	2.26
1951-63	6.88	6.07	0.84	-0.03	2.60	1.97	2.31
1964-80	7.79	6.27	0.98	0.54	2.69	2.28	2.83
1981-93	1.64	1.82	0.65	-0.83	0.78	1.52	-0.66
1994-00	3.05	1.61	-0.11	1.55	0.69	-0.25	2.61

Following Mankiw, Romer and Weil (1992), our second TFP measure builds on a production function augmented to include human capital (H), in addition to physical capital (K) and labor (L):

$$Y = AK^\alpha H^\gamma L^{1-\alpha-\gamma}$$

We use the average years of schooling of 20-year-olds as a proxy for the human capital stock in the economy. As above, estimates of TFP and of the contributions of factor accumulation to growth depend on the values of α and γ . Our time series data for Brazil revealed collinearity between physical and human capital growth. Controlling for the contribution of physical capital to labor productivity growth, we find no additional statistically significant contribution from human capital growth (that is, we cannot reject the hypothesis that $\gamma=0$).⁵ This contrasts with the parameter values used in Mankiw (1995), namely $\alpha=0.3$ and $\gamma=0.5$, which assume that about two thirds of labor income can be considered return to human capital. Using Mankiw's parameter values, taking logs and time derivatives, we have

$$TFP = GdpGrowth - 0.3 * CapGrowth - 0.5 * SchoolGrowth - 0.2 * LaborForceGrowth,$$

which, when applied to the values in Table 2.3, gives the growth decomposition in Table 2.7.

The results are not qualitatively different from above, reflecting the fact that even with Mankiw's high elasticity for human capital,⁶ its contribution to GDP growth in 1930-2000 is small. The decline in the growth rate of schooling accounts for a notable share of the post-1980 drop in GDP growth, but its role is again less important than that of TFP and capital accumulation. And it is still the case that the jump in TFP growth explains all the rise in GDP growth after 1994. The small contributions of labor and physical and human capital reflect, by construction, the low growth that their respective stocks experienced in this period. Indeed, this second decomposition confirms that the failure of factor accumulation to occur, including human capital, has prevented Brazil from resuming pre-1980 GDP growth rates after the *Real* Plan.

⁵ The same result is obtained by Abreu and Verner (1997) with a different measure of schooling, namely, average years of primary, secondary and tertiary education per person over 10.

⁶ Mankiw, Romer and Weil (1992) actually estimate $\alpha = 0.59$ for middle-income countries, when only labor and capital are included in the model, as above, and $\alpha = 0.29$ and $\gamma = 0.30$, when human capital is also considered. With the figures in Table 2.3, these values would imply a higher contribution of capital to output growth than estimated with Mankiw's (1995) elasticities.

Table 2.7
Growth Decomposition with Human Capital Using Mankiw's (1995) Elasticities

Period	GDP	Physical Capital	Labor	Human Capital	TFP
1931-50	5.14	1.59	0.37	0.84	2.35
1951-63	6.88	2.60	0.56	1.06	2.66
1964-80	7.79	2.69	0.65	1.31	3.14
1981-93	1.64	0.78	0.43	0.26	0.17
1994-00	3.05	0.69	-0.07	0.21	2.23

Physical capital accumulation and TFP growth explain most of the growth dynamics of the Brazilian economy since 1930. The higher the value of the capital elasticity of output used for decomposing growth, the higher the contribution of capital and the lower that of TFP. Note, though, that the two need not be dissociated. TFP growth seems to have been systematically associated with the growth in the stock of machinery and equipment, as can be seen comparing Table 2.5 with Tables 2.5 and 2.6. It may therefore be that some TFP growth was gained through capital-embodied technological progress.⁷

The next section looks at how the economy and policy evolved in the 20th century, with a focus on variables that might explain the dynamics of Brazilian output growth in that period. We start with a cursory description of the 1900-30 period, setting the stage for a gradually more detailed analysis of the following periods.

2.3 – Characterizing Growth and Policies in the 20th Century ⁸

2.3.1 – Oligarchic Orthodoxy, 1901–30 ⁹

In the first three decades of last century—the high point of the so-called “First Republic”—Brazilian GDP expanded an average 4.3 percent per annum, or 2.0 percent per capita, a substantial improvement on earlier growth rates. The century started with a cyclical recovery from the difficult years of late 19th century, sparked by the boom in rubber export prices. Aggregate investment reacted with a lag to the performance of output—partly because almost all capital goods had to be imported—increasing continuously as a ratio of GDP from 4.9 percent in 1901 to 17.8 percent in 1908, declining slightly in 1909, and rising again from 1910 to 1913, when it peaked at 29.1 percent of GDP (in constant 1980 prices). A substantial part of this investment went to industry and infrastructure: in 1901–14 the railway network expanded 4.0 percent per annum, while total power generation capacity increased thirty times, largely through FDI.

The improvement in the trade and capital accounts led to a substantial currency appreciation, with the *mil-réis* rising from 14.5 cents of a US dollar in 1899 to 25.0 cents in 1905. To curb a further appreciation, a currency board was established in 1906, fixing the exchange rate at 32.3 cents per *mil-réis*. Although a brief financial crisis in international markets in 1907 caused a recession in 1907-08, the economy boomed in 1909-12, helped by favorable terms of trade and easy access to external credit, with a particularly good performance of the industrial sector (Tables A.1 and A.4). Contributing to this rapid industrial growth was the monetary expansion that took place as a result of the pro-cyclical incentives created by the currency board, through which monetary policy reinforced the stimulus provided by the trade account.

The decline in export prices, in 1913, together with the surge in imports, caused liquidity to fall, leading to a major deflation, and initiating a credit crunch that would last until the beginning of

⁷ See De Long and Summers (1991) and Eaton and Kartun (2001) for a discussion of the importance of machinery and equipment investment to growth, particularly when using machinery imported from capital-goods-R&D-intensive countries such as the US, Germany and Japan.

⁸ The following sections do not aim at providing a full historical account of the Brazilian economy in the 20th century. For that, see, among others, Furtado (xxxx), Fishlow (1972), Prado Jr. (xxx), Suzigan (1986), Abreu (1990), Lamounier, Carneiro and Abreu (1994), and Giambiagi and Moreira (1999).

⁹ For a description of economic events and policies in this period see Fritsch (1990), on which we partly draw.

the war, when the currency board was discontinued. Abandonment of the gold standard would then be followed by an acceleration of inflation, which averaged 17.1 percent per annum in 1915-16, and large fiscal imbalances. However, the government succeeded in stabilizing the economy, with the assistance of a loan from its foreign creditors, which also helped to sustain the exchange rate around US\$0.25 per *mil-réis* in 1915-18.

GDP remained essentially stagnant during the war, but the industrial sector picked up in 1915-17, after contracting 8.7 percent in 1914. With output capacity enhanced by the capital accumulation that took place in the years preceding the war, firms were able to engage in import substitution, particularly of processed foodstuffs, and in expanding non-traditional exports (Fishlow, 1972). The decline in imports reduced fiscal revenues and forced the government to widen the basket of products on which the consumption tax was levied. Together with a low growth in public expenditures, this reduced the public deficit during the war.

Investment levels collapsed with the credit crunch initiated in 1913, falling to 11.7 percent of GDP, and afterwards with the war, which made importation of capital goods and access to FDI much harder. In 1915-18 the rate of investment averaged a mere 5.7 percent of GDP, with a substantial decline in construction and especially in machinery and equipment capital accumulation, in this period on average just a seventh of its peak value in 1913. Electricity generating capacity and the rail network expanded less than 7.9 percent and 6.3 percent, respectively, from 1914 to 1918.

Brazil experienced a dramatic decline in its terms of trade during the war, which in 1915-18 averaged just 41 percent of their peak level in 1914. Yet the loss of a large share of the coffee crop in 1918, as a result of cold weather, and a pronounced recovery in world economic growth after the war, caused Brazilian exports to double from 1918 to 1919, with a 66.5 percent improvement in its terms of trade. The adoption of restrictive monetary policies in the US and England in 1920 would produce a further major drop in terms of trade, and a decline in exports in 1921, by when imports had doubled with respect to 1918, reflecting high GDP growth and the partial recovery of investment levels. Although severe, as reflected in the 15.3 percent decline in the GDP deflator in 1921, and important for its influence on policy, this shock would be short-lived. Both exports and terms of trade rose in the following years, thanks to a recovery of the world economy and a successful move by Brazil to reduce the supply of coffee in international markets.

After appreciating slightly in 1919, the *mil-réis* would experience a major devaluation in 1920-21 and again in 1923, when the exchange rate declined to \$0.10 per *mil réis*. This depreciation and loose monetary policy would stoke inflation to a peak of 30.1 percent in 1923. Currency weakness, high inflation and the military upheaval of mid-1924 would then convince President Bernardes to adopt an orthodox stabilization program with restrictive monetary *and* fiscal policies, which caused growth to decline to 1.4 percent that year and zero in 1925, down from an average 8.2 percent in 1922-23. Industrial output, which had expanded at an average 16.0 percent per annum in 1922-23, showed zero growth in 1924-25.

Despite its high costs with respect to lost output, the stabilization program was successful in bringing inflation down. As measured by consumer prices in Rio de Janeiro, inflation fell from 16.9 percent in 1924 to 2.7 percent in 1926, and the currency strengthened to \$0.14 per *mil-réis*. Contributing to this appreciation was the recovery in Brazil's balance of payments, with the rise in exports and terms of trade referred to above, and renewed expansion in FDI. Concerned once more with the negative impact of a strong currency on the income of coffee growers and entrepreneurs, the government resorted to a currency board, with the exchange rate fixed at \$0.12 per *mil-réis*.

The events that followed resembled those of the pre-war period. Expansionist monetary and fiscal policies lasted while the balance of payments recorded favorable results, but became suddenly contractionist when exports declined, at a time when imports were still growing, thus greatly reducing the trade balance and consequently the money supply. In 1926-28, when the government succeeded in keeping coffee prices high, GDP expanded an average 9.2 percent per annum. In 1928 the trade surplus fell to \$85 million from \$118 million in 1926, just as the supply of foreign credit declined, reducing domestic liquidity. Concerned with the balance of payments, the government reduced domestic credit, constraining the ability of government of the State of Paulo to finance its coffee price support scheme, particularly in light of the record crops of 1927 and 1929. Coffee prices began to decline in late 1929, fell rapidly during 1930, and this further tightened Brazil's monetary policy.

Despite the recessionary effects of the currency board in this unfavorable environment, and with a decline in industrial GDP, virtual stagnation in the rest of the economy, and a 3.6 percent deflation, the government stuck to the gold standard, hoping for a change in the external environment. Instead, the situation deteriorated further, with a 2.1 percent decline in GDP (-6.7 percent for industrial GDP) and a 12.4 percent decline in the GDP deflator.

The late 20s illustrate well the volatility in growth, terms of trade and exchange rates that marked the first three decades of the century, as was typical in a primary export economy subject to weather and external shocks, particularly shocks with the magnitude of those registered in 1914–30. These shocks would eventually lead to a shift in economic models and the form of integration into the world economy, and to the evolution of new political alliances, based on the new urban interests that developed over those three decades, overcoming the dominant influence of agricultural interests, and coffee growers in particular, which had characterized Brazil for several decades.

Although it is debatable how orthodox were Brazilian policy makers in this period, particularly regarding fiscal and monetary policy, there is a relative consensus that economic policy was predominantly liberal, and that state intervention in foreign trade and private activities was kept to a minimum, except for the policies aimed at supporting international coffee prices. Governments endeavored to keep inflation low, and indeed succeeded by the standards Brazil would set for the rest of the century. Moreover, although import tariffs—measured as the ratio of import taxes to import value—were highest in this period for the century, these were used less for industrial policy purposes than to generate public revenues.¹⁰ The Brazilian economy remained highly concentrated on agriculture throughout this period, and the share of industry in total output only rose from 13.2 percent in 1900 to 17.0 percent in 1930 (Table 2.8).

Table 2.8
Sector Composition of GDP (Factor Cost, 1980 prices) and Employment

	Agriculture		Industry		Services	
	GDP	Labor	GDP	Labor	GDP	Labor
1900 ⁽¹⁾	45.0	66.9	13.2	4.2	41.8	28.9
1930 ⁽¹⁾	36.3	66.3	17.0	13.6	46.7	20.2
1950	23.2	59.9	25.9	17.6	50.9	22.5
1963	16.2	51.0	34.9	18.8	48.9	30.2
1980	10.1	29.4	40.9	29.1	49.0	41.5
1993 ⁽²⁾	12.5	26.1	39.5	20.8	48.0	53.0
2000 ^(2,3)	12.9	23.6	38.4	19.2	48.7	57.2

1 Allocates in services workers in arts and crafts and (artes e ofícios) and with unidentified occupations.

2 Uses labor force figures from the New National Accounts System.

3 Labor figures refer to 1999.

Economic policy would change substantially in the following decades. Fritsch (1990) argues convincingly that this change resulted less from the new political alliances that triumphed in the 1930 revolution than from the shift in the international order and external environment caused by the Great Depression:

“[I]n explaining the profound change in the style of economic policy that takes place from the thirties onwards, in the sense of greater government intervention in international transactions, a more prominent role must be ascribed to the restrictions imposed by the changes in the external environment that prevented the maintenance of the traditional stance. This amounts to minimizing the validity of the notion that, in this change of styles, there was any a priori intention towards increasing incentives to industry, as not rarely is inferred from the assumptions regarding the loss of power of exporters after the collapse of the First Republic.

¹⁰ Indeed, the fact that those revenues were for a long time the main source of public funds also made fiscal policy pro-cyclical, helping to accentuate the volatility in growth.

“The dramatic external disequilibria experienced by Brazil since the late twenties, as a consequence of the collapse in international capital markets, the brutal contraction in international trade and the problems generated by large coffee crops, completely changed the viability of the forms of interaction to the world economy consolidated in the First Republic. Ironically, this created the conditions for overcoming the old problem of how to sustain domestic stability when faced with external shocks without any of the structural or institutional reforms that would have been necessary with the world economy under normal conditions.”

2.3.2 – Unstructured Import Substitution, 1931–50

The thirties and forties were a period of relatively high growth marked by a substantial rise in the share of industry in output, from 17.0 percent in 1930 to 25.9 percent in 1950 (Table 2.8). Most of this period was characterized by low import volumes, which were limited either by the attempt to reduce balance of payments disequilibria, or by supply restrictions during World War II. Only in 1948 would imports surpass their real level of 1930, to decline again in the following year, as the government reacted to the trade account by reinstating several controls on foreign exchange expenditures. Overall, imports increased 0.5 percent on average in these two decades, versus 5.1 percent annual GDP growth and 7.3 percent industrial output growth.

Table 2.9
Trade and Current Account Indicators

	Real Annual Growth of		Trade Balance	Current Account	Terms of Trade (1980=100)	Parity Rate*	
	Exports	Imports	GDP	Bal./GDP		Mean	SD
1901-30**	2.5	3.0			160.6	42.7	10.1
1931-50	1.5	0.4			118.2	77.1	17.7
1951-63	-1.2	1.7	-0.4	-1.4	164.0	65.8	13.0
1964-80	8.0	5.6	-0.7	-2.4	143.3	86.9	6.0
1981-93	6.5	1.9	3.6	-1.1	94.7	92.6	16.8
1994-00	4.3	13.5	-0.2	-3.3	124.1	68.4	9.6

* Against US\$ using wholesale price indices. ** 1908-30 for parity rate.

The process of import substitution in this period was most of the time a side effect of policies targeted at dealing with the reduction in trade and capital flows during the Depression and World War II, and the foreign exchange constraints stemming from Brazil’s high foreign debt. Only in the late forties did the government realize the potential of fostering industrialization through the selective protection of specific sectors, coupled with a targeted expansion of public credit (Vianna, 1990). As output growth became less closely linked to agriculture and the world market, growth also became more stable, particularly in industry (Table 2.10). This would help to foster capital accumulation, as suggested by the recovery of investment from the rather low rates recorded in the early thirties, with a substantial rise after World War II, when trade liberalization and a grossly overvalued exchange rate boosted capital goods imports. A remarkable increase in capital goods investment ensued, more than three times as high in 1946–50 compared with 1930–45.

Table 2.10
Average Growth and Annual Variation

			Period					
			1901-30	1931-50	1951-63	1964-80	1981-93	1994-00
GDP	Total	Mean	4.3	5.1	6.9	7.8	1,6	3,1
		Std Dev	5.1	4.4	2.9	3.3	4,1	2,0
	Agriculture	Mean	3.6	2.7	4.1	4.5	2,4	3,4
		Std Dev	7.5	5.1	4.0	4.5	5,9	2,6
	Industry	Mean	5.2	7.3	9.5	8.5	0,4	2,6
		Std Dev	7.0	5.6	4.9	5.3	6,5	3,2
	Services	Mean	4.7	5.5	6.7	7.5	0,5	3,2
		Std Dev	7.0	5.9	3.9	4.0	5,0	5,0
Population			2,4	2,0	3.0	2.6	1.9	1.4
Per Capita GDP			2,0	3,1	3.9	5.1	-0.2	1.7

Following the difficult years of 1930–31, when GDP declined 2.7 percent per annum, the economy experienced a robust recovery in 1932–39, with GDP growing 6.1 percent per annum. Compared with the first decades of the century, growth became more inward-oriented and was fueled by expansionist fiscal policies, mainly deficits caused by massive purchases of coffee, which was then burned, in order to sustain international coffee prices.¹¹ Monetary policy too, which had been clearly contractionist in 1931–32, when prices declined a total of 32.8 percent, became more expansionist, with inflation averaging 3.4 percent in 1932-39.

The combination of expansionist fiscal, monetary and credit policies, severe quantitative controls on imports (particularly until 1937, when servicing the foreign debt was a central objective of the foreign exchange controls),¹² and the existence of substantial idle capacity from the rise in investment in the late 1920s, provided a great stimulus to industry. In 1932–39, industrial output expanded 9.0 percent per annum, allowing for a decline in the share of imports in domestic supply, in 1939 prices, from 45 percent in 1928 to 25 percent in 1931 and 20 percent in 1939 (Abreu, 1990). Yet because this industrial growth was accomplished essentially by a rise in capacity utilization, the structure of output changed little, with the share of traditional industries (e.g., foodstuffs and textiles) declining a mere 10 percentage points. in 20 years, from 80 percent in 1919 to 70 percent in 1939 (Fishlow, 1972).¹³

The thirties were marked by controls on foreign exchange purchases, the severity of which varied over time. Faced with a 49 percent decline in terms of trade in 1930–32, and with no access to

¹¹ As noted by Fishlow (1972), though counter-cyclical fiscal policy might have been unintended, from 1933 onwards the deficits were foreseen in the budget. According to Abreu (1990), this willingness to accommodate fiscal shocks with an increase in the fiscal deficit, so different from the usual policy orientation in the First Republic, allows us to “state that the Provisional Government’s economic policy was pre-keynesian.”

¹² An interesting development in the late thirties was the decision to prioritize foreign exchange expenditures with imports, to allow the economy to expand at a reasonable rate, at the expense of servicing the foreign debt (Abreu 1990). Another was the creation, in 1940, of the Commission of the National Steel Plan and the concomitant decision to establish Brazil’s first large integrated steel producer, under state ownership, *Companhia Siderúrgica Nacional*, which would begin its operations in 1946.

¹³ In 1939, domestic output already accounted for the largest part of intermediate goods and consumer non-durables, but this was not true for capital goods and consumer durables (Fishlow, 1972).

international capital markets, the government suspended the service of the foreign debt and created a foreign exchange monopoly through Banco do Brasil, to which went all export revenues. Imports and other foreign exchange expenditures were then allowed according to a list or to priorities defined by the government. As in other episodes in 1931–50, devaluation was not deemed worthwhile, owing to its negative impacts on the international price of coffee, inflation, and the fiscal accounts, through government foreign exchange expenditures (in domestic currency). In this sense, the overvalued exchange rate, coupled with the obligation to sell to the government, worked as a tax on coffee and other traditional exports, and was raised on foreign coffee consumers.

As terms of trade improved in 1934, foreign exchange controls were relaxed somewhat, both regarding the freedom of non-traditional exporters to sell in the “free” market—mitigating the negative impact on competitiveness of an overvalued exchange rate—as well as regarding importers and foreign investors right to buy hard currency. Later, controls would again be tightened, when liberalization and a decline in terms of trade caused the current account to widen. In different forms, the foreign exchange market would remain segmented for many years, with the coexistence of two, three, five or even ten exchange rates, each applying to a different client, product, purpose or end of the market. For domestic producers, the virtual ban on competing imports, and the access to inputs and capital goods at an overvalued exchange rate, provided extreme protection, regardless of the actual nominal tariffs imposed on imports, which actually declined compared with 1901–30 (Table 2.11). Moreover, through the moderate trade opening of the mid-thirties and the privileges ascribed to “essential imports,” the stock of imported capital goods increased 27.5 percent from 1934 to 1939.

Table 2.11
Average Import Tariffs

	All Goods	Non-Oil
1901-30	30.4	
1931-50	22.3	25.7
1951-63	9.2	10.9
1964-80	10.8	13.9
1981-93	7.6	11.4
1994-00	8.7	8.7

With the beginning of the second world war, the economy would again suffer from a loss of export markets and access to foreign capital, particularly in 1940–42, when GDP grew slowly. In 1942, however, growth resumed, as a consequence of expansionist fiscal, monetary and credit policies, and the stimulus of both an import substitution drive and an expansion in non-traditional exports made competitive by war conditions. In 1943–45, GDP expanded 6.4 percent per annum, with industrial output rising 9.8 percent per annum.

Inflation also rose, however, not only owing to rapid GDP growth, but also to lower imports as a result of the war. A further factor was an expansion in the money supply, owing both to monetization of the public deficit (which until 1942 had been financed mainly by increases in public debt), and an increase in the trade surplus, which caused current account surpluses and rising foreign reserves.

When the war ended and a new government took office, in 1946, foreign exchange controls were loosened, with the focus of economic policy turned to fighting inflation, which had risen to 20.6 percent in 1944, before falling to 14.9 percent in 1945. The combination of three factors—rising output, an overvalued exchange rate (which had stayed constant in nominal terms since 1939 against an accumulated inflation of 150 percent in this period), and repressed import demand—caused a boom in imports, which almost doubled in real terms from 1946 to 1948. Meanwhile, exports, no longer benefited by the special competitiveness conditions created by the war and penalized by the exchange rate overvaluation, stagnated, causing the trade account to go from a US\$391 million surplus in 1946 to a US\$59 million deficit in 1948.

Already in 1947, however, faced with a substantial deterioration in terms of trade, Brazil recorded a deficit of US\$182 million in its balance of payments, financed by a combination of losses in convertible reserve (US\$ 59 million), accumulation of commercial arrears (US\$ 72 million), and a loan from the Federal Reserve Bank in New York (US\$ 80 million) (Malan, Bonelli, Abreu and Pereira, 1980). As a consequence, in mid-1947 foreign exchange controls were reinstated.¹⁴ The new import-licensing system would soon bring the trade account back into a surplus, to which a decline in import prices and a rise in coffee prices also contributed.

Industry experienced another boom in the post-WW II years, with average growth of 8.1 percent per annum, bringing up the average growth rate in the forties to 7.5 percent. Moreover, the industrial structure continued to change, with a 7.5 percentage point rise in the share of intermediate goods in manufacturing output from 1939 to 1949 (Fishlow, 1972), compensated by a similar decline in the share of traditional industries (consumer non-durables). Nonetheless, as had been the case ten years earlier, capital- and technology-intensive sectors (capital and durable consumer goods) continued to answer for less than 8 percent of total manufacturing output.

2.3.3 – Government-Led Import Substitution, 1951–63

The import-licensing schemes and foreign exchange controls implemented in 1931–50 aimed largely at curbing foreign exchange expenditures, usually to overcome balance of payments disequilibria. It was not until the late forties, therefore, that its potential as an incentive for industrialization was realized and exploited (Malan, Bonelli, Abreu and Pereira, 1980, and Vianna, 1990). Beginning at that time, the government began to rely more intensively on tariffs and the sector distribution of import licenses to encourage industrialization through import substitution. A rise in the supply of (public) credit to industry, access to imports of capital goods and inputs at an overvalued exchange rate, incentives to FDI in manufacturing and a rise in SOE investment were other instruments adopted in the late forties and, more intensively, in the fifties, to foster industrialization.

However, although formally in place throughout this period, import-licensing schemes were relaxed in 1951–1953, when the Korean War began. Contributing to that stance were an increase in export prices, which produced a major gain in terms of trade and a trade surplus in 1950; the concern that the war would cause another shortage of raw materials and capital goods; and the expectation that import liberalization would help to curb inflation, which in 1951 had reached 18.1 percent, from 9.2 percent in 1950 (Malan, Bonelli, Abreu and Pereira, 1980). Not only would imports raise the supply of goods, but a decline in the trade surplus would reduce upwards pressures on money supply.

The setup was, therefore, similar to the one that in the trade opening episode of 1946: high output growth, a grossly overvalued exchange rate (in 1951 the parity rate, Cr\$/\$, was at 52 percent of the level recorded ten years before, further appreciating to 40 percent in 1953), and repressed import demand. Unsurprisingly, the result was also the same: an import boom (52 percent real growth in 1951–52) and a substantial worsening of the trade account. In 1952 the current account deficit rose to US\$624 million (2.9 percent of GDP), mostly financed through commercial arrears.

Eventually the government changed courses, tightening import-licensing schemes and introducing a five-tier exchange rate system that penalized traditional exporters (coffee, cotton and cocoa), non-essential imports, and most profit remittances. This system would later be simplified somewhat, with the determination of the “free” rate in foreign exchange auctions, but the principles guiding the multiple exchange rate system would stay in place.

A remarkable consequence of the trade opening episode of 1951–52 was an increase in the rate of investment from 18.0 percent of GDP in 1949 to 22.1 percent of GDP in 1952, when imports of capital goods peaked at twice the average level in 1948–50. The private sector was responsible for all of this increase, with its share in total investment rising from 66 percent in 1950 to 78 percent in 1952. This investment boom (boosted by a highly expansionist public credit policy), a 9.1 percent rise in agricultural output in 1952, and an increase in imports (services), largely explain why GDP growth averaged 6.1 percent in 1951-52, despite the priority ascribed by fiscal and monetary policy to price stabilization.

¹⁴ Once more, the option was not to devalue, but for a small 13 percent depreciation of the (official) exchange rate, which remained constant afterwards until 1952.

The consequence of these policy inconsistencies was an acceleration of inflation, which escalated from 9.3 percent in 1952 to 27.1 percent in 1954, its highest level since 1923. Also contributing to inflation were a decline in imports, which reduced domestic supply, and the 216 percent and 100 percent nominal increases in the minimum wage in 1952 and 1954, respectively (Vianna 1990). Economic turbulence was further aggravated by power shortages in 1953, caused by a particularly intense drought and the relatively slow expansion in power generation capacity (a rise of 4.7 percent per annum in 1944–53 versus annual growth of 7.9 percent in industrial output over the same period).

The crisis building around President Vargas, which culminated with his suicide in August 1954, would be only the prologue of a year and half of political instability. The new government took office amidst not only a politically tense situation, but also a foreign exchange crisis—resulting from the 49 percent decline in Brazil’s terms of trade in 1954—and serious domestic imbalances, with a large public deficit and rising inflation. New loans were raised with the Federal Reserve Bank in Washington and a syndicate of private banks led by Citibank and Chase Manhattan, attenuating short-term constraints, while new measures were established to attract FDI (Pinho Neto, 1990).

On the domestic front, the government cut public spending, largely capital expenditures, and tightened monetary and credit policies, by raising reserve requirements and curbing lending by Banco do Brasil. The result was a decline in the rate of investment in 1955 and a slowdown in GDP growth, from an average 8.3 percent in 1954–55 to 2.9 percent in 1956. A change of Finance Ministers six months into the new government would lead, however, to a reversal of several of these measures, including a reduction in reserve requirements and a more expansionist stance by Banco do Brasil. Inflation, which had declined in 1955, went back to 24.5 percent in 1956.

The first year of the new government was affected by a decline in agricultural output and stagnation in services, causing GDP to grow a “mere” 2.9 percent, despite an 8.6 percent rise in industrial output. Growth would, however, accelerate in the following years, as the government embarked on President Kubitscheck’s Plan of Targets, which, launched in late 1956, proposed ambitious and detailed initiatives to foster industrialization and greatly expand infrastructure. It foresaw that by 1960 Brazil would, among other things, expand electricity generation from 3 to 5 million KW; raise oil production from almost zero to 100 thousand barrels a day, and oil refining capacity from 100 thousand to 300 thousand barrels a day; pave 5 thousand kilometers of roads and build 12 thousand kilometers of first-rate highways; double steel output; increase the production of cement from 2.7 to 5.0 million tons; raise the output of barilla, non-ferrous metals, pulp and paper, rubber and iron ore for exports; and establish a car industry able to produce 170 thousand vehicles per year, with a high national content ratio (Abreu 1994).

The Plan was largely successful in attaining its targets. The extension of paved roads more than trebled in 1957–60, while electricity generation capacity increased by 35 percent, contributing to the major expansion in electricity and transportation infrastructure that marked the 1951–63 period (Table 2.14).¹⁵ Industrialization through import substitution also proceeded quickly, with industrial output expanding an average 10.8 percent in 1957–61, causing its share in GDP to reach 25 percent in 1961 from 21.4 percent in 1948. Equally remarkable, by 1959 the share of consumer non-durable goods in manufacturing value added had declined to 46.6 percent, down from 61.9 percent in 1949, whereas those of consumer durables, intermediate and capital goods rose from 2.5 percent, 30.4 percent and 5.2 percent to 5.0 percent, 37.3 percent and 11.1 percent, respectively (Fishlow, 1972).

¹⁵ See Table 7.2 in Orenstein and Sochaczewski (1990) for a more complete quantitative assessment of the government’s success in implementing the *Plano de Metas*.

Table 2.12
Expansion in Infrastructure

	Railways	Electricity	Roads	Paved Roads	Telecom
1901-30	2.6	15.6			
1931-50*	0.6	4.5	4.6	5.1	
1951-63**	-0.3	9.8	5.4	23.9	6.8
1964-80	-1.6	9.8	5.6	16.0	11.2
1981-93	1.0	4.1	0.8	4.9	6.9
1994-00***	-1.5	3.6	0.7	1.7	24.8

*1930-52 for roads and 1930-55 for paved roads.

** 1953-63 for roads and 1956-63 for paved roads.

*** 1994-98 for railways and 1994-99 for roads and paved roads.

In addition to tariff and non-tariff barriers, and an expansion in domestic credit, the main policy instruments used in fostering the objectives of the *Plano de Metas* were the increase in public and SOE investment, essentially in infrastructure and basic inputs, and the attraction of FDI into manufacturing, just when its weight in the utilities sectors was declining. Overall investment averaged 20.0 percent of GDP, up from 18.3 percent in 1955–56, with the share of public investment rising from 21.6 percent of total capital accumulation in 1950–55 to 25.0 percent in 1956–60 (the share of SOEs rose from 2.7 percent to 7.4 percent in the same period). The government was also successful in attracting FDI, particularly in the case of the car industry (see Shapiro). The main instrument, in this case, was “Instruction 113,” which allowed foreign investment to be made directly through imports of capital goods. This eliminated the need to bring capital into the country at the overvalued exchange rate, and then import capital goods at the “free” market rate. Malan (1984, cited in Abreu 1994) estimates that 75 percent of FDI and 70 percent of all capital goods imports in 1956–60 entered Brazil under the aegis of Instruction 113.

The exchange rate regime continued to operate in this period through a system of multiple rates, some of which continued to be determined at foreign-exchange auctions. The overvalued exchange rate, and the much higher return of inward-oriented investment, discouraged exports, which stagnated in this period and only in 1970 would surpass, in real terms, the peak of 1947.¹⁶ Later, in 1957, when *ad valorem* tariffs were introduced, tariffs were set so as to produce high effective rates of protection for target sectors, but quantitative restrictions continued to play a central role. This was the case of the Law of National Substitute (Lei do Similar Nacional), a law approved in 1911, and that had been barely used until then, which virtually blocked imports that competed with “similar” domestically produced goods.

Together with the construction of a new capital city, Brasília, and expenditures with the coffee price support mechanism, the rise in public and SOE investment and the cost of incentives for industrialization dramatically increased public spending, generating a deficit, which was then largely monetized: in 1957–63, the monetary base would rise an average 38.8 percent per annum, more than twice its growth in 1951–56 (18.0 percent), causing inflation to rise. After rising a moderate 7.0 percent in 1957, prices went up 39.4 percent in 1959, 47.8 percent in 1961 and 79.9 percent in 1963. The worsening of the macroeconomic situation led to negotiations towards an adjustment loan from the IMF, talks that were suspended in 1959, upon the refusal of the Kubitscheck government to comply with IMF conditions. Negotiations were resumed and an agreement concluded with the IMF during the Quadros administration, in 1961, but with the President’s resignation just eight months after his inauguration, new negotiations were started, without coming to a successful conclusion until the end of the Goulart administration in March 1964.

Overall, the 1951–63 period witnessed the first concerted policy effort to promote industrialization and infrastructure development. It was marked by a substantial acceleration of GDP

¹⁶ Even in current dollars the 1951 peak in exports would not be surpassed until 1968.

growth, particularly in industry, but also in agriculture and services. Growth was inward-oriented, with imports rising an average 1.7 percent per annum, against a GDP rate four times larger, and exports declining 1.2 percent per annum. Contributing to this bright performance was a substantial rise in investment, to 19.1 percent of GDP from 11.8 percent of GDP in 1931–50 (Table 2.13). About half of this increase in the investment rate was financed by a rise in savings, while the other half was covered by a decline in the relative price of investments goods, caused to a large extent by the relatively open stance towards capital good imports and by the overvalued exchange rate that prevailed in this period (Table 2.9).

Table 2.13
Investment Prices and Decomposition

Period	Gross Fixed Capital Formation/GDP		Inv Prices/ GDP Deflator	Investment		Savings			
	Current Prices	1980 prices		Public	Private	Foreign	National		
							Total	Public	Private
1901-30		12.9							
1931-50	11.6	11.8	103.4						
1951-63	15.4	19.1	81.3	3.7	11.7	1.4	14.1	2.5	11.5
1964-80	19.8	21.7	91.2	3.9	15.9	2.4	17.5	3.6	13.9
1981-93	21.2	17.0	125.3	2.9	18.3	1.1	20.0	-7.0	27.0
1994-00*	19.7	16.5	119.3	2.5	17.4	3.3	16.4	-5.4	21.8

* For public savings and investment breakdown, averages refer to 1994-1999.

The favorable terms of trade in this period, and the low growth of imports, prevented a major deterioration of the external accounts, despite the decline in exports. Domestic economic fundamentals would, however, deteriorate substantially with the large increase in the public deficit, and its financing through monetary mechanisms, bringing inflation to a new threshold. On average, the GDP deflator increased 27.1 percent per annum in 1951–63, almost four times as much as in 1931–50, and more than five times the average increase in 1909–30 (Table 2.14). Inflation became a trait of Brazilian culture.

Table 2.14
Indicators of Macroeconomic Stability

	Inflation			Black Market Premium	Curr.Acc. Balance/ Exports (percent)	Foreign Debt/ Exports
	GDP Deflator	IGP-DI	SD of monthly inflation (IGP-DI)			
1901-30*	5.1					2.2
1931-50	7.4				10.3	2.8
1951-63	27.1	29.9	1.4	64.3	-17.6	1.9
1964-80	40.3	40.1	1.0	14.4	-35.0	2.5
1981-93	695.7	768.4	6.4	46.5	-13.7	3.9
1994-00**	20.1	10.5	0.7	5.4	-44.5	4.1

* 1909-30 for GDP Deflator.

** 1995-2000 for inflation indicators.

2.3.4 – The Brazilian Miracle, 1964-80

In 1963 GDP stagnated, private investment declined, the public deficit reached 50 percent of fiscal revenues, inflation accelerated and the import substitution process began to show signs of exhaustion. Political instability increased, and in March 1964, a military coup, on the cards since the early fifties, overthrew the Goulart government, with the high rates of inflation recorded in the previous two years being responsible for part of the popular support the coup initially received.

In government, the military adopted a stabilization program to lower inflation, reduce the public deficit, and correct relative prices. The exchange rate was devalued and a tax reform implemented, greatly reducing tax distortions and raising revenues from 16.3 percent to 22.4 percent of GDP, helping to bring down the public deficit. The stabilization program improved the current account, from a deficit of 0.5 percent of GDP in 1963 to a surplus of 1.6 percent of GDP in 1965, and reigned in inflation, from 87 percent in 1964 to 24 percent in 1967, to which a dramatic salary squeeze—the real minimum wage in Rio de Janeiro fell 34 percent between February 1964 and March 1967—made a central contribution (Bacha, 1977).

The new government also implemented significant monetary and capital market reforms, with the establishment of the monetary correction (indexation) mechanism, which protected investors from “inflation surprises,” and was key in restoring confidence in long-term contracts in capital and credit markets. In particular, indexation restored the government’s ability to finance its deficit in a non-inflationary way (through the sale of public debt securities). Moreover, it allowed the development of mortgage finance, which in coming years would provide a major boost to housing construction. All private and public savings also became protected by indexation.

In the foreign exchange market, the government also introduced an indexation mechanism to protect exporters from inflation surprises, establishing a crawling-peg regime with small devaluations at randomly determined moments. This greatly enhanced the stability of real exchange rates, which had experienced large fluctuations in previous years. Furthermore, in the late sixties the real exchange rate depreciated further, which together with a system of tax exemptions and other incentives introduced in this period caused a substantial expansion of manufactured exports.

The consequence of the contractionary monetary and fiscal policies adopted in this period would be the slowdown in GDP growth, which nonetheless averaged 3.6 percent in 1964-66, and in industrial output, which stagnated in 1964-65. However, with a sharp decline in the relative price of investment goods, the rate of investment reacted positively to the more stable political and economic environment, rising from 16.3 percent of GDP in 1964 to 18.9 percent of GDP in 1966 (1980 prices). Also noteworthy was the particularly strong growth in capital goods investment, which more than doubled in this period. The combination of low GDP growth and the rise in investment created of a large amount of idle capacity: 17.5 percent for the economy as a whole, and 25 percent in manufacturing, in 1967.

Economic policy changed dramatically in the following years, after a new administration took office, with fiscal, monetary and particularly credit policies all becoming highly expansionist. A boom in consumer and mortgage credit helped to boost the output of durable consumer goods and construction, to which the rise in public investment also contributed, particularly in infrastructure. In 1968-73, the growth rates of investment in transportation network, electricity and telecommunications averaged 15.1 percent, 13.9 percent and 44.7 percent per annum, respectively (Ferreira and Malliagos, 1999). This period would also record a rise in overall capital accumulation, with the rate of investment rising from 18.6 percent of GDP in 1967 to 23.6 percent of GDP in 1973. Capital goods investment increased an average 17.8 percent per annum, with imports of capital goods rising 24.8 percent per annum.

The concession of export incentives, a more stable and competitive exchange rate, and the improvement in the external environment, with high growth in international trade, led to a surge in exports, which grew an average 9.7 percent per annum, in real terms, with strongest expansion in manufactured exports, whose share in total exports rose from 28.7 percent in 1967 to 40.6 percent in 1973. Brazil’s external position also improved as a result of a 26.7 percent increase in its terms of trade, between 1966-68 and 1972-73. In this way, the 150 percent real increase in imports was accommodated with a moderate increase in the current account deficit, from 0.75 percent of GDP in 1967 to 2.01 percent in 1973.

Benefiting from the low initial rate of capacity utilization, and with easy access to euromarkets softening balance of payments constraints, the change in policy orientation would accentuate the cyclical recovery of GDP, which expanded an average 11.5 percent per annum in 1968-73. Industry led this boom, growing on average 13.2 percent per annum, with the output of durable consumer goods expanding 25.4 percent per annum. This surge in growth would not, however, prevent inflation from falling, from 25.5 percent in 1968 to 15.5 percent in 1973 (IGP-DI). The unusual combination of high growth, industrialization and declining inflation rates caused this period to be dubbed the “Brazilian Miracle.”

Matters would change rather dramatically with the first oil shock. With the price of a barrel of oil jumping from US\$2.8 in 1973 to US\$11.1 in 1974, and importing 705 thousand barrels of oil per day (as much as 81 percent of its consumption), Brazil was hit hard. The oil shock was not, however, the only problem inherited by the administration that took office in 1974. The final days of the Medici administration had been marked by strong inflationary pressures, stemming from the rapid non-sterilized expansion of foreign reserves (53 percent in 1973 alone) and the maintenance of expansionist policies when output was close to full-employment levels (as illustrated by the 35 percent real expansion in domestic credit in 1973).¹⁷ The rise in the price of raw-material imports (e.g., wheat, copper, and coal) and of exports also added pressure on domestic prices. Furthermore, inflation had been artificially controlled in the early seventies, through price freezes that left a number of key prices misaligned.

Full employment was also pressuring the trade account, which had shown a surplus of \$7 million in 1973, after recording deficits of \$341 and \$244 million in 1971 and 1972, respectively. With the deficit in services also rising, the current account deficit doubled from 1969 to 1970, expanded 133 percent in 1971 and 13.5 percent per year in 1972-73. As noted by Malan and Bonelli (1977), Brazil had been living beyond its means for a number of years, and in this fashion had accumulated rising levels of foreign debt, which increased almost four-fold in 1968-73. That was not the full extent of Brazil’s rising vulnerability: “[m]ost important, currency loans, which accounted for only 20 percent of total debt in 1967, represented almost two-thirds (62.4 percent, or US\$ 7.85 billion) of total debt by 1973.” (Malan and Bonelli, 1977, p. 24).

The deterioration in the external environment in 1974 went beyond the rise in oil prices. As noted above, other imports on which Brazil was highly dependent, including raw materials and capital goods, also posted substantial price increases. And the industrialized economies, on which Brazil had relied as a market for its exports and as a source of capital, that year went into recession. Repressed inflation and the need for a major structural adjustment in the foreign accounts were legacies of the “miracle” years:

“[T]he balance-of-payments situation during the 1968-73 upswing was not sound: even without the 1974 international oil crisis, Brazil would not have been able to maintain its potential growth rate of GDP because of balance-of-payments disequilibria; when domestic capacity limits and balance-of-payments constraints emerged after 1972, economic policy went into disarray—substituting optimistic propaganda for effective action, Brazilian policy-makers let the external debt reach staggering proportions; during the next four years, a rigid import diet will have to be implemented to reduce the net external indebtedness of the country; as a consequence, economic growth will have to slow down during a period when significant political changes can be expected to occur.”
(Bacha, 1977, p. 47)

The government opted not to follow an “orthodox” stabilization program, choosing instead to sustain the pace of economic growth, with inflation control coming as a second priority and the external accounts being left as the adjustment variable. Indeed, the basic lines of the government economic program for 1974–79 stressed real GDP growth of 10 percent; a 150 percent increase in exports; accelerated import substitution of capital and intermediate goods; and a large expansion of domestic oil output and infrastructure capital, both under the responsibility of state enterprises.

¹⁷ The volume of credit to the private sector rose from 15.4 percent of GDP in 1966 to 47.9 percent of GDP in 1973, and an average 59.8 percent of GDP in 1978–79, before declining in the following years (Serra, 1980).

This decision to grow out of external imbalances, rather than trying to adjust through contractionary fiscal and monetary policies, was motivated mainly by two factors. One, the belief that the oil shock would be brief and the external environment would rapidly return to its previous state (Malan and Bonelli, 1977). Another, the constraints imposed on economic policy by the decision to move ahead with the political transition alluded to by Bacha (1977). That is, it would have been extremely difficult to overpower military hardliners, who opposed the gradual political opening initiated in the mid-seventies, in an environment of low growth, so much in contrast with the rapid growth, hard line regime of 1968-73.

In a sense, therefore, economic growth was sought as a source of political legitimacy, not much differently from the early seventies. As pointed out by Lamounier and Moura (1983), during this political transition there was “the need to sustain optimism,” at a time in which “the euphoria with the rates of GDP growth, virtually deified in the Medici period, and even the rhetoric that we would be a great power” were still very present in people’s minds. Finally, the constituency for growth also included the influential business community, which was not expected to support an orthodox stabilization attempt, as would become evident in the late seventies, when Finance Minister Simonsen attempted one, and was soon after sacked from government. In turn, the substantial liquidity in international capital markets, created by the recycling of petro-dollars, provided the means to sustain the previous policy course, through the borrowing of large loans at negative (although floating) real rates of interest.

Therefore, contrary to most other semi-industrialized countries, which adjusted to the negative impact of the first oil shock by expanding exports and reducing output growth, Brazil reacted by further substituting imports, borrowing more, mildly expanding exports and accelerating growth (World Bank, 1981, and Fundação Getúlio Vargas, 1981).¹⁸ As part of this heterodox response, and in an attempt to prevent a further rise in inflation, the government decided also not to let the exchange rate depreciate, despite the 29 percent decline in terms of trade in 1974–75. This policy stance lacked credibility, however, and an import boom ensued, as private agents feared either a devaluation or an increase in import duties. Import quantities rose 20 percent in 1974, helping to bring the current account deficit to US\$7 billion, or 6.3 percent of GDP.

The government reacted by raising import barriers, reversing the mild trade liberalization process initiated in 1967 (Coes, 1988). Tariffs were increased, surcharges of 30 percent to 100 percent were levied on 40 percent of all goods, prior deposits became mandatory before receiving import licenses, and a number of other non-tariff barriers were created, including a negative import list known as “Annex C” and a more rigorous application of the Law of National Substitute (Pinheiro and Almeida, 1995).¹⁹ These measures put all the burden of adjustment on imports, with real exports remaining virtually stagnant in 1974–77. However, a 55 percent rise in export prices, together with a 21 percent decline in import quantities, were sufficient to generate a trade surplus of US\$97 million in 1977, from a deficit of US\$5.0 billion in 1974.

But this adjustment had clay feet. In 1978–80 Brazil’s current account deficit widened again, reaching US\$12.8 billion, or 5.4 percent of GDP in 1980. Contributing to that were a 36 percent decline in terms of trade, a rise in import quantities, and, especially, a rapidly growing external debt, largely contracted at floating interest rates, the cost of which rose enormously as Paul Volcker tightened monetary policy in the US.

Until mid 1980 the government held out, not adjusting to the deterioration in the external environment, trusting that a combination of further import substitution, high growth, and a rollover of foreign debt would suffice to insulate it from external shocks until the external situation returned to normal. In this way, despite rising inflation and mounting external imbalances, monetary, fiscal and credit policies remained expansionary, causing GDP to grow 9.3 percent in 1980.

Taken as a whole, 1964-80 was a period of exceptionally high growth. GDP increased an average 7.8 percent per annum, with industry expanding 8.5 percent annually. This was also a period of relative stability in key macro indicators, such as GDP growth, the real exchange rate and inflation, which, despite higher than in previous decades, was more or less constant (Table 2.14). This stability

¹⁸ For a favorable assessment of this strategy see Cline (1981).

¹⁹ Cline (1981) estimates that tariff protection, including prior deposit requirements, increased by 47.4 percent from 1973 to 1976.

provided an important stimulus to private investment, which in current prices increased from 11.3 percent of GDP in 1970 to 16.8 percent of GDP a decade later. Equally impressive was the investment drive of SOEs, which rose from an average 1.9 percent of GDP in 1961–65 to 7.7 percent of GDP in 1977, before declining to 4.5 percent of GDP in 1980. The consequence was a rapid expansion in infrastructure capital, sustaining the high growth rates of 1951–63.

The structure of the economy also changed substantially in this period. The share of industry in output and employment rose from 34.9 percent and 18.8 percent in 1963 to 40.9 percent and 29.1 percent in 1980, respectively. In manufacturing, the share of the traditional sectors—foodstuffs, beverages, textiles, clothing, tobacco and wood—declined in value added from 39.4 percent in 1959 to 27.0 percent in 1980, while that of more capital and technology intensive—mechanical, electrical equipment and transportation equipment—rose from 15.0 percent to 24.9 percent. This period marked, therefore, the high point of import substitution industrialization, and culminated with perhaps the highest ratio of per capita income in Brazil to the US in the 20th century.

2.3.5 – The Long Lost-Decade, 1981–93

With the benefit of hindsight, it is clear that policymakers made the wrong choices in both 1974 and 1979–80, insisting on a strategy that had outlived its usefulness. Trying to *grow* out of its external problems, Brazil rapidly accumulated large external liabilities, with net foreign debt increasing from US\$6.2 billion in 1973 to US\$58.4 billion in 1980, while the current account deficit went from US\$1.7 billion to US\$12.8 billion. Brazil entered the eighties with its economic fundamentals seriously weakened: inflation was high and rising, while the external accounts were in an explosive trend. Unable to deal with those twin crises, Brazil experienced in 1981–93 a long “decade” of stagnation. In these 13 years, GDP grew on average 1.6 percent per annum, against a demographic expansion of 1.9 percent per annum, resulting in an average annual decline of 0.2 percent in per capita income. Industry was particularly affected, growing a mere 0.4 percent per annum.

With the sharp deterioration of Brazil’s external accounts in the late seventies, the government allowed the currency to depreciate, with the parity rate against the dollar (Cr\$/US\$) rising 15.2 percent from 1978 to 1980. But the subsequent rise in inflation caused the currency to appreciate in real terms again in 1981–82, and as the current account deficit continued to increase, trade policy was entirely subordinate to macroeconomic objectives. The negative import list (Annex C) was substantially expanded, covering 40 percent of all tradable goods in 1983, while firm import programs and import financing became mandatory. Administrative procedures (e.g., delaying the concession of import licenses) became the main instrument to control imports.²⁰ On the export side, credit and financial subsidies compensated the exchange rate appreciation in the early eighties, and compounded the effect of a weaker currency in 1983–85. In 1981–82, firms received incentives worth 74 cents for every dollar exported of manufactured goods (Pinheiro et al, 1993). In 1983 the real exchange (parity) rate devalued 25.0 percent.

GDP declined a total 6.3 percent in 1981–83, which together with the large currency devaluation and the stepping up of import barriers and export incentives produced a major turnaround in Brazil’s current account, which averaged a small US\$ 98.5 million deficit in 1984–85. But low growth, the devaluation, and the rise in export subsidies had a devastating effect on the public accounts. For a variety of reasons—going from large public loans contracted in the late seventies and early eighties to finance the current account, to the fear that a devaluation would cause the bankruptcy of a number of firms with foreign liabilities—a large part of the exchange rate risk on the foreign debt ended up on the public sector books in the early 1980s. This made the external crisis also a fiscal crisis, particularly after the 1983 devaluation, which caused the net public debt, as a ratio of GDP, to jump from 29.5 percent in 1982 to 49.5 percent in 1983 and 53.5 percent in 1984.²¹

With imperfectly indexed fiscal revenues, the acceleration of inflation caused tax collections to decline, from an average 25.4 percent of GDP in the seventies to 22.0 percent of GDP in 1985 (the Oliveira-Tanzi effect). Rising public indebtedness caused interest payments to increase, just when public subsidies were going up, rising from an average 1.7 percent of GDP in 1976–79 to 2.9 percent of GDP in 1980–83. The 1988 Constitution compounded the public finance problem, transferring a

²⁰ For a discussion of these policies see Pinheiro and Almeida (1995) and the references therein.

²¹ Obviously, part of this jump was just the accounting effect of the devaluation on GDP measured in dollars.

significant share of tax revenues from the federal to state and municipal governments, but doing very little towards redistributing expenditures. States and municipalities used the extra revenues to increase their payroll, so that the deficit created at the federal level was not compensated by a surplus at the state and municipal levels. As a result, the public sector ran very large operational deficits throughout the eighties, culminating with an operational deficit of 7.4 percent of GDP in 1989. The bottom line was a dramatic decline in public savings, which plummeted from a positive 4.7 percent of GDP in the seventies to minus 5.8 percent of GDP in the eighties.

Inflation, which had gone up in the late seventies, span out of control in 1981–93, averaging an annual increase of 768 percent, in contrast with an average annual rate of 40 percent over 1964–80 (IGP-DI). Over the 12 months of 1993 prices increased by a factor of 28. Taking the whole 1981–93 period, prices increased 7.7 billion times. In the early eighties, inflation was fueled by the large public deficit and sparked off by the need to achieve a substantial real devaluation. In an economy that for years had been developing sophisticated indexing mechanisms, it soon became clear that once triggered by a change in the exchange rate, inertia would set in and inflation rates accelerate. The *Cruzado Plan*, in 1986, attempted to deal with inflationary inertia through a price freeze, but the failure to eliminate the high public deficit, the excessive increase in money supply and the 8.0 percent decline in crop output would soon make the plan fail. Two other heterodox stabilization plans were attempted during the Sarney administration, in 1987 (Bresser Plan) and 1989 (Summer Plan), but both were short-lived.

Two additional attempts took place during the Collor administration, in 1990 and 1991. The plan launched in March 1990 was certainly the most traumatic: after a bank holiday, a large share of the economy's financial assets were frozen in the Central Bank, where they stayed for 18 months, to be later returned in 12 monthly installments. The result of this brutal contraction in money supply was a sharp fall in output. Policy makers reacted by freeing some of the assets held at the Central Bank, but again this was done beyond reasonable limits. At the beginning of 1991 inflation was picking up again, and another plan was launched, this time resorting to a price freeze. As the others before it, this too was short-lived.

All the five heterodox stabilization plans implemented in 1986–91 included price freezes and changes in established contracts, and although unable to contain inflation, contributed to increase uncertainty and diminish government credibility. In this sense they contributed to another key feature of the 1981–93 period: the high volatility in growth, inflation and the exchange rate.²² A change of finance ministers in mid-1991 brought a more orthodox economic team into government, which tightened monetary policy, in this way keeping monthly inflation rates at the 20-percent level for several months in a row. As a side effect of the high rates of interest in this period, the country experienced a large inflow of foreign portfolio investment, with foreign reserves more than doubling from 1991 to 1992, which helped to strengthen the currency and curb inflationary pressures. The cocktail of low and irregular growth, high and accelerating inflation, price freezes, breaches of contracts by policy makers, and high interest rates could have no other impact than to cause investment to slump. Although in current prices the rate of investment in 1981–93 was 1.4 percent of GDP higher than in 1964–80, in constant 1980 prices it was 4.7 percent of GDP lower. The difference stems from a 37.4 percent rise in the relative price of investment, the origin of which dates back to 1974 when import barriers to capital goods began to rise, causing capital goods imports to decline 81.2 percent from 1974 to 1984. This period also witnessed a decline in infrastructure investment, which in the case of the transportation network and electricity fell 50 percent and 45 percent, respectively, between 1980 and 1993. As a result, growth in the stock of infrastructure capital, although staying positive, showed a remarkable decline when compared to the previous three decades.

This strategy was quite successful in producing trade surpluses, which in 1984 amounted to US\$13.1 billion, in contrast to a trade deficit of US\$2.8 billion in 1980. But by the same token, fiscal

²² An outcome of the five heterodox stabilization programs of 1986–91 was a reduction of the public debt, resulting from changes in rules and breach of contracts that caused indexation of public liabilities to be less than perfect, or that just forcefully lowered rates of interest on the debt. Together with the currency appreciation in 1986–94, these would bring the public debt down to 29.6 percent of GDP at the end of 1994. Creditors, however, sued the government, and since 1995 have been awarded some 5 percent of GDP in compensation, known as “skeletons”.

and credit incentives were a major obstacle to fiscal austerity, which was becoming ever more necessary to curb soaring inflation rates. Concerns were also raised as to whether export competitiveness would outlive the end of government incentives. These policies were clearly not sustainable. Therefore, as the foreign exchange constraint lessened, Brazil gradually moved towards a more open and neutral trade policy.

The bright side of the economic record in 1981–93 was Brazil's ability to overcome the external shocks of 1979–81, turning the large current account deficits experienced in 1980–82 into a small surplus in 1984. Adjustment was obtained through a substantial rise in exports, stagnant real import levels and an improvement in terms of trade, particularly after 1986, when oil prices declined considerably. In this period the quantum of exports expanded an average 6.5 percent per annum, four times more than output, partially reverting the economy's inward orientation. Imports, in turn, showed a mere 1.9 percent growth rate, slightly more than GDP. All this growth in imports took place after 1988, and most after 1990. Indeed, the 1983–88 period recorded a major compression in import quantities, making Brazil a very closed economy.²³

The early nineties were marked by dramatic changes in the role of the state in the economy. Trade liberalization, privatization, the end of price controls, a reduction in entry and exit barriers, the enactment of legislation protecting competition, a more open attitude towards foreign investment, and a sharp reduction in red tape in the life of citizens significantly changed the business environment. Starting in 1988, Brazil progressively reduced protection to domestic producers. Two reforms, in 1988 and 1989, brought the average tariff on imports down, from 54.9 percent in 1987 to 29.4 percent in 1989. Most non-tariff barriers were eliminated in 1990, with the ban on imports of computer products ending in October 1992. Starting in 1990, a pre-announced schedule of tariff reductions gradually brought the average nominal import tariff down to 13.5 percent in 1993. In 1994 tariffs were further reduced, to 10.2 percent, as part of the effort to consolidate the *Real Plan*, but were raised again to 13.4 percent in 1997–98 (Kume, Piani and Souza, 2000). On the export side, trade policy also became more neutral from the mid-1980s onwards, especially after 1990. Several subsidies were discontinued in 1983–85, and essentially eliminated in 1990. As a consequence, the value of incentives fell from an average of 3.1 percent of GDP in 1981–84 to 1.3 percent in 1990–91, despite the significant expansion of exports in the meantime (Pinheiro et al, 1993).

In addition to trade liberalization, the government sponsored policies that fostered competition and reduced the regulatory burden of firms. The competition law and the anti-trust agency were both strengthened, while a number of laws and decrees were revoked, discontinuing public monopolies, entry barriers and restrictions on certain activities. Regulations on FDI were also eased, which helped to boost FDI inflows in the late nineties.

Privatization also brought a major change in policy orientation in 1981–93. Brazil's first attempt to control the expansion of state enterprises dates back to 1979, but privatization did not begin officially until 1981, when a presidential decree created the Special Privatization Commission. Over the rest of the eighties the government sold 38 companies, transferred 18 to state governments, merged 10 into other federal institutions, closed four, and rented one. Most of the sales were re-privatizations of small companies and proceeds were minimal (US\$723 million) and largely financed from within government. In 1990 the government launched the National Privatization Program, greatly expanding privatization, which came to include large SOEs in manufacturing. In 1991–93, large state holdings in steel, petrochemicals, fertilizers and other manufacturing sectors were sold to private investors.

2.3.6 – Adjustment under the *Real Plan*, 1994–2000

Notwithstanding the importance of the structural reforms of the early nineties, it was the *Real Plan*, and its success in bringing inflation down, and keeping it there, that marked the most important transformation of the Brazilian economy in recent years. The Plan evolved in three stages. In Phase I, the public deficit was reduced through the creation of the Social Emergency Fund, approved by Congress in February 1994, which allowed the government the freedom to allocate resources (or not to spend them), in 1994–95, amounting to 20 percent of its revenues, which until then were earmarked for specific areas. Phase II was launched a month later, with the creation of the so-called Real Value Unit (URV). The URV was a unit of account, kept at a one-to-one parity with the dollar, which

23 In 1983–87, non-oil imports were equivalent to just 2.8 percent of GDP.

allowed the alignment of most prices and wages, as well as inflationary expectations, avoiding the carry over of residual inflation into Phase III, as had happened in previous stabilization attempts. Finally, on July 1st, as most prices and wages had been converted into URVs, currencies were changed, with prices in URVs being quoted in *reais*, which became not only a unit of account but also a means of payment. In addition to the careful preparation, other factors that contributed to the success of the *real* include the large increase in agricultural output in 1994–96, which helped to keep food prices down, the appreciation of the exchange rate, and tight monetary policy.

The sudden decline in inflation, from 46.6 percent in June 1994 to 0.6 percent in December, and the currency appreciation caused real incomes and credit supply to rise, leading to a consumption boom that reinforced the cyclical recovery begun in 1993 and caused GDP to rise of 5.9 percent in 1994. In the first quarter of 1995 the economy was clearly overheated, with GDP expanding 10.7 percent with respect to the same period in 1994. Growth rates of that magnitude were not compatible with the stabilization effort, not least because the substantial increase in output, largely derived from increasing capacity utilization, did not keep pace with the growth of absorption, causing the trade account to go from a US\$10.8 billion surplus in 1994 to a US\$3.3 billion deficit in 1995.

The Mexican crisis of December 1994 inaugurated a series of external shocks that would force Brazilian policymakers to make adjustments to the *Real* Plan. In March 1995, the government raised interest rates, contracted domestic credit and devalued the exchange rate, causing GDP to stagnate in the following six quarters. Other shocks in 1997 and 1998 were countered in the same fashion, in particular by tightening monetary policy, which caused real interest rates to remain extremely high throughout this period: an average 23.4 percent in 1994–98.

Fiscal policy, however, took the opposite direction, becoming highly expansionist after 1994. With the decline in inflation, real public spending went up, unveiling a fiscal deficit hidden theretofore by the acceleration of inflation. Real increases in pensions and civil servant salaries, in 1995, and a broadly lax approach towards controlling discretionary spending in 1995–97 were also important. The net result was the deterioration of the primary accounts, which went from a surplus of 2.65 percent of GDP in 1993 to a deficit of 0.98 percent of GDP in 1997, before a fiscal adjustment package was put in place after the Asian crisis. Combined with very high rates of interest, this deterioration in the primary accounts raised the operational deficit from less than 1 percent of GDP in 1993 to almost 8 percent of GDP in 1998.

As a reflection of the booming domestic economy, a strong currency and the lagged impact of trade liberalization, import quantities soared after the *Real* Plan, rising 20.4 percent per annum in 1994–98. Export quantities, however, stagnated, increasing at a rate of just 2.3 percent in the same period. Therefore, even though terms of trade increased by 40.6 percent in 1994–96, declining only moderately in the following two years, the external accounts showed a continuous deterioration, culminating with a US\$33.6 billion current account deficit (4.3 percent of GDP) in 1998.

The result of this combination of an expansionist fiscal policy, a strong currency and tight monetary policy was the rapid accumulation of public and external liabilities, which after a point threatened to gain a life of its own. With the decline in international liquidity that followed the Asian crisis, the government was forced to change this policy mix, and this was done initially with gradual measures aimed at weakening the *real* and reducing the public deficit. The Russian crisis and the continued rise in fiscal and current-account deficits forced a more dramatic reform in early 1999, however. In January of that year the *real* was floated, depreciating significantly, while a more substantial fiscal adjustment program was put in place, generating primary surpluses of 3.3 percent and 3.5 percent of GDP in 1999 and 2000, respectively.

In 1994–98 the government also implemented significant structural reforms, notably the extension of privatization to infrastructure, with the transfer to private investors of SOEs in telecommunications, electricity, rail transportation and ports, in addition to highway concessions. A number of constitutional amendments were approved in 1995 ending public monopolies in oil, telecommunications and gas distribution, and reducing discrimination against foreign companies, including the opening of the mining and electricity sectors to foreign investors. Furthermore, with the boom in imports and FDI after 1994, the economy became more open than at any moment since the late fifties.

The growth performance in this period was not anything remarkable, as noted earlier. GDP growth accelerated, compared to 1981–93, but only moderately. Moreover, growth volatility,

although also declining, remained high in contrast to the 1951–80 period. Output growth was pulled by agriculture, which benefited from trade liberalization, and services, with industry growing less than the rest of the economy. Capital accumulation showed an even weaker recovery than output, with the rate of investment declining in both current and 1980 prices. In this regard, it is noteworthy that although the relative price of investment goods declined *vis-à-vis* the 1981–93 period, as a result of lower inflation, trade opening, and a strong currency, this decline was much lower than one might have expected (Table 2.13). The low rate of investment translated into a further deterioration of infrastructure, except for telecommunications, which boomed with privatization. The network of roads and highways remained virtually stagnant, with investment declining as a ratio to GDP, while electricity generation capacity grew only marginally above output. Last but not least, the growth in human capital continued to decelerate from the already low growth rates of the 1981–93 period (Table 2.3).

Boosted by the depreciation of the *real*, and reflecting the fact that a large part of the public debt was either foreign debt or domestic debt indexed to the exchange rate, public liabilities jumped as a proportion of GDP in 1999, closing 2000 at 49.3 percent of GDP. As a consequence, the public deficit stayed high, despite the large effort in increasing revenues and reducing expenditures. With interest payments on the public debt of 8.0 percent of GDP, the fiscal deficit closed 2000 at 4.5 percent of GDP. Likewise, the adjustment in the external accounts was also partial, with only a moderate decline in the current account deficit, which closed 2000 at 4.1 percent of GDP (US\$24.6 billion). In this sense, the reforms implemented in the nineties have been insufficient to overcome the problems inherited from the eighties, or generated in the last decade. It is not a surprise, therefore, that growth has not resumed the bright performance of 1951–80.

2.4 – Explaining Differences in Growth Performance

Summarizing 100 years of economic developments in a chapter or a paper is a daring proposition. Anyone familiar with Brazil and who read the previous pages would certainly identify relevant facts or interpretations that are missing in this summary account. One cannot hope to do justice to the richness of policy initiatives, the interplay of politics and economics, or the influence foreign constraints on economic policy and growth in a few pages. The usefulness of the period breakdown used in the previous description can also be challenged, as may be evident from the fact that outcomes in one period were often the result of policy initiatives or mistakes in previous periods. There are also different interpretations of the facts and decisions described above. Further summarizing these 100 years of economic growth in a few regression statistics would be an outright sacrilege, yet one too tempting to resist.

In this section we look at a number of variables that may account for differentials in growth rates across the six periods analyzed in the previous section, using a cross-country conditional convergence regression estimated with data for 20 Latin American countries in 1960–99 extracted from the GDN data base (www.worldbank.org/research/growth).

In Table 2.15 we present the results of our growth regressions. In all cases the dependent variable is the rate of growth in per capita income, in constant international prices for each decade (1960s, 1970s, 1980s and 1990s). Right-hand-side variables include per capita income, measured in PPP prices as a proportion of US per capita GDP, in the beginning of each decade; inflation; the rate of investment; black market premium; gross secondary enrollment rate and life expectancy in the beginning of each decade; total trade (X+M) as a percentage of GDP; and average terms of trade in each period, as a ratio of the average terms of trade in 1960–99. The rates of investment in 1960, 1960s, 1970s and 1980s were used as instruments for the rate of investment in the 1960s, 1970s, 1980s and 1990s, respectively. To capture the effect of difference in the world environment across the four decades we use the growth rate of world output (PPP prices) in each decade and decadal dummy variables. The regressions are estimated using ordinary least squares (OLS), three-stage least squares (TSLS) and generalized method of moments (GMM) estimators.

The regression results are similar to De Gregorio and Lee's (1999), with two noteworthy differences. First, trade openness has a negative influence on growth, contrary to their finding using an alternative definition of openness. Our coefficient seems to reflect the fact that Latin American countries were in general more open in the eighties and nineties than in the previous decades, and that

therefore lower growth did indeed coincide with greater openness. It may also be the case that greater openness is picking up the effect of a lower degree of industrial development. Second, we omit institutional variables such as democracy and rule of law indices, for these features have varied over time in Latin America and this effect would not be picked up by GDN data bank's fixed country indicators.

Average values of the explanatory variables are presented for each period in Table 2.16 and in Table 2.17 we use our GMM estimators to measure the contribution of each of those variables to growth performance in each period. The main insight from these results seem to be that while the model predicts fairly accurately the differential in per capita GDP growth between 1931–50, 1950–63 and 1981–93 and 1964–80, it performs much poorly in explaining the decline in per capita GDP growth in 1994–2000. A possible reason for that may lie with the human capital variables, which suggest an improvement that is not consistent with the growth in schooling of the labor force.

Table 2.15
Cross Country Regressions with a Sample of Latin American Countries (*)

Variable	OLS 1	OLS 2	TOLS	GMM
Initial Income	-0,0406	-0,0349	-0,0206	-0,0349
	(-2,22)	(-1,92)	(-1,24)	(-6,56)
Inflation	-0,0092	-0,0072	-0,0064	-0,0072
	(-2,10)	(-1,73)	(-2,25)	(-7,20)
Investment rate	0,1421	0,0989	0,0558	0,0526
	(2,82)	(1,98)	(1,01)	(3,88)
Black market premium	-0,0007	-0,0006	-0,0005	-0,0006
	(-1,93)	(-1,97)	(-2,62)	(-9,36)
Terms of trade	0,0131	0,0104	-0,0062	0,0118
	(0,98)	(0,82)	(-0,62)	(3,33)
Trade(X+M)/GDP	-0,0351	-0,0290	-0,0310	-0,0279
	(-3,15)	(-2,71)	(-3,17)	(-9,15)
Secondary enrollment	0,0207	0,0192	0,0243	0,0205
	(1,18)	(1,17)	(1,84)	(5,10)
Life expectancy	0,0513	0,0618	0,0635	0,0830
	(1,00)	(1,23)	(1,38)	(6,02)
World Growth	1,1266			
	(3,47)			
Intercept 60s to 90s	-7,9798	-2,5877		
	(-2,21)	(-0,89)		
Dummy 80s		-2,5702		
		(-4,69)		
Dummy 90s		-2,0661		
		(-3,19)		
Intercept 60s and 70s			-0,5754	-3,1904
			(-0,23)	(-3,91)
Intercept 80s			-3,3872	-5,8385
			(-1,28)	(-6,98)
Intercept 90s			-2,7651	-5,4437
			(-0,99)	(-6,30)

R² (number of observations)				
All	0.52 (72)	0.58 (72)		
1960s			0.25 (14)	0.26 (14)
1970s			0.11 (19)	0.06 (19)
1980s			0.75 (20)	0.72 (20)
1990s			0.33 (19)	0.28 (19)

* Growth in per capita GDP is the explanatory variable in all four models

Table 2.16
Average Value of Explanatory Variables

Variable	1901-30	1931-50	1951-63	1964-80	1981-93	1994-00
Per Capita Income (% USA, PPP)	17,2	17,1	16,8	19,4	25,7	21,2
Inflation	5,1	7,4	29,9	40,1	768,4	10,5
Investment (% of GDP)	12,9	11,8	19,1	21,7	17	16,5
Black Market Premium (%)	0		64,3	14,4	46,5	5,4
Terms of Trade (1960-200=100)	128,1	94,3	130,8	114,3	75,5	99,0
Trade ((X+M)/GDP)	19,9	7,5	18,5	13,9	15,6	15,1
Schooling (secondary enrollment rate)		2,8	5,8	15	33,2	43,2
Life Expectancy		39,8	45,9	52,49	62,8	66,9
World Growth (PPP)	2,2	1,8	4,5	4,5	2,6	3,4

Table 2.17
Contribution to Growth Differentials from Explanatory Variables, with respect to 1964-80

Variable	1901-30	1931-50	1951-63	1981-93	1994-00
Per Capita Income (% USA, PPP)	0,08	0,08	0,09	-0,22	-0,06
Inflation	0,25	0,24	0,07	-5,26	0,21
Investment (% of GDP)	-0,46	-0,52	-0,14	-0,25	-0,27
Black Market Premium (%)	0,01	0,01	-0,03	-0,02	0,01
Terms of Trade (1960-200=100)	0,16	-0,24	0,19	-0,46	-0,18
Trade ((X+M)/GDP)	-0,17	0,18	-0,13	-0,05	-0,03
Schooling (secondary enrollment rate)		-0,25	-0,19	0,37	0,58
Life Expectancy		-1,05	-0,55	0,85	1,20
World Growth (PPP)	-2,6	-3,0	0,1	-2,1	-1,2
Estimated differential in per capita GDP growth		-1,56	-0,67	-5,03	1,45
Actual differential in per capita GDP growth	-3,46	-2,65	-0,91	-6,15	-4,74

3 – PRODUCTIVITY GROWTH IN BRAZILIAN INDUSTRY

This section takes a fresh look at the evolution and determinants of total factor productivity (TFP) growth in Brazil's industrial sector during the 1980s and 1990s. The objective is to identify the factors that shaped observed TFP performance. The analysis focuses on four issues: the impact of trade liberalization, the contribution of knowledge embodied in input quality, the role of resource reallocation across firms and sectors, and the factors and constraints shaping investment decisions.

Unlike most previous empirical studies of TFP in Brazil, which make use of economy- or industry-wide aggregates, this is the first systematic exploration of a large firm-level data set available in Brazil, the *Pesquisa Industrial Annual* (PIA). On *a priori* grounds, microeconomic data offer two important advantages over aggregate data for studying TFP. First, aggregate TFP patterns may conceal diverging trends among different subsectors and/or types of firms. For example, TFP performance may vary systematically with firm-specific characteristics (e.g., size, composition of input mix, etc), and these relations would be masked in aggregate data. Second, measures of TFP growth based on aggregate data mix together firm-level TFP growth with the effects on TFP of reallocation of inputs and outputs across microeconomic units with different productivity levels (through channels such as changing market shares of incumbent firms or entry and exit of firms).²⁴ With disaggregated data it is possible to disentangle the contribution to overall TFP performance of these two conceptually distinct forces.

In the case of Brazil, however, the microeconomic data also pose major challenges concerning the coverage, consistency and reliability of the information. PIA presents methodological breaks that hamper comparability of the data across different time periods, lacks information on the utilization of productive inputs—even on capital stocks after 1995—and much of its time coverage corresponds to years of extreme inflation, which complicates considerably the construction of variables. While we have made a major effort to correct some of these shortcomings, and we believe that we have been largely successful in limiting the extent of measurement error embedded in our TFP estimates, the empirical results reported below should be taken with caution.

This section draws extensively from Muendler (2001a, b). It is organized as follows. First, we provide an overview of a selected group of earlier studies of productivity growth in Brazil. We then lay out the methodological approach to the estimation of TFP with firm-level data, and summarize the main features and problems of our data set. We then describe the patterns of the resulting TFP estimates over time, across industrial sectors, and across geographical regions. Finally we examine the factors behind the observed TFP performance to shed light on the issues under investigation and conclude.

3.1 – Previous Studies

The evolution of productivity in Brazil has been the focus of a number of empirical studies. Some are concerned with productivity at the aggregate (GDP) level, while others focus on the industrial sector as a whole, or on specific subsectors. Among the former group, several studies offer cross-country results and therefore allow a comparative perspective on Brazil's productivity performance. Table 3.1 summarizes the results of some recent empirical analyses. Among aggregate-level studies, De Gregorio and Lee (1999) estimated a TFP growth rate for the period 1960–90 of 0.80 percent (below the average in Latin America). When they considered the decade of the 1980s only, however, they found that the Brazilian economy experienced a negative TFP growth of -1.40 percent. In turn, Bonelli and Fonseca (1998) found average TFP growth of 0.1 percent in the period 1980-89, and 0.2 percent over 1990-97. Using data for a much longer period, Hofman (2000) estimates a TFP growth rate of 2.60 percent for Brazil in 1950-89. This contrasts with the earlier results in Elías (1990), who finds a much lower TFP growth rate (0.8) over a similarly long period, 1940–90. Over the 1990s, however, Hofman finds that TFP growth slowed to 0.10 percent (similar to the results of Bonelli and Fonseca), although with a considerable acceleration (to 0.70 percent) after 1992.

²⁴ This reallocation effect may be particularly important for the short-run evolution of aggregate TFP: see Jorgenson (1990).

Finally, two of the most recent studies of aggregate TFP, by Teixeira da Silva (2001) and Gomes (2001), find a similar pattern of fall and recovery in spite of using different methodologies and data. According to the results of Teixeira da Silva, TFP fell at an annual rate of -0.70 percent over 1980-92, and then rose at an average rate of 0.9 percent over 1993-2000. Moreover, aggregate labor productivity is found to display a very similar pattern. In turn, Gomes finds a similar turnaround in TFP growth, from 0.6-0.7 percent in 1985-89 to 4.7-5.7 percent in 1991-98, with the exact figure depending on the specific method used.

In turn, studies of TFP in Brazil's industry vary considerably in terms of coverage. Among the earliest studies, Braga and Rossi (1988) analyzed factor productivity for 21 sectors in industry for the period 1970-83 using a translog production function. They found that 10 of the 21 sectors had experienced negative TFP growth rate in this period.²⁵ Bonelli (1992) used a growth accounting method to estimate TFP growth in manufacturing between 1975-85 using data from the industrial census of 1970, 1975 and 1980. He found average TFP growth in manufacturing of 0.80 percent yearly. In his study, only leather, pharmaceuticals and furniture presented negative TFP growth rates. The economic reforms of the 1990s renewed interest in estimates of TFP in manufacturing. Bonelli and Fonseca (1998) estimate TFP growth for overall manufacturing and for 21 individual sectors. At the aggregate manufacturing level, they calculate a negative TFP growth rate of -0.73 percent in the 1980s. For the 1990s, in contrast, they find positive TFP growth of 3.4 percent per annum. Likewise, Rossi and Ferreira (1999) calculate TFP and labor productivity for 16 industrial sectors in the period 1985-97. They find that TFP and labor productivity growth accelerated for virtually all sectors after 1991. On average, TFP grew at 2.2 percent in 1991-97, while in 1985-90 it had declined at an annual rate of -2.5. Finally, the study by Gomes (2001) cited above also reports estimates of aggregate industrial TFP that display a similar acceleration in the recent period: according to this study, annual TFP growth rose from 0.4 percent in 1976-89 to 3.4-4.4 percent in 1991-98.

How does this performance compare with that of other countries? The development in recent years of several large international data sets has made it possible to compare the growth experience of a substantial number of countries by employing a transparent methodology. A review of these studies is presented in Table 3.2. Elias (1990) presents TFP growth for a group of seven Latin American countries for the period 1940-90. Among them Brazil shows TFP growth below the Latin America average, and below Chile's and Mexico's TFP growth. De Gregorio and Lee (1999) examine TFP growth for a larger sample of Latin American countries (21) for the years 1960-90, a shorter time span than Elías (1990). They find Brazilian TFP growth higher than average for Latin America.

Latin America TFP grew in the 1960s at 1.9 percent per annum, in the 1970s at 0.7 percent and in the 1980s at -2.0 percent per annum. Brazil's TFP growth rates in the 1960s, 1970s and 1980s were 1.5, 2.5 and -1.4 percent respectively. To sum up, Brazil's TFP growth (decline) was above (below) Latin America's TFP growth (decline) in the three decades covered by De Gregorio and Lee study, with the exception of the 1960-69 period. Brazil's 1970s TFP growth was almost three times the Latin American average. Finally, Nehru and Dhareshwar (1994), using a sample of 83 industrial and developing countries for the period 1960-87, obtain an average TFP growth for Brazil, Chile and Mexico of 1.39, 0.37 and 0.68 percent per annum respectively. These figures are higher than the ones observed in the studies of Elías (1990) and De Gregorio and Lee (1999) with a smaller sample of countries. Moreover, Brazil's TFP growth is higher than the average TFP growth for the OECD and Latin America countries in the same period.

It is interesting to compare the performance of *industrial* TFP in Brazil with other countries. Jorgensen and Stiroh (2000) report TFP growth for 37 industries in the United States using a growth accounting methodology for the period 1958-96. Industry-wide TFP grew 0.48 percent per year over this period. However, industrial TFP growth ranged from 1.97 percent in Electronic and Electric Equipment to -0.44 percent in Printing and Publishing. Nine industries experienced negative productivity growth for a period of nearly 40 years.

²⁵ Another early study is that of Pinheiro (1989), based on firm-level data from the 1970 and 1980 census.

Table 3.1
Some Recent Studies of Productivity Growth in Brazil

Authors	Aggregation Level	Period	TFP Growth (annual)	Labor Productivity Growth (annual)		
Bacha and Bonelli (2001)	GDP	1940-00	0.32			
		1970-80	0.09			
		1980-91	-2.28			
		1991-00	1.73			
	Industry (excluding construction)	1950-99			3.38	
		1980-91			0.47	
1991-99			4.80			
Bonelli and Fonseca (1998)	GDP	1980-89	0.10			
		1990-97	0.20			
	Transformation Industries	1989-89	-0.73			
		1990-97	3.38			
	General Industry	1992-97				9.59
	Textiles					6.20
Non-metallic mineral products			11.46			
Castelar Pinheiro (1989)						
De Gregorio and Lee (1999)	GDP	1960-90	0.80			
		1980-89	-1.40			
Elías (1990)	GDP	1940-90	0.80			
Gomes (2001)	GDP	1975-98	0.56	0.21-0.3		
		1975-89		0.14-0.12		
	Industry	1990-98	3.2-4.07	0.39-0.46		
Hofman (2000)	GDP	1950-89	2.60	3.90		
		1990-98	0.10	0.40		
		1992-98	0.70	1.00		
	Industry	1976-89	0.37	3.76		
		1986-98	0.78-1.37			
		1976-98				
		1986-98				
					3.5-4.7	

Table 3.2
International Studies of TFP Growth

Authors	Aggregation Level	Period	TFP Growth (annual)		
Collins and Bosworth (1996)	GDP	1960-94			
	Latin America			0.2	
	East Asia			1.1	
	Taiwan			2.0	
	Korea			1.5	
United States	0.3				
De Gregorio and Lee (1999)	GDP	1960-90			
	Latin America			0.1	
	Argentina			-0.5	
	Brazil			0.8	
	Chile			0.9	
	México	0.5			
	Latin America	1960-69			
	Argentina				1.9
	Brazil				0.7
	Chile				1.5
	México				1.6
	Latin America	1970-79			
	Argentina				2.3
	Brazil				0.7
	Chile				0.6
	México				2.5
Latin America	1980-89				
Argentina				0.5	
Brazil				1.2	
Chile				-2.0	
México				-2.6	
Elías (1990)	GDP	1940-900			
	Latin America			1.2	
	Argentina			0.5	
	Chile			1.4	
	Colombia			0.8	
	Mexico			1.1	
Nehru and Dhareshwar (1994)	GDP	1960-87			
	Latin America			0.13	
	Brazil			1.39	
	Chile			0.37	
	Mexico			0.68	
	OECD			0.76	

Liang and Jorgenson (1999) present industry TFP growth using a translog production function for Taiwan, in the period 1961–93. TFP growth of the manufacturing sector increased from 0.2 percent per annum during 1961–82 to 0.55 percent during 1982–93, and 0.32 percent for the whole period. In the period 1961–82, the highest TFP growth was in Electrical Machinery and Electronics with a 5.44 percent per annum followed by textiles and food. The laggards were wood and furniture products with -12.35 percent per annum and Paper and Printing with -8.66 percent.

In Latin America, the World Bank (1999) presents TFP growth for manufacturing in Mexico for 1993–97. Between 1993 and 1995 TFP growth accelerated from 0.6 percent per annum to 13.8 percent. Subsequently TFP growth rates declined to 1.3 percent in 1995–96 and to -3.9 percent in 1996–97. TFP growth estimated at the two-digit industry show two groups. The first group—Food, Textiles and Apparel, Wood Product and Furniture and Clay and Cement Products—has lower TFP growth than the industrial average. The second group—Paper and Printing, Chemicals, Metals, Machinery and Other Industries—has higher rates of TFP growth.

On the whole, the international evidence suggests that (i) productivity growth in Brazil has lagged behind that of East Asian economies in recent decades, but was roughly on par with that in the rest of Latin America; (ii) Brazil, like other developing economies, experienced a TFP acceleration in the 1990s, after its disappointing performance during the 1980s; and (iii) industrial TFP growth in Brazil, as well as in other developed and developing countries, varies widely across sectors, and negative TFP growth rates at the sector level are often encountered in existing studies.

Several of the Brazil studies offer hypotheses—and a few studies actually test some of them—regarding the reasons behind this time path of TFP. We should note that one likely reason behind the recovery of TFP in the 1990s in Brazil (as well as other Latin American economies) is the procyclicality of productivity estimates, that tend to follow the pattern of recession in the 1980s and recovery in the 1990s experienced by many economies in the region.

This is particularly clear from the annual TFP growth figures underlying the period-average TFP growth rates in Brazil to which we have referred so far. These figures display large swings from year to year, tracking closely the economy's annual growth performance. For example, most estimates show abrupt TFP declines in the severe recessions of 1983 and, especially, 1990 (Teixeira da Silva 2001, Gomes 2001, Bonelli and Fonseca 1998).²⁶ Indeed, estimated TFP growth is strongly correlated with the growth rate of the corresponding value added aggregate, whether at the economy-wide level (GDP) or the industrial level (industrial GDP). For example, Gomes (2001) reports that the correlation between his estimates of aggregate TFP growth and observed GDP growth is in the range 0.72–0.76, while for industrial TFP the correlation is even higher, 0.86–0.88. This procyclicality reflects in part measurement error regarding the utilization of labor and capital, for which no good proxies exist in the Brazilian case, as well as the possible action of economies of scale unaccounted for in the methodologies underlying the TFP estimates in the available studies.

But there are also other factors at play behind this dynamic pattern. First, the decline in macroeconomic instability in the 1990s relative to the preceding decade, particularly reflected in the containment of inflation after 1994, likely played an important role in the recovery of TFP, by facilitating investment decisions and restoring the informational value of relative prices to guide resource allocation, as argued by Teixeira da Silva (2001) and McKinsey (1998). Secondly, the structural reforms of the 1990s, which strengthened the role of domestic and foreign competition, have also been underscored by several studies, which have emphasized the impact on TFP of the lowering of foreign trade barriers that took place over the last decade (Hay 1997, McKinsey 1998, Rossi and Ferreira 1999, Gomes 2001). The decline in public infrastructure investment as part of the fiscal crunch of the 1980s, and the action of labor regulations constraining firms' ability to shed labor (and hence their willingness to employ it) are also among the reasons that have been offered to explain the productivity slowdown of the 1980s. These are explored in some detail in McKinsey (1988), which concludes that they did not play a major role in the observed time path of TFP in Brazil. We shall revisit these issues below.

²⁶ For this reason, Gomes (2001) excludes the year 1990 when computing period averages of TFP growth.

3.2 – Estimation Technique

The analytical approach underlying our estimations of TFP is described in detail in Muendler (2001a). The approach is based on the estimation of sector-specific Cobb-Douglas production functions relating output to capital, intermediate materials and skilled and unskilled labor:

$$y_{it} = \beta_k k_{it} + \beta_{bl} l_{it}^{bl} + \beta_{wh} l_{it}^{wh} + \beta_m m_{it} + \omega_{it} + \varepsilon_{it} \quad (1)$$

Here y denotes real output, k is capital, m are materials and l is labor input, with the superindices bl and wh respectively denoting the unskilled and skilled categories (more precisely, blue and white-collar in our case). All variables are expressed in logs, and the subscripts i and t refer to the firm and period, respectively. (Log) TFP is measured by the composite error term, which consists of a serially correlated productivity index ω observed by the firm, and an unobservable random technology shock ε . Estimation of (1) using firm-level data poses two well-known problems. The first is that firms choose their inputs on the basis of the observed productivity index ω , which renders the right-hand side variables endogenous and requires an instrumental variable procedure for consistent estimation of the β s. The second, related problem is that firms' entry and exit decision will likewise depend on their level of productivity; this means that at any given time the available sample of firms suffers from selection bias, owing to the exit of the least productive firms and the entry or survival of the most productive ones. The estimation procedure adopted here follows that of Olley and Pakes (1996) and is designed to overcome the simultaneity and selection problems when estimating production functions. In this manner, we can recover from estimation of (1) firm-level values of TFP and hence its growth rate. To arrive at sector- or industry-wide TFP growth estimates, which often are of direct interest, it is important to note that aggregate TFP change between two periods can be decomposed into four ingredients:²⁷ (i) the TFP growth of incumbent firms, given their size (i.e., given their respective shares in total output); (ii) the change in size of incumbent firms, given their respective TFP levels; (iii) the TFP level of new entrants; (iv) the TFP level of exiting firms.

To assess the factors behind observed TFP performance, we rely mainly on a regression framework relating TFP, as estimated from (1) above, to a set of explanatory variables that summarize firm and sector characteristics. The basic specification is of the form

$$\omega_{it} = \mathbf{x}_{it} \delta + \alpha_i + u_{it} \quad (2)$$

where \mathbf{x} is a vector of explanatory variables, δ are the parameters to be estimated, α is a firm-specific time-invariant effect and u is a random disturbance. In the experiments reported below, parameter estimates for equation (2) were obtained using fixed-effects regressions, since Hausman tests rejected the random effects specification.

In addition to (2), we also estimated specifications with the dependent variable in first differences, to assess the effects of different factors on TFP growth. In these equations the explanatory variables were lagged one period, since the objective is to examine the role of firm and sector features on subsequent TFP growth performance. For both the level and difference regressions we checked for residual autocorrelation using the technique developed by Baltagi and Wu (1999), devised to control for time gaps in the sample (e.g., the unavailability of PIA in 1991) in unbalanced panels. In general we found no evidence of serial correlation.

3.3 – Data

Our source of firm-level data is the *Pesquisa Industrial Anual* (henceforth PIA), an annual survey of manufacturing firms²⁸ administered by the Brazilian census bureau since 1986, and available until 1998 (with the exception of 1991, in which no survey was conducted). The survey is biased towards

²⁷ The decomposition we use follows along the lines of Baily, Hulten and Campbell (1992).

²⁸ PIA contains also plant-level data, although much less comprehensive than the firm-level data used here.

medium and large firms, and thus cannot be viewed as representative of the manufacturing sector as a whole, which includes a very large number of small firms. The features of PIA are described in detail elsewhere (Muendler 2001b), so that here we will limit the discussion to a few key issues.

Sample: The sampling method, and thus the representativity of the sample vis-à-vis the universe of larger industrial firms, has changed over time. When the survey was first launched, it included all of the largest manufacturing firms, plus a random sample of medium-sized ones, and a non-random selection of (large) new entrants. Over the years, all surviving originally-surveyed firms remained in the sample, while the inclusion of new entrants was discontinued in 1993. Exit of old firms and absence of new entrants has reduced the representativeness of the sample. Furthermore, in 1996, almost a third of the original sample was dropped from the PIA records due to a change in sampling method. As a result, the data before and after 1995 are not strictly comparable.

Measurement issues: PIA contains income statement and balance sheet data, plus information on a few economic variables: among them, number of workers and investment flows. These data pose some measurement problems for TFP estimation.

Only the number of workers (by white and blue-collar) is available, not hours worked. No information is available on utilization of the capital stock, a common problem with firm-level data. As a result, standard estimation procedures such as ours will incorrectly identify as TFP changes any output fluctuations derived from varying utilization of labor (and capital) inputs. As hours worked are procyclical, our TFP estimates will tend to behave procyclically as well, although this seems to be less of a problem with our data than in earlier studies.²⁹

Brazil's high inflation environment during the period of analysis introduces difficulties for the calculation of real output and intermediate input series. These series must be constructed from income statements, which are reported in nominal terms. Hence the task requires price deflators for outputs and intermediate inputs. In the absence of firm-level price data, it is customary to use sector-level price indices. In our case, the measurement error generated by the use of approximate deflators is likely to be magnified by the relative price volatility that usually accompanies extreme inflation,³⁰ as well as by the fluctuation in output sales, input purchases, and inflation over the year. Considerable effort was devoted to the construction of adequate sector-specific price indices for input purchases, and a number of alternative deflators were considered for output.³¹

Construction of the capital stock poses similar difficulties. Up to 1994, our capital stock figures are mainly based on balance-sheet data (which typically include an adjustment for inflation based on government-mandated price indices that tended to understate actual inflation). The situation is more complicated after 1995, because PIA ceases to include balance-sheet data and capital-stock figures for later years must be constructed on the basis of investment flows. As with value added, considerable efforts were made to arrive at suitable deflators for investment and the capital stock; yet measurement error is still likely to remain in the constructed capital stock series.

In summary, these measurement problems³² imply that the TFP estimates reported below should be interpreted with caution. But it is also worth noting that in the context of regressions such as (2) much of the measurement problem error is likely to wash out. Measurement error in the dependent variable should not affect the consistency of parameter estimates provided the measurement error is uncorrelated with the right-hand side variables. If this latter condition is met, the inferences drawn from estimation of equations like (2) regarding the determinants of TFP should remain valid even if TFP itself is measured with error.

Sample selection and aggregation: Firms in the sample were grouped into sectors according to their 2-digit level industrial classification—the so-called *Nível 50* classification—which comprises a total of 27 industrial sectors accounting for roughly two-thirds of total industrial value added in the

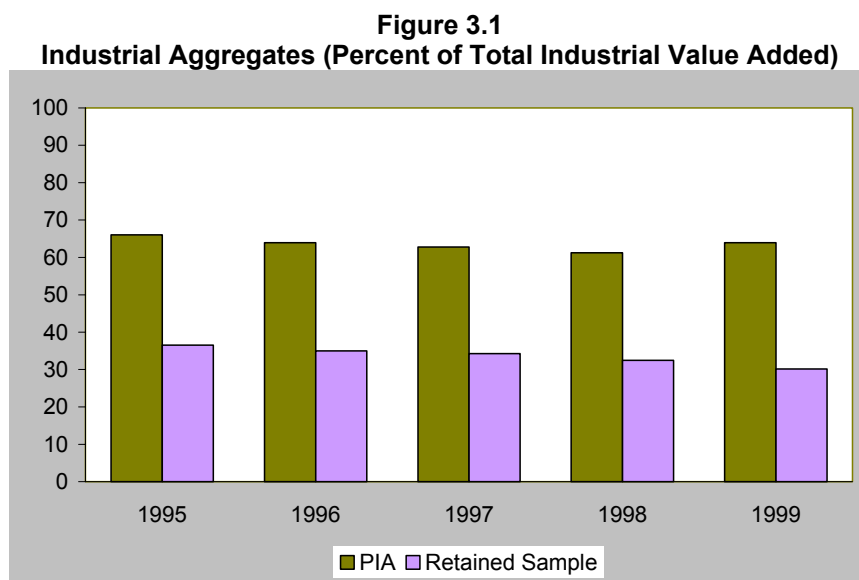
²⁹ There are reasons other than measurement error why productivity should be procyclical; see Basu and Fernald (2000). However, in our data these are very likely of secondary importance relative to that mentioned in the text.

³⁰ For the Brazilian case, see Fava and Cyrillo (1999).

³¹ The results reported in this draft make use of the sectoral WPI. See Muendler (2001b) for extensive details on the efforts made to construct appropriate deflators for output, intermediate inputs and capital.

³² We should also note that, like many other firm-level studies, we also lack information on input quality -- other than the crude distinction between blue- and white-collar workers. One should keep in mind that changing input quality has been shown to be a major factor behind TFP growth; see Jorgenson (1990) and Gu and Ho (2000) for some illustrative figures for the US and Canada.

late 1990s.³³ For most of the empirical analysis, however, only thirteen sectors possessing the largest number of firm-year observations were retained.³⁴ In the late 1990s, these thirteen sectors accounted for about half of the value added by *Nível 50* industry, or about one-third of value added in overall industry (Figure 3.1). Equation (1) was separately estimated for each of these thirteen sectors.



3.4 – Pattern of TFP Growth

Figure 3.2 plots the estimated (log) TFP series for all (*Nível 50*) industry, as well as that corresponding to the 13 sectors under consideration. In addition, for comparison the figure presents the industry-wide log TFP series estimated by Gomes (2001) on the basis of data from PIM (*Pesquisa Industrial Mensal*³⁵). For comparability, all three series are rebased to equal 1 in 1986.

The time pattern of our firm-level data estimates of TFP is qualitatively similar to that found by most of the studies summarized in section 2 above: TFP experiences a declining trend in the late 1980s and then recovers in the 1990s. However, the amplitude of this cycle is very small, and on the whole the figure suggests that Brazil's industry-wide TFP has shown little change over the period of analysis. This conclusion is further strengthened if we ignore 1990, in which the severe recession that accompanied the Collor Plan results in a largely artificial collapse of measured TFP due to the sharp decline in labor and capital utilization.

As Figure 3.4 also shows, until 1995 the PIA-based TFP estimates display a time pattern similar to that of Gomes' (2001) PIM-based estimates, but the volatility of the former is much smaller than that of the latter. This suggests that the PIA-based estimates may be less subject to measurement error, and hence display less procyclicality, than the estimates obtained by Gomes. After 1995, however, the two sources yield divergent TFP estimates, with those of Gomes showing a steep increase that is absent from the estimates obtained here.

³³ *Nível 50* excludes 5 sectors included in overall industry: Minerals, Oil and gas, Other industries, Utilities and Construction. The latter is by far the largest, accounting for nearly 10 percent of GDP.

³⁴ 2,500 at a minimum.

³⁵ Unlike PIA, whose unit of observation is the firm, PIM is based on production-line data (although the study by Gomes cited in the text is based on aggregated PIM information, rather than the raw data). While PIM's sample size is smaller than PIA's, PIM contains information on hours worked, so that utilization can be taken into consideration in the analysis. See Gomes (2001) for details.

Figure 3.2
Industry-wide TFP, 1986–98

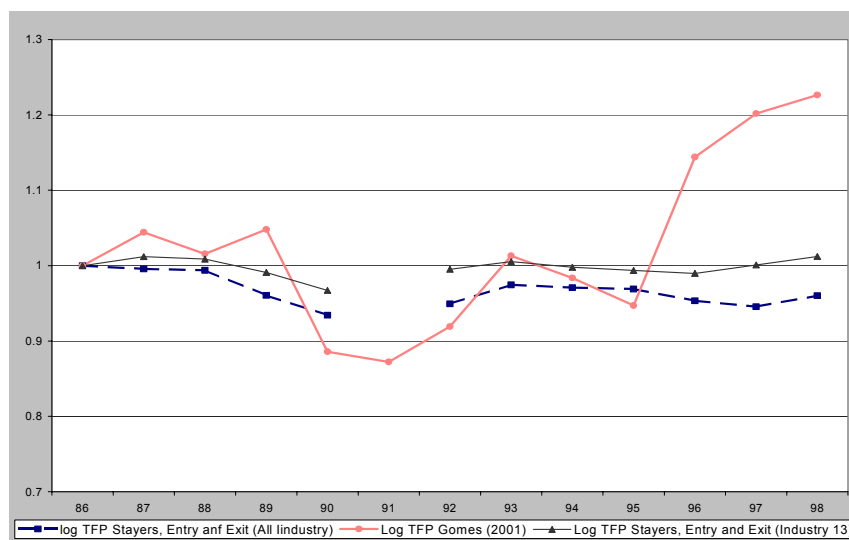
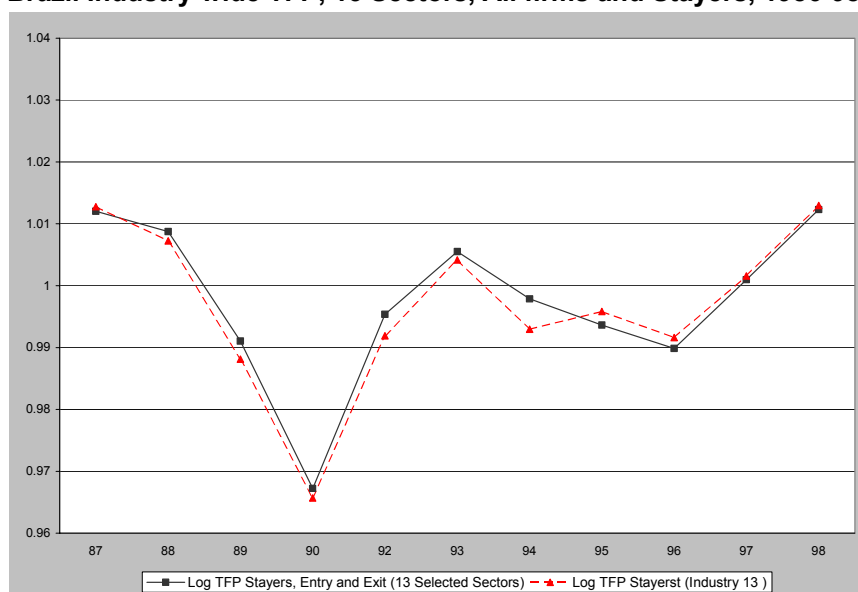


Figure 3.3
Brazil Industry-wide TFP, 13 Sectors, All firms and Stayers, 1986-98



As noted earlier, aggregate TFP growth reflects resource reallocation across firms in the form of exit by old firms, entry by new ones, and changes in the productivity of staying firms (with this latter component in turn including both productivity changes at the firm level and changes in the relative size of staying firms).³⁶ Using PIA, we can separate the effects of entry and exit from the change in the TFP of the group of staying firms. The results of this decomposition are displayed in Figure 3.3, which compares the time path of aggregate TFP for the 13 sectors of analysis with the one that results from ignoring entrants and exiters. The two series move very closely together; the biggest

³⁶ The importance of these reallocation effects for aggregate measures of TFP has been amply documented – e.g., by Jorgenson (1990) at the macroeconomic level and by Olley and Pakes (1996) at the firm level.

gap between them arises in 1994, but its magnitude is negligible. This is essentially a reflection of the limited role of entry in the PIA sample.

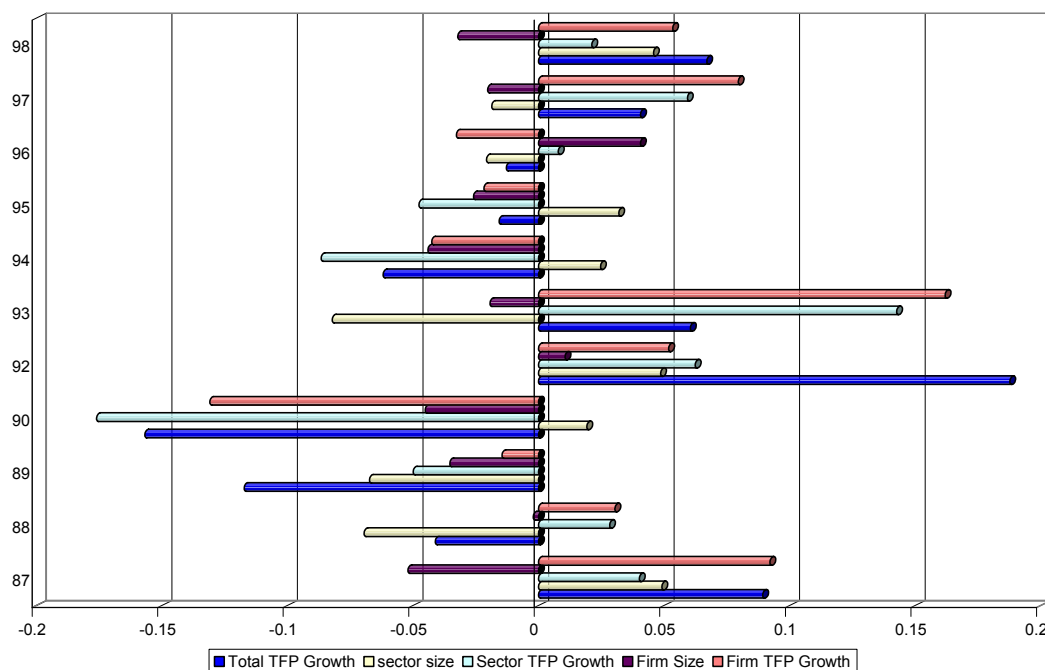
In sum, our estimates agree with previous results in that they show a recovery of TFP in the 1990s, but disagree in that they also show much less TFP variation over time than earlier estimates. Table 3.5 condenses the information in Figure 3.3 into the average TFP growth rate over the 1980s and 1990s in the PIA data; for comparison the figures from Gomes (2001) are also presented. In the 1980s, TFP declined at an annual rate of 0.8 percent (0.3 if 1990 is ignored) for the 13 sectors of analysis, and 1.6 percent for overall industry (1.3 without 1990). In the 1990s, however, TFP grew at positive (albeit modest) rates, 0.3 percent per annum for the combined 13 industrial sectors on which we focus, and 0.2 percent for overall industry.

Table 3.5
Brazil Industry-wide annual TFP Growth, 1987-98

	13 Selected Sectors	All Industry (Nivel 50)	Gomes(2001)
1987-89	-0.29	-1.30	1.67
1987-90	-0.81	-1.62	-2.49
1991-98	0.29	0.19	5.99
1987-98	0.10	-0.33	2.12

Figure 3.4
Decomposition of TFP Growth among Stayers by Sector, 1987-98

DECOMPOSITION OF TFP GROWTH AMONG STAYERS 1987-98



As mentioned earlier, the evolution of aggregate productivity of staying firms reflects two forces: the time path of firm-level TFP, and the changes in firms' relative size. It is useful to examine the contributions of both factors. The decomposition is provided by Figure 3.4, which for each year in the sample shows the contribution to TFP growth from firm-level TFP and changing firm and sector size. It is apparent that firm size changes actually *detracted* from aggregate productivity in most years, with the only exceptions being 1992 and 1996, while sector size changes had a more mixed contribution to observed TFP growth. This seems to suggest that resource reallocation proceeded in a way harmful to aggregate productivity: we shall return to this issue later on.

The patterns of TFP growth across sectors, underlying these aggregate figures from PIA, are summarized in Table 3.6. We report only average TFP growth rates over the same sub-periods as in the preceding table and the figures include only the group of staying firms for the 13 sectors under consideration. The period to 1990 was characterized by a TFP slump in virtually all sectors, with the only exception being Other Metallic Products, which exhibited positive TFP growth during the late 1980s. The worst performance came in Apparel and Wood and Furniture, for which the estimated TFP decline is very large. Again, exclusion of 1990 would considerably reduce the magnitude of some of these seeming TFP declines, but would not reverse them. In the 1990s, by contrast, nine out of 13 sectors experienced positive TFP growth, at especially high rates in Electrical Equipment and Vehicles and Parts. Four sectors continued to experience a TFP slump in the 1990s: Food, Textiles, Leather, and Non-Metallic Minerals.

This pattern is broadly similar to that reported by Rossi and Ferreira (1999) using aggregate PIA data. They also report a uniform TFP decline in 1985–90, followed by a uniform increase in 1991–97. Furthermore, in their results the Vehicles and Parts sector is also the recent performance leader, with the Electrical Equipment sector among the top performers as well.³⁷ The rapid productivity gains achieved by the Vehicles and Parts sector in the 1990s are also documented in McKinsey (1998), which traces them to trade opening in the 1990s.

Finally, we examine the patterns of TFP growth from a regional perspective. For this purpose, we divide the country into three geographical regions: São Paulo, the South plus the rest of the Southeast, and the North and Northeast. It is important to note from the outset that these regions differ considerably in terms of the size of their industrial sectors. In 1997, São Paulo contributed 44 percent of Brazil's industrial value added. Adding the South and the rest of the South East, the figure rises to 85 percent. The North and Northeast regions account for the remaining 15 percent. Furthermore, the three regions also differ considerably in terms of the sector composition of their industries. Since not all sectors are significantly represented in every region, we focus on industry aggregates. Until 1990, the profile is fairly homogeneous across regions: all experience declining TFP. In the 1990s, however, a large gap opens between the Northeast, which experiences a further abrupt decline in TFP in 1994–95, and the other two regions, which show rising TFP, especially rapid in the South and Southeast region. This contrasting regional performance likely reflects the limited presence in the Northeast of the industrial sectors that were the TFP performance leaders in the 1990s (such as Cars and Parts and Electrical Equipment).³⁸

³⁷ They also find rapid TFP gains during 1991-97 in the Chemical sector, which is not included in our analysis. We should note, however, that our sectoral TFP performance rankings are fairly different from those reported by Gomes (2001), who uses National Accounts data on industrial value added by sector. He reports negative TFP growth over 1990-98 in 8 out of our 13 sectors. This might reflect his inclusion of the year 1990 in the period of analysis. In that year, most sectors display a TFP decline, which basically reflects the deep recession that took place. Nevertheless, Gomes also finds that the Automobiles sector was the at the top in terms of TFP growth in the 1990s.

³⁸ Indeed, if we perform the same exercise but including all industrial sectors – rather than the 13 in the text – the estimated TFP performance of the Northeast compares much more favorably with that of the other regions.

Table 3.6
TFP Growth by Sector

	1987-90	1991-98	1987-98
Non Metallic Mineral Products	-7.77	-1.16	-3.56
Other Metallic Products	1.17	1.15	1.16
Manufacturing and Maintenance of Machinery	-5.42	3.06	-0.02
Electrical Equipment	-3.32	12.07	6.48
Wood and Furniture	-12.94	0.43	-4.43
Paper, Pulp and Cardboard	-0.02	2.83	1.80
Plastics	-5.76	0.14	-2.01
Textiles	-1.25	-2.06	-1.77
Apparel	-16.73	6.05	-2.23
Leather Products and Footwear	-0.79	-2.34	-1.78
Processed and Edible Products	-7.31	0.03	-2.64
Food and Beverages	-3.06	-4.10	-3.72
Vehicles and Parts	-3.34	6.95	3.21

3.5 – Policy, Structural Factors and TFP Growth

We next study the policy and structural factors shaping TFP performance using TFP estimates constructed above. The ultimate objective is to assess how selected aspects of the policy and regulatory framework have affected the evolution of Brazilian industrial firms over the last decade. Specifically, we focus on four broad questions:

Trade Barriers: how has the changing exposure to foreign competition affected firm productivity? Did the decline in protection witnessed during the 1990s encourage TFP improvements?

Knowledge: what has been the role of knowledge embodied in physical and human capital in promoting firm productivity? Has the latter been positively affected by the availability and use of foreign equipment—which may embody the latest technology available in world markets—information technology, and human capital?

Resource Allocation: how do firm size and TFP relate to each other? Do newer firms bring in higher-productivity techniques? Does higher capital intensity of production result in higher or lower TFP? Did the regulatory environment result in resource reallocation towards the most productive firms? How did the rules and regulations that constrain labor adjustment affect firm performance? Did they pose a significant burden to those firms seeking to downsize their operation?

Physical Capital and Investment: was insufficient investment an obstacle to productivity improvement? What factors constrained firms' ability to expand their capital stocks?

To address these issues, we rely mainly on the results from the multivariate regressions introduced in section 3 above. To avoid omitted variables bias, we include explanatory variables that attempt to capture the various factors affecting TFP. Thus, to reflect the changing exposure of domestic producers to foreign competition, we include in the regressions the value added-weighted nominal tariff rates by sector constructed by Kume, Piani and Souza (2000); the real exchange rate; the sector-specific degree of local market penetration by foreign exporters (defined as the ratio of

imports over total final uses for each sector's goods, based on Ramos and Zonnenschain 2000), and the firm-specific ratio of exports to total sales. Next, regarding the impact of embodied knowledge, we examine the effects on TFP of the composition of capital and labor inputs. Regarding capital, we focus on the ratio of used machinery to all machinery and the ratio of imported machinery to the all machinery. For labor we examine the effects of the white/blue collar composition of the labor force as a proxy for its skilled/unskilled composition.³⁹ Regarding resource allocation, the available regressors are the capital/labor ratio, the age of the firm and its size. The latter is measured by both value added and output. For size and age we allow nonlinear effects by including quadratic terms.⁴⁰

Not all regressors are available in every year. The composition of the capital stock (foreign and used machinery, as well as computers) is available in 1986–95. The export ratio to sales is unavailable prior to 1989. The only observations for which all candidate regressors are simultaneously available are 1989–95.⁴¹ For this reason, we present two sets of results, for the periods 1989–98 (excluding variables describing the composition of capital) and 1989–95 (including them). Descriptive statistics for the dependent and independent variables are shown in Table 3.7.

The parameter estimates from the regressions appear in Table 3.8. Note that on the whole the regressions possess satisfactory explanatory power given the huge sample sizes, especially in the case of the equations with TFP level as the dependent variable. Nevertheless, the R-squared measures suggest that unobserved factors are responsible for much of the variation in TFP and its growth rate. The estimated parameters are in all cases significant jointly, as implied by the Wald statistics. Finally, these regression results should be interpreted with caution, since we cannot rule out the possibility of reverse causation from TFP to some of the regressors: e.g., high tariffs might result from successful lobbying by low-productivity firms, rather than the other way round.

Trade Barriers. Liberalization proceeded in four stages (Kume, Piani and Souza 2000). In 1987–89, reforms sought primarily the removal of numerous redundant tariffs. The (value-weighted) average effective tariff declined from 68 to 39 percent. In the second stage (to 1993), non-tariff barriers were removed—leaving tariffs and the real exchange rate as the main protection instruments—and tariffs reduced, bringing the average effective tariff down to 15 percent. Next, in 1994, with the advent of the *Real Plan*, the process of tariff reduction sped up, and the average effective tariff fell to 12 percent. Finally, in 1995–98, a partial reversal took place. First certain rates were raised (automobiles, consumer durables, textiles), and then a generalized 3 percent increase was imposed, so that the effective rate rose back to an average of 15 percent.

Figure 3.5 plots the time path of the average nominal tariff, with and without adjustment for the protection accorded by the level of the real exchange rate, as well as the degree of foreign market penetration (as defined above), with all variables corresponding to the overall industry average. The steep decline in protection after 1989 is apparent from the figure, as is the partial reversal of the reform after 1995 and the steady increase in foreign penetration. This general framework conceals significant variation across sectors. One interesting experience is that of the automobile and car parts industry, which prior to liberalization enjoyed one of the highest nominal protection rates, as well as the highest effective protection rate throughout the reform period (Kume, Piani and Souza 2000). In this case the pattern of abrupt tariff decline and reversal is particularly striking, as is the steady increase in foreign penetration in spite of the partial rollback of the tariff cuts in the late 1990s.

³⁹ For 1996–98 PIA also includes information on the ratio of foreign materials to total materials used. In these years, however, the composition of the capital stock is not available. Nevertheless, we performed some additional regressions using only 1996–98 data, to assess the effect of the composition of intermediate goods on TFP and its growth rate. The results were never significant, and we do not report these regressions in the text.

⁴⁰ In addition, the regressions include regional dummies, invariably insignificant and hence not reported below, and the inflation rate, to control for cyclical factors, rather than the effect of inflation itself. We regard its coefficient as uninformative and ignore it. In addition, we performed additional experiments to assess the determinants of firm size change, the effects of labor regulations, and the determinants of investment. These experiments are described in detail in Muendler (2001b).

⁴¹ Ignoring the information on the composition of intermediates available for 1996–98 only.

Table 3.7
Descriptive Statistics for Alternative Samples

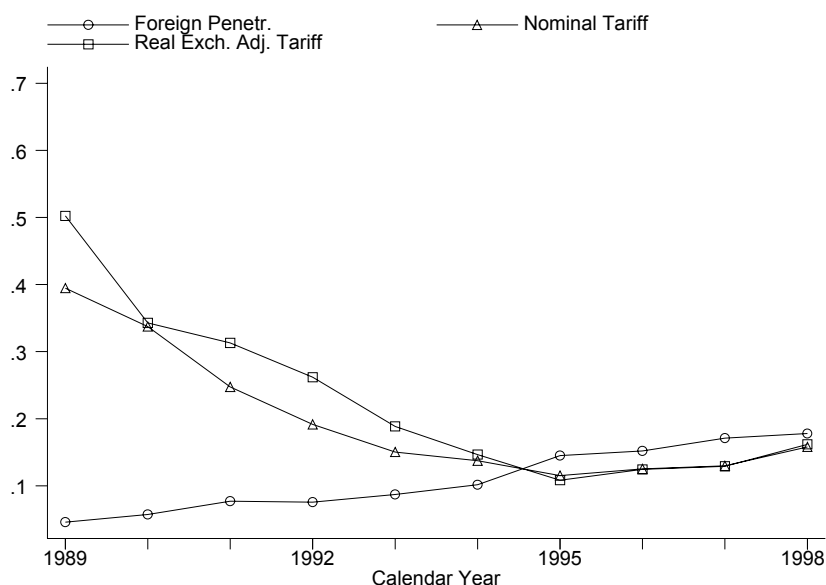
	TFP				TFP growth			
	1989-98		1989-95		1989-98		1989-95	
	Mean	Std. Dev.	Mean	Std. Dev.	Mean	Std. Dev.	Mean	Std. Dev.
Trade								
Tariff	0.2288	0.1470	0.2125	0.1315	0.2110	0.1384	0.1978	0.1186
Real Exchange Rate	1.0006	0.1299	1.0444	0.1396	1.030	0.1362	1.0655	0.1366
Exports to sales Ratio	0.5627	0.1370	0.0587	0.1361	0.058	0.1358	0.0590	0.1334
Foreign Penetration	0.0651	0.0635	0.0611	0.0587	0.0644	0.0612	0.0621	0.0594
Knowledge								
Used Machinery to Total Machinery			0.0586	0.1505			0.0579	0.1479
Imported Machinery to Total Machinery			0.0467	0.1191			0.0489	0.1209
Computer Equipment to Total Machinery			0.0070	0.0124			0.0071	0.0120
Skilled Employees to Total Workers	0.2514	0.1748	0.2614	0.1767	0.2521	0.1739	0.2585	0.1744
Resource Allocation								
Age	25.5432	16.7961	27.3608	16.54	27.0833	16.8392	27.8095	16.5874
Size (Output)	5.49E+07	2.74E+08	6.33E+07	3.04E+08	6.06E+07	3.02E+08	6.73E+07	3.27E+08
Physical Investment								
Capital-Labor Ratio	9841.54	25046.65	9232.446	24747.6	9529.551	24372.42	9080.968	24157.72
Total Factor Productivity								
TFP	5.944	2.0232	6.009	2.0440				
TFP Growth					0.0438	0.3863	0.0514	0.3774

Table 3.8
Regression Coefficients from TFP Level and Growth Equations

	TFP		TFP growth	
	1989-98	1989-95	1989-98	1989-95
Trade				
Tariff	-0.1688**	-0.0543**	-0.1449**	-0.2299**
Real Exchange Rate	-0.0580**	-0.0106	-0.9248**	-0.9809
Exports to sales Ratio	-0.0741**	-0.1477**	-0.1239*	-0.2057*
Foreign Penetration	1.6274**	0.9048**	-0.7590**	-0.6825**
Knowledge				
Used Machinery to Total Machinery		0.0023		-0.0010
Imported Machinery to Total Machinery		0.0557		0.0268
Computer Equipment to Total Machinery		2.0329**		1.3266**
Skilled Employees to Total Workers	-0.0057	0.0317	0.0642**	0.1157**
Resource Allocation				
Age	-0.0301**	-0.0049	-0.0333**	-0.0519**
Age Squared	-0.0001**	-0.0002**	0.0000	0.0001
Size (Output)	2.19E-09**	2.41E-09**	1.47E-09**	1.70E-09**
Size Squared	-1.95E-19**	-1.95E-19**	-1.25E-19**	-1.35E-19**
Physical Investment				
Capital-Labor Ratio	-8.05E-07**	1.92E-06**	7.97E-07**	3.25E-06**
R ² within	0.1373	0.1018	0.0653	0.0838
No of Observations	30913	15739	20679	12164
Wald Test of joint significance of all parameters (p value)	0.0000	0.0000	0.0000	0.0000

Note: **significant at 5 percent level, * significant at 10 percent level

Figure 3.5
Average Nominal Tariff and Import Penetration All Industry, 1989-98



A few studies have focused on the impact of this reduction in trade barriers on Brazil's TFP. Hay (1997) examines the impact of nominal and effective protection rates on the TFP of a group of large industrial firms. He finds negative effects of both variables, as well as from protection accorded by depreciated real exchange rates, and concludes that both the elimination of non-tariff barriers at the end of the 1980s and the reduction in tariffs in the 1990s had positive effects on the level of TFP (along with domestic deregulation and privatization). Rossi and Ferreira (1999) likewise find a strong negative impact of nominal and effective tariffs on the growth rate of aggregate TFP, and conclude that the process of trade opening was a key factor behind the TFP recovery observed in the 1990s. Finally, the report by McKinsey (1998) also emphasizes tariff reductions as the main force behind the productivity improvements observed in the automobile and auto parts sectors, and underscores the obstacle that high tariffs on capital goods (particularly telecommunication equipment) posed to investment and plant modernization at the beginning of the reform period.

Foreign Competition. The first group of coefficients in Table 3.8 allow us to assess the impact on TFP of this opening up to foreign competition. *On a priori* grounds, we expect protection via tariffs or the real exchange rate to have a negative impact on TFP, while market penetration by foreigners and contact with export markets should have a positive effect.

Starting with tariff levels, we find that higher tariffs are invariably associated with lower TFP levels and growth rates in both sample periods. In the case of TFP levels, however, the association is significant only in the longer sample. In the case of TFP growth rates, the coefficients are significant over both time periods. They suggest a positive effect on TFP growth of around 0.2 percent for each point decline in tariff rates. Thus, a 30-percentage point decline in tariff rates (roughly the decline in the average tariff rate over the reform period) would yield, other things equal, a 6 percentage point acceleration in TFP growth.

In turn, the real exchange rate also carries a uniformly negative coefficient, both in the regressions of TFP level and growth rate, although as with tariffs the coefficient is insignificant in the level regression for the 1989–95 sample. More depreciated real exchange rates allow domestic firms additional protection from foreign competition. They also tend to raise the real cost of imported

intermediates and machinery. On the whole, the regression results suggest that the net result is that a higher real exchange rate allows firms to get by with lower or more slowly growing TFP.⁴²

Foreign penetration in local markets has a significant positive effect on the TFP level in both sample periods (columns 1-2). However, it has a negative impact on the subsequent growth rate of TFP (columns 3-4), somewhat puzzling.

Finally, in the case of export orientation we find a negative and significant association with TFP and its growth rate in both sample periods, contrary to expectations. We should note, however, that in this experiment we are holding constant a number of key variables—skill intensity, machinery use, age and size of the firm—which other studies have found to be significantly associated with export orientation. The interpretation of this result is therefore unclear.⁴³

Knowledge. We turn to the second broad issue, the role of knowledge embodied in physical and human capital. To explore this question, we focus on the variables describing the composition of the physical capital stock—the ratios of used machinery, imported machinery, and computer equipment to total machinery—and the white/blue collar composition of the labor force. It is worth noting that the foreign machinery ratio reflects access to foreign markets on the input side, as opposed to the output access discussed in the preceding subsection. On *a priori* grounds, we would expect all these input-quality and embodied-knowledge measures to be positively related to TFP performance, with the exception of the used machinery ratio, which should exert a negative effect.

Skills. Of all the variables just listed, only the skill ratio is available in both sample periods under study. Table 3.8 (second group of coefficients) shows that it has a positive and significant effect on TFP growth in both periods, but no significant effect on the TFP level in either period. Regarding the composition of the capital stock (available for 1989–95 only), the ratio of computers to machinery is significantly associated with higher TFP and TFP growth, and its coefficient is of large magnitude.⁴⁴ In contrast, neither the used nor the foreign machinery ratio exhibit any significant effect on TFP or its growth rate. The latter result, in particular, suggests that quality differences between domestic and foreign machinery are inconsequential from the perspective of productivity.⁴⁵ Finally, the same conclusion applies to foreign intermediates: their ratio to total intermediate inputs is not significantly associated with TFP level or TFP growth.

Firm characteristics. On the role of resource allocation in the observed patterns of TFP, we are interested in four questions: (i) does productivity vary systematically with firm age and size: i.e., do newer or smaller firms bring in higher-productivity techniques? (ii) does capital intensity bear any relationship to TFP? (iii) did more productive firms tend to expand faster than less productive ones? and (iv) do labor regulations pose a significant burden on firms' operation? To answer the first two questions we can look at the third group of estimates in Table 3.8.

Firm Age. In general, older firms exhibit significantly lower TFP as well as TFP growth. In the case of the TFP level, the effect is convex: it becomes stronger as firms become older. Its magnitude seems considerable: other things equal, a one-year increase in age lowers TFP growth by 3-5 percent (note that mean age is around 25-30 years). In interpreting this result, however, it is important to keep in mind that other features that vary systematically with firm age—firm size, for instance—are being held constant.

Firm Size. This is measured both by output and value added, and in both cases we find a strongly significant effect, which in the case of value added is concave: larger firms exhibit higher productivity and faster productivity growth, although beyond a certain size the relationship changes sign. Near the sample mean, a 10-percent increase in size as measured by value added is associated with an increase in TFP of about 0.5–0.8 percentage points, and an increase in TFP growth of roughly the same magnitude. In turn, an increase in size as measured by output yields a more modest (but still positive) impact on TFP.

⁴² Caution is necessary regarding this result, as the real exchange rate measure included in the regressions lacks cross-sectional variation and only displays time variation. It may thus partly capture the effects of other aggregate shocks affecting Brazilian industry, in addition to the effects of the real exchange rate itself.

⁴³ Moreover, additional work in progress by Muendler (forthcoming) using a different econometric approach finds that export orientation and TFP show a positive association among Brazilian manufacturing firms.

⁴⁴ The computer/machinery ratio is generally very small. Its sample mean is 0.6 percent.

⁴⁵ As noted earlier, the same result was found for foreign intermediates over the shorter 1996–98 sample.

Capital Intensity. Table 3.8 shows that this exerts a positive and significant effect on TFP growth in both sample periods. Its impact on the level of TFP, however, is less clear. It is positive in the 1989–95 sample, when the variables describing the capital stock composition are available, and negative in 1989–98, when they are not.

Changes in Firm Size. We saw above that, contrary to expectations, the contribution of firm size changes to aggregate TFP was negative in several years. Firm size changes acted as a drag on aggregate productivity. It is worth inspecting this result more closely. To do so, we ran fixed-effects regressions with firm size change (as measured by value added) as the dependent variable, and with the same explanatory variables (other than size) as in the TFP regressions summarized above, including as additional regressors the profit rate and the TFP level. On the whole, these regressions had a high explanatory power (with R-squared coefficients around 0.20). The main result they yield is that size change is strongly positively affected by firm TFP levels. Thus, other things equal, more productive firms did tend to expand faster over the sample period. Other things, of course, did not remain equal, and must lie behind the negative contribution of firm size changes to aggregate TFP growth that arises from Figure 3.6 above.⁴⁶

Labor Regulations. We tried to assess the burden posed by regulations on dismissals on firms' ability to adjust to changing conditions by looking at the share of labor costs in total costs for those firms that were shrinking. The constraints on labor shedding should be reflected in rising shares of labor costs for those firms. The main finding from these experiments (see Muendler 2001a) is that shrinking output is indeed associated with higher cost shares of labor, after controlling for other firm characteristics, which seems consistent with the above reasoning. However, it is difficult to establish the direction of causality underlying this association, and hence it cannot be viewed as conclusive.

Physical Investment. Given the above result that capital intensity encourages TFP growth, it is of interest to investigate the factors that shape firms' investment decisions. To do this, our final set of empirical experiments involved the estimation of investment equations relating fixed capital formation to a set of real and financial variables. Among the real regressors, we added to the variables used so far the firm's TFP level and its capital/output ratio. In turn, the financial variables included the profit and credit ratios to output and a set of indicators of the financial structure of the firm. The two key results from this analysis were: (i) TFP affects investment negatively, which might be interpreted as reflecting a "catch-up" effect: firms invest precisely to raise productivity, and slow down their investment once productivity has reached a high enough level; and (ii) investment is systematically affected by financial variables, such as the profit ratio, the ratio of credit to output, the ratio of long-term credit to the total, and the credit/equity ratio. The first three of these variables are positively associated with investment; the fourth is negatively related to it. It is tempting to conclude that this reflects the action of financial constraints on firm investment; as before, however, it is difficult to establish causality, and hence the empirical association of investment with these variables has to be interpreted with considerable caution. Other work that has looked for the existence of credit constraints in Brazilian investment since the Real Plan has also found evidence in their favor, however, increasing our confidence in this interpretation of the results (Thomas, 2001).

3.6 – Conclusions

At the firm level, Brazilian TFP growth was on average negative in the 1980s before recovering modestly in the 1990s. Performance differed widely by industry, with the automotive and electrical equipment industries showing the strongest productivity growth in the 1990s. Less technological sectors—food, textiles, leather, and non-metallic minerals—showed the worst performance and actually declined in productivity during the 1990s. The industrial composition of the manufacturing sector in the North and Northeast of Brazil led to lower TFP growth in these regions relative to the South and Southeast.

TFP and TFP growth regressions across firms within industries suggest that trade opening may have contributed to raise average TFP by about 6 percent. Market penetration by foreign competitors

⁴⁶ More precisely, while the *unconditional* correlation between size change and TFP level is negative in the sample, the *conditional* correlation (that is, controlling for the other factors mentioned in the text) is significantly positive.

raised the level of TFP, though not its growth rate. On the other hand, export orientation does not raise TFP in the Brazilian data; indeed this relationship is negative. Other findings suggest the importance of technological innovation: higher shares of IT in physical capital raised both TFP and its growth rate. To complement this result, firms employing more skilled labor, in the form of a higher white-to-blue collar ratio, showed faster TFP growth, suggesting that Brazilian human capital investments contribute to TFP growth. Foreign machinery, on the other hand, had no significant effect, questioning the role of this as a conduit of embodied technological change in recent Brazilian growth. Given evidence from firms elsewhere on the importance of international knowledge flows, this result raises the concern that Brazil's integration into international production is not generating all its potential benefits, perhaps owing to a bias towards regional trade, perhaps owing to impediments to technology transfer. Finally, new firms possessed higher and faster-growing TFP, suggesting that measures to ease their entry may be a source of future productivity gains for Brazil.

4 – HOUSEHOLD INCOME GROWTH AND ITS DISTRIBUTION

This section focuses on household income growth and its distribution: in particular, how much economic growth accrues to the poor. Dollar and Kray (2000) have recently found that growth in GDP per capita across countries is more or less unrelated to changes in measures of their inequality. This finding can be interpreted in two ways: it refutes the arguments of those who claim that growth an irrelevant measure of welfare, that it is systematically regressive because it is generated and captured by elites; but it also suggests that the distribution of growth might be an interesting second statistic to examine, since it is essentially “orthogonal,” that is unrelated to, the level of growth. We will treat this as an open question for Brazil, and to answer it will compare patterns in aggregate income growth with those in its distribution. We will then go further, by examining the causes underlying both growth and its distribution. We shall return to possible explanations of growth and its pattern later in this section.

This section makes use of stacked household data from the years 1982–98.⁴⁷ The data come from Brazil’s Annual National Household Survey (*Pesquisa Nacional por Amostra de Domicílios*: PNAD). Our approach has two main advantages. First, PNAD has a stratified sample design that makes it representative at the state level. This is useful in itself: it is interesting to compare growth in household incomes across different states, to assess aspects of state performance. But beyond this, using household data to compile income growth measures allows us to focus on income growth among the poor (as well as among the whole population), and subsequently to calculate partial correlation with factors that vary at the household or the local level.

The PNAD also has some fairly well documented shortcomings (see Ferreira, Lanjouw, and Neri, 1998, for the most complete discussion of this topic). In particular, its measures of income are rather partial, since the questionnaire does not pay much heed to assessing home production and non-market income (important in rural areas). However, its one overriding advantage for present purposes is its comparability across time. Furthermore, the patterns obtained from the PNAD are consistent with the regional accounts (see Azzoni, Menezes-Filho and Menezes, 2001), suggesting at least that the conclusions in their general form are robust to any design faults specific to the PNAD survey.

The measure of income growth we use is change in log per capita household income.⁴⁸ For each year that the survey was performed (1982–98 with the exception of 1994), two such measures are constructed: change in mean income for the population, and change in mean income of the poorest (as measured in the earlier year) 25 percent of the population. These two measures are then treated as the independent variable in the regression analysis.

The implicit unit of analysis for most of the analysis is the state. There are two parts to the presentation of results, the first descriptive, the second analytical. The descriptive part presents state growth rates in four periods: 1981–85, 1985–89, 1989–93, and 1993–98. For the analytical section, the unit of observation is an age cohort within a state. This allows us to make use of greater variation in important dimensions such as educational attainment, employment patterns, and access to infrastructure. We do not have repeated observations of the same households over time (panel data), but by aggregating within state-cohort cells, we do have repeated observations of cohort means over time (quasi-panel data: see Deaton, 1980). The analysis then uses panel estimation techniques to derive consistent estimates of partial correlations between state-cohort characteristics and the state-cohort income growth. In this sense, the analysis in the second part of the paper tries to answer the question: what parts of Brazilian state-level characteristics or policies coincided with income growth within the periods studied?

⁴⁷ In the context of explaining historical patterns in Brazil, it would have been nice to have comparable data from the 1970s. Unfortunately, such data are not available.

⁴⁸ For changes of about 10 percent or less, this measure is approximately equal to the percentage change in income. Using log-differences has certain analytical advantages that make it preferable, however. Parts of the analysis were performed using percentage changes in income, without making a great difference. The main difference between the two is that log-differences deflate large (greater than ten percent, say) income growth figures. The results suggest that this distortion does not do too much harm to the main conclusions of this analysis.

4.1 – Hypotheses

To frame the answer to this question, it is necessary to start from some hypotheses about what determines or constrains household income growth in Brazil and its states. There are many such hypotheses; many are not testable using the data and methods of this paper. The following are hypotheses that the paper addresses, with notes on the evidence that would support each:

Education Constraints. Brazil's low level of education among its workforce (it ranks behind most of its South American neighbors in most of the statistics) are often cited by investing companies as an impediment to economic activity. So it is natural to posit this as one of the constraints holding back present-day Brazil. Were this the case, one would expect to see states and cohorts with more education among the workforce showing significantly higher levels of income growth.

Political and Policy Uncertainty. Policy uncertainty has been cited by firms in many survey as the number one obstacle to investing in Brazil. It is sometimes difficult to ascertain exactly what this uncertainty consists of: exchange rates, economic uncertainty, unpredictable legal rulings, and so on may all form parts. For present purposes, we shall focus on the educational level of public sector employees in a state, the frequency of ideological shifts in government, and the volatility of voting patterns as measures of uncertainty that may impede economic growth.

Infrastructure Bottlenecks. Brazil's infrastructure is not worse overall than its neighbors in many categories. There is, however, great variation in infrastructure between the states (e.g., electrification, water, paved roads, and public services such as garbage collection). If infrastructure were a constraining factor, one would expect to see the states best endowed in these dimensions growing faster, *ceteris paribus*.

Labor Rigidities. Brazil's labor code is onerous by international standards. Again, the extent to which this impedes growth is unclear, but were this the case, then under certain assumptions, one would expect to find lower income growth rates in states and cohorts with higher levels of formal labor contracts. The proportion of contracts that are formal is of course endogenously determined as a function of their associated costs and benefits, so the line of analysis suggested in the previous paragraph can only be pursued with some skepticism. However, nearly all the explicit costs of formality are federally imposed, and thus invariant across states and cohorts. Variation in the proportion of contracts that are formal must therefore be owing to other factors, some of which will be controlled for in the analysis: education and employment composition by sector, for example. The assumption needed is thus that remaining variation in the extent of formal contracts is exogenous.

Climate. A long strand of economic literature posits that some countries are geographically doomed to lower growth rates owing to climatic conditions that impede economic activity. The most common evidence cited is the negative coefficient on "tropical" dummy variables in cross country growth regressions. We therefore investigate whether rainfall, latitude or altitude are associated with differences in income growth rates.

Agglomeration and Spatial Factors. A related hypothesis is that poor areas remain poor owing to low aggregate demand (so-called trading externalities, discussed theoretically in Diamond, 1982). These effects are therefore also "geographical" (see Jalan and Ravallion, 2000, on China), but would show up in data as low growth rates associated with low local measures of economic activity.

Access to Markets and Trade Volume. Brazil's economy, despite lowered tariffs in the 1990s, remains relatively closed. There is also variation in the distance to major markets among the states. If integration were constraining growth, we would expect to see states furthest from markets, and those trading least, growing more slowly (*ceteris paribus*). We use distance from the sea as a proxy for market access, and interstate trading volumes as a proxy for integration into the national economy, to attempt to test for these effects.

Migration. Brazil's economic miracle included processes of urbanization, transformation of the productive base from traditional industries towards manufacturing, and migration, particularly from the Northeast to the Southeast of the country (see Gordon, 2001). Recently these migratory flows have diminished and even reversed (Fiess and Verner, 2001). It is an interesting question, though one hard to answer convincingly, to what extent this has been a causal factor in Brazil's economic slowdown. The question is hard to answer because opportunities for income growth cause and are caused by migration, and so most attempts to assess causality are doomed to ambiguity.

4.2 – Descriptive Results

The main issues we are interested in describing before a discussion of underlying causes are:

Income Growth over Time. How does income growth behave in different periods since 1982? What are the relative performances of the states and regions?

Convergence. Is there a tendency for poor states to catch up with richer ones? How fast?

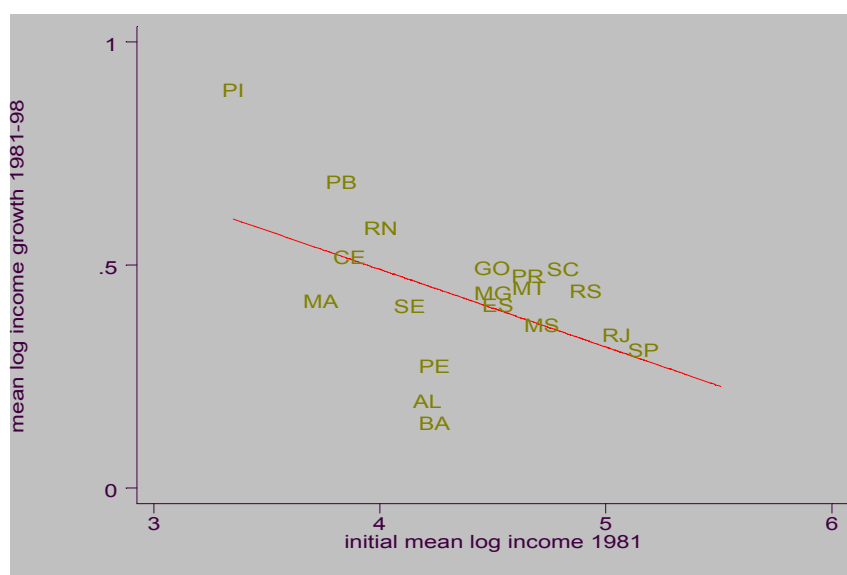
Income Growth Among the Poor. To what extent does income growth accrue to the poor? How does this vary by state and region?

Changes in Inequality. What are the effects of income growth, and its accrual to the poor, on inequality? Has it risen or fallen? Is there a “tradeoff” between income and inequality?

For convenience we divide the full period 1981-98 into four approximately five-year sub-periods: the early eighties including and following the debt crisis (1981–85); the late eighties including and following the *Cruzado* Plan (1985–89); the early nineties including and following the Collor plan (1989–93); and the late nineties including and following the *Real* Plan and stabilization (1993–98).

Figure 4.1 shows state household-income growth (vertical axis) versus initial household per-capita income (horizontal axis) for the whole period, and shows the high divergence in states’ growth rates. Only 19 of Brazil’s 27 federated units are shown on the diagrams. The Federal District comprising Brasília and neighboring towns is not a state. Also, the states of Brazil’s Northern region⁴⁹ have been excluded. These states are special cases in Brazil owing to their “frontier” characteristics. They have exhibited extremely variable growth rates, mainly owing to waves of immigration and exploitation of natural resources (e.g., oil in Roraima). Their inclusion would obscure more than it would reveal.

Figure 4.1
Initial Income and Income Growth, 1981-98



There is some evidence of states falling into regional blocks.⁵⁰ Brazil’s regions are to some extent economically homogeneous clusters. The Southeast (SP, RJ, MG, ES) is richest and forms the industrial powerhouse of the country. The South (RS, SC, PR) is also relatively wealthy but more

⁴⁹ Rondônia, Acre, Roraima, Amapá, Pará, and Amazonas. The state of Tocantins, which separated from Goiás only in 1991, has been merged with Goiás for the purpose of comparability across time.

⁵⁰ Brazil has standardized definitions of its regions. The Southeast comprises São Paulo (SP), Rio de Janeiro (RJ), Minas Gerais (MG), and Espírito Santo (ES). The South comprises Rio Grande do Sul (RS), Santa Catarina (SC), and Paraná (PR). The Center-West comprises Mato Grosso (MT), Mato Grosso do Sul (MS), Goiás (GO) and the Federal District (DF). The Northeast comprises Bahia (BA), Sergipe (SE), Alagoas (AL), Pernambuco (PE), Paraíba (PB), Rio Grande do Norte (RN), Ceará (CE), Piauí (PI), and Maranhão (MA).

agricultural and less industrial than the Southeast. The Center West (MT, MS, GO, DF) is poorer than the first two, and relies mainly on natural resources and agriculture. Its infrastructure is far less developed than that of the South and Southeast of the country. The Northeast (PI, PB, RN, CE, MA, SE, PE, AL, BA) is much poorer. The Northeast's 28 percent of the national population account for only 13 percent of GDP. Its interior contains a large semiarid expanse, the *Sertão*, within which Brazil's most extreme problems of rural poverty are found. Infrastructure and social indicators are also much less advanced in the Northeast.

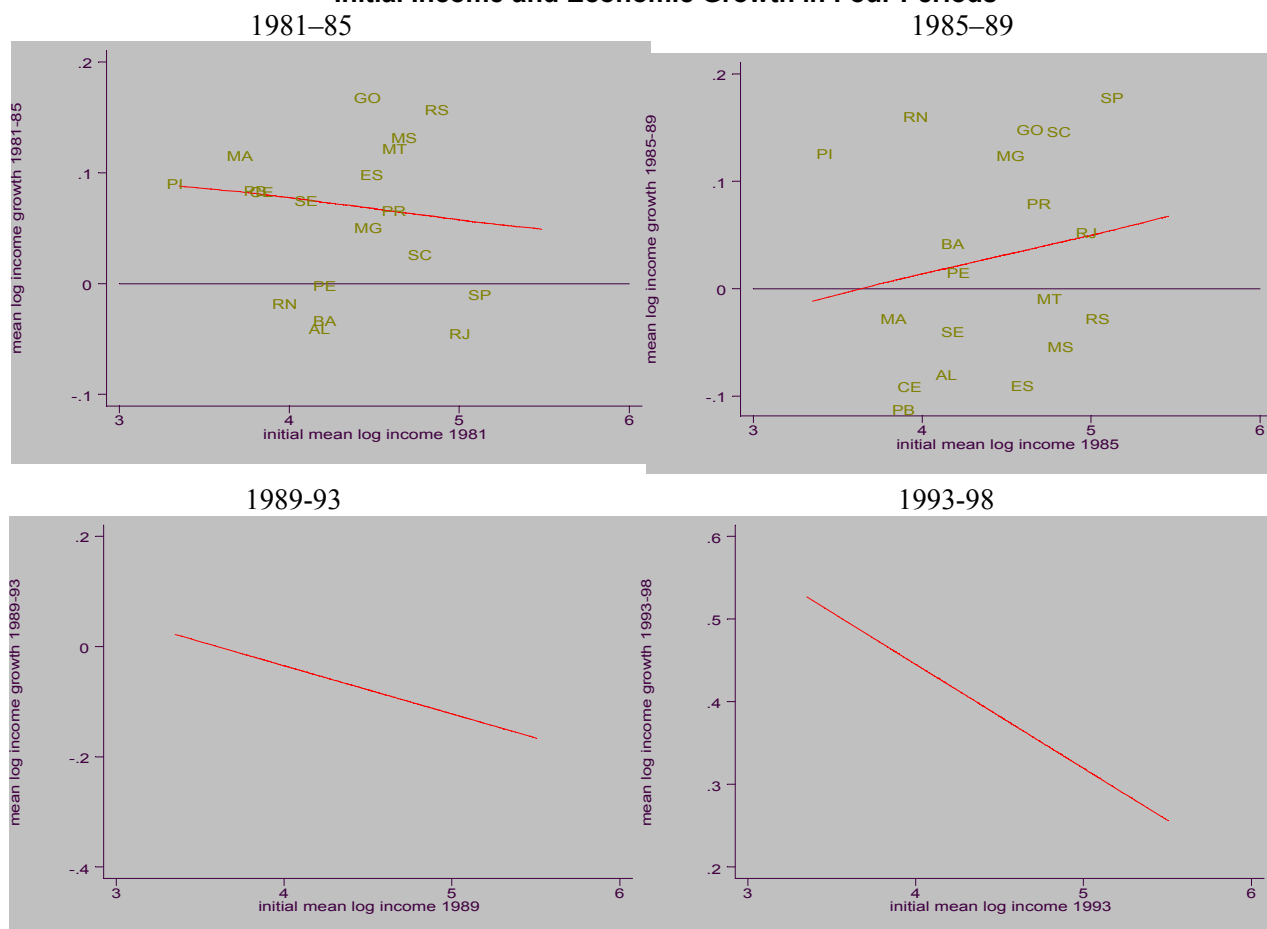
Where the states differ to a greater extent within regions is in their public policies. Evidence of clustering into regional growth performance is therefore evidence that initial conditions or conditions that change only slowly (levels of industrialization, some social indicators such as adult literacy) are responsible for a large part of growth differentials. In this context, differences between seemingly similar states within the same region are notable, although here a more analytical approach is then called for to try to disentangle the causes. The South, Southeast, and Center-West all show less within region variation than the Northeast in Figure 4.1. In the Southeast, for example, the states of Rio de Janeiro and São Paulo are neighbors on the graph. Paraná, Santa Catarina, and Rio Grande do Sul all had about equal income in 1981 and showed similar growth rates over the period. This suggests that for these regions initial conditions and national considerations dominated state policies in determining economic growth.

The Northeast is another story. The region contains Brazil's fastest growing state over the period (within the 19 we are discussing)—Piauí—and its slowest—Bahia. Despite starting from similar initial income, the states of the Northeast displayed widely divergent growth rates over the period. What can explain this? We will argue that at least part of the reason is state public policy.

Figure 4.2 illustrates growth versus initial income for states in each of the four periods separately. The periods do not resemble one another graphically very much, supporting the argument of the previous paragraph. The PNAD data confirm, at the microeconomic level, the macroeconomic observation that the 1980s were a "lost decade." For 1981–85, four states record negative or zero real per-capita household income growth in the data. For 1985–89 the story is worse: the 19 states are split about in half between those that record negative or zero per-capita income growth and those that record positive growth. And the recession of 1991–92 creates even worse effects in the third period, when only seven states show positive growth. Positive growth returns to the micro data just as it does to the macro data only after 1993. The dispersion between states is also slightly higher in 1989–93 than it is in 1993–98.

Some of the regional clustering that was apparent for the whole period is less so within sub-periods. A closer look at the data reveals that for the bulk of the growth over the whole period is accounted for by the growth that occurs in the fourth period. It is also in this period that the regional clustering is most apparent, even for the Northeast, though this region still shows greater within-region variation in growth than the other three.

Figure 4.2
Initial Income and Economic Growth in Four Periods



4.3 – Convergence among States

A now extensive literature discusses the concept of economic convergence between countries, that is, the notion that, for reasons of technological imitation, factor mobility, and higher returns to scarce factors such as capital (physical and human), poor countries ought theoretically to be able to “catch up” with rich countries. The cross-country evidence is mixed, and there are many reasons why “theoretically” may accord with inappropriate theory. Nonetheless, the theories that imply convergence between countries ought to apply more readily to states within the same country. Obstacles to factor mobility and to technological imitation are fewer. And many institutional parameters are fixed at the country level and, therefore, to a first approximation are fixed across states, bringing the implicit *ceteris paribus* assumption behind growth comparisons a little closer to reality (see Barro and Sala-i-Martin, 1991, for an analysis of convergence applied to states and regions in the USA and Europe over the long run).

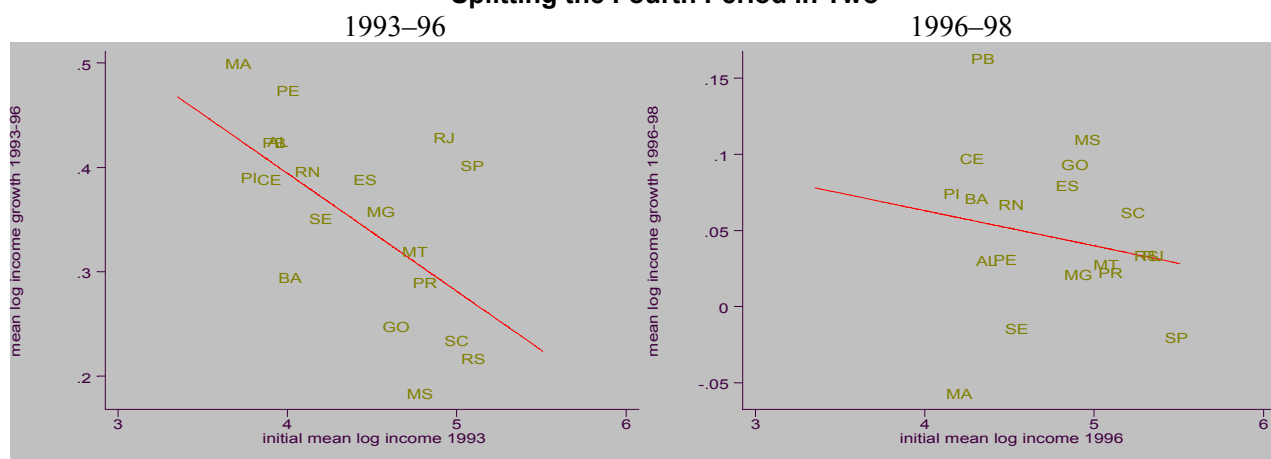
Figure 4.2 shows quite clearly that if convergence has occurred at all in Brazil since 1981, this has in fact only been since 1993, or possibly, if one reads the third graph charitably, since 1989.⁵¹ In the three earlier periods there is simply no visual (let alone statistically significant) relationship between initial levels of income and subsequent income growth. Since the *Real Plan*, however, there is

⁵¹ There is an important distinction made in the literature on the subject between conditional and unconditional convergence. The former is understood to mean relative catch-up in residual income after controlling for many factors such as education and governance, which are at lower standards in poorer countries. The discussion of this section limits itself to the simpler concept of unconditional convergence between states. Azzoni, Menezes-Filho and Menezes (2001) investigate conditional convergence between Brazilian states using the same data, and find some evidence in its favor.

a striking relationship: poorer states (particularly those in the Northeast) have exhibited faster income growth. This is no doubt in part because greater macroeconomic stability allows longer-term planning and investment, clearly a necessary component of the convergence story. It is also in part because the costs of high inflation had been disproportionately born by the poor (who could not protect themselves against inflation through asset switching as effectively as richer households). The elimination of inflation in 1993-95 therefore generated relative gains for the poor.

Which of these two explanations fits the data best can be suggested by dividing the latter period into two: 1993-96 and 1996-98. The gains from the eradication of inflation were concentrated in the first of these. The gains from greater stability and long term investment only began to be felt in the second. Figure 4.3 shows what happened to convergence in these periods, and illustrates that the early part of the real plan accounts for a large part of the convergence effect of the fourth period (1993-98) as a whole. It is likely that the eradication of inflation had beneficial consequences that helped the poor. Earlier changes, such as trade opening, may also have changed market structures during this period in ways that helped the poor. We thus hypothesize that the speed of convergence between 1993 and 1996 may be difficult to recreate without explicit regional initiatives. A final note in this regard: the evidence from elsewhere does not suggest that we should expect “automatic” convergence of Brazil’s poorer states with its richer ones at any rapid pace. Barro and Sala-i-Martin’s (1991) analysis of Europe and the US suggests conditional convergence of around 2 percent per annum. This corresponds to a catch-up “half-life” of about 35 years.

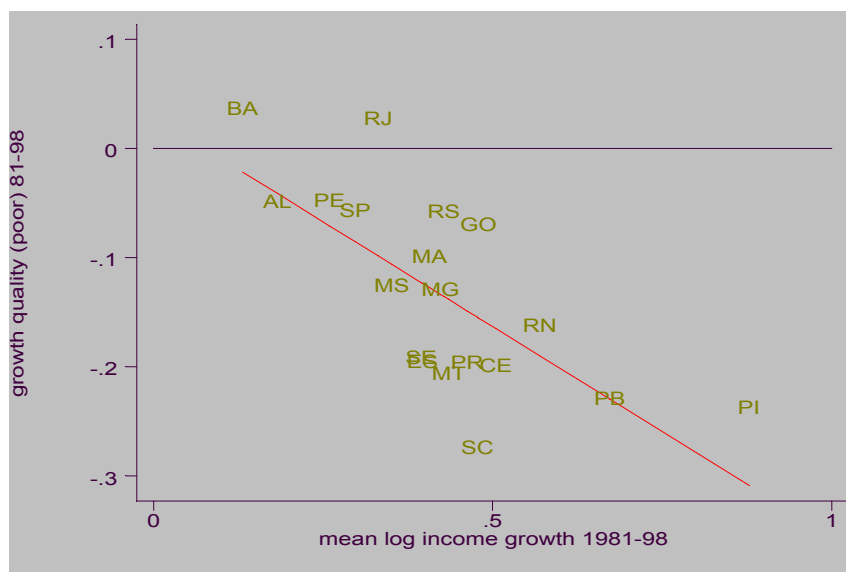
Figure 4.3
Splitting the Fourth Period in Two



4.4 – Income Growth among the Poor

Figure 4.4 displays the rates of income growth among the poor against general income growth, for the whole period and each of the sub-periods. Between 1981 and 1998 the income of the poor grew at a lower rate than the income of the whole population. Inequality thus increased. A related observation is that the slopes of the lines of best fit in the four quadrants of Figure 4 have slopes of less than one. If one considers a thought experiment in which a “less successful” state takes on the growth characteristics of a “more successful” state, this says that the poor of that state will benefit less than its population as a whole. The situation has improved in the fourth period: the slopes of the lines are, respectively, 0.46, 0.63, 0.48, and 0.90.

Figure 4.5
Growth: Quantity and Equality, 1981–98



There has been a systematic relationship between growth and its distribution. Any tradeoff between growth and inequality—between quantity and equality of growth—would show up in these graphs as a downward line of best fit. For the period as a whole, the line of best fit is downward and has a statistically significant slope of -0.38 . For the four sub-periods the slopes of these lines of best fit are -0.54 , -0.37 , -0.52 , and -0.10 , with the first three statistically different from zero (at a 5-percent level), and the last one not. It is to be hoped that the significant negative relationship between quantity and equality has disappeared entirely since the *Real Plan*, but this may be over-optimistic given the pro-poor effects of the one-time fall in inflation. It would therefore not be surprising were the “growth-inequality tradeoff” of the earlier periods to return in the near future.

If the poor-income growth coincides with broader income growth, and if inequality changes are (recently) unrelated to income growth, then we would expect poverty reduction to occur in states where higher income growth occurred. This is indeed the case. The three states with the highest income growth in the period, the small Northeastern states of Piauí, Paraíba and Rio Grande do Norte, also saw the largest falls in the poverty headcount rate.⁵³ São Paulo and Rio de Janeiro had the lowest falls in the poverty rate, and were among the five lowest rates of economic growth during the period.

In summary, although there was an apparent tradeoff in Brazilian household data between economic growth and inequality until the *Real Plan*, this tradeoff diminished or disappeared in the data after 1993. Economic growth is highly correlated with the growth of the incomes of the poor, and thus to poverty reduction. However, income growth has not accrued proportionately to the poor. For one percent of income growth over the whole period (1981–98), the poor’s income rose by a little over half a percent. This ratio has risen to about 0.9 since the *Real Plan*, but some of this improvement may not be sustained fully beyond the period of inflation eradication.

⁵³ The poverty headcount referred to here uses a food-poverty line, and is often also referred to as the extreme poverty rate (or *taxa de indigência*).

Table 4.1: Summary of Variables Used

Variable Name	Description	Mean	Standard Deviation
Dependent Variables	NB. "cell" refers to by-state by-cohort groupings.		
Delta	Difference in mean log income in cell over the year	0.0317	0.231
Delta25	Difference in mean log income of the poorest quartile	0.0215	0.231
Quality	Difference in differences: Delta25-Delta	-0.0119	0.159
Weakly Exogenous Variables			
Educ	Average completed years of schooling of household head	3.51	1.57
Primary	Fraction of cell with completed primary education	0.691	0.189
Middle School	Fraction of cell with completed lower secondary education	0.154	0.125
High School	Fraction of cell with completed high school education	0.103	0.076
College	Fraction of cell that attended college	0.052	0.042
Public Admin	Average years of education of state's public employees	7.14	2.62
Political	Sum of squares of changes in parties' vote shares	0.411	0.287
Policy	Indicator of change in political leaning of governor	0.529	0.499
Electric	Percentage of electrification in the state	0.773	0.169
Trash	Penetration rate of garbage collection in the state	0.500	0.200
Industry	Fraction of households in cell with industry employee	0.190	0.108
Agriculture	Fraction of households in cell with agricultural employee	0.326	0.136
Services	Fraction of households in cell with services employee	0.366	0.139
Urban	Fraction of cell that lives in an urban area	0.659	0.144
Formal	Fraction of households where head formally employed	0.216	0.150
Rain	Annual rainfall (cm)	103.1	24.6
Latitude	Average Latitude of the State (degrees)	13.34	7.10
Altitude	Average Altitude of the State (m)	328.6	164.9
Distance	Average distance from the sea (km)	226.1	204.2
Migration	Fraction of population that immigrated from out of state	0.146	0.109

Table 4.2: Evolution of Selected Variables

Variable	1981	1985	1989	1993	1998
Log Income	4.41	4.48	4.52	4.50	4.91
Log Poor Income	3.51	3.56	3.48	3.44	3.84
Education	3.22	3.36	3.47	3.66	3.90
Primary	0.779	0.738	0.691	0.658	0.583
Middle School	0.106	0.125	0.152	0.176	0.212
High School	0.0640	0.0910	0.105	0.114	0.142
Tertiary	0.0506	0.0454	0.0524	0.0525	0.063
Public Admin	6.99	6.62	6.91	7.15	8.06
Electric	0.620	0.694	0.772	0.840	0.900
Trash	0.336	0.423	0.477	0.585	0.673
Industry	0.258	0.202	0.196	0.160	0.128
Agriculture	0.354	0.379	0.332	0.300	0.268
Services	0.376	0.403	0.428	0.309	0.287
Urban	0.615	0.627	0.640	0.703	0.709
Formal	0.294	0.273	0.258	0.161	0.117

4.5.1 – Income Growth Across States

The first column of Table 4.3 reports coefficients from the regression of observations on overall income growth, pooled over the whole period, on the right-hand side variables. The corresponding OLS specification in first-differences explained 67 percent of the variation in income growth, a high proportion for quasi-panel data. The significant effects are from average years of education, the political and policy variables, the penetration rate of garbage collection, and the level of employment in industry and services (that is, in relative terms, agriculture fared poorly).

Many studies find positive relationships between the level of education and income (whether analyzing households, countries, or other levels of aggregation): all of the literature on returns to education falls within this category, for instance. Yet, in the instance of our education coefficient, this is not what we are reporting, but rather a significant positive relationship between the *initial level* of education (of an age cohort in a state) and the subsequent *rate of growth* of income (of that age-cohort in that state). It is far less obvious that we should expect to find such a robust effect in the Brazilian data (the coefficient is also large: approximately 0.1, implying an extra year of average education completed increases subsequent income growth by ten percent). Similarly, it is worthy of note that political and policy uncertainty both have the expected signs and are significant. States with uncertain political outcomes, or where the governorship moved between different points on the ideological spectrum, grew more slowly. The effect of the variable *trash* is interesting. This variable is a proxy for public provision of infrastructure. The interpretation of this effect is of a direct effect of the level of infrastructure on productivity growth. This effect could also be viewed as an indicator of geographical effects: the same people have higher income growth from living in a richer location.

The second column of Table 4.3 reports the coefficients from the same estimation restricting to the later two sub-periods described earlier, covering 1989-98.⁵⁴ The education effect is almost identical, while the infrastructure effect (from *trash*) is still significant though smaller. There is also now a significant effect from the other infrastructure variable, the level of electrification of the state. Political uncertainty increases in importance, while policy uncertainty does not appear significant. This difference in the behavior of the sector variables across the two periods (1981-98 versus 1989-98) may reflect the true underlying differences in productivity growth across time. Finally, there is a significant positive effect from the proportion of workers in the formal sector.⁵⁵

⁵⁴ It would be desirable from the point of view of contemporary relevance to restrict even further to, say, the period 1993-98, but this is not feasible econometrically since the methodology being used relies on having enough variation in the regressors across time to identify effects.

⁵⁵ This effect was absent from the OLS specifications and also from the longer time period.

Table 4.3
Coefficients (absolute Z-values)⁵⁶ from Income Growth Equations

	I	II	III	IV
Period	1981-98	1989-98	1981-98	1989-98
Dependant Variable	Delta	Delta	Delta25	Delta25
Coefficients				
Educ	0.103** (7.20)	0.104** (6.38)	-0.0076 (0.51)	-0.024 (1.29)
Public Admin	0.0068** (3.37)	0.0034 (1.36)	-0.0002 (0.10)	-0.0020 (0.82)
Political	-0.044** (2.27)	-0.055** (2.93)	-0.042** (2.23)	-0.051** (2.63)
Policy	-0.013** (2.61)	-0.0017 (0.16)	-0.0062 (1.09)	-0.0002 (0.02)
Electric	0.126 (1.44)	0.343** (3.12)	0.095 (1.10)	0.402** (3.68)
Trash	0.361** (4.04)	0.605** (4.79)	0.194* (1.71)	0.264* (1.73)
Industry	0.177* (1.95)	0.361** (1.98)	0.106 (1.09)	0.183 (0.93)
Agriculture	0.152 (1.38)	0.334** (2.37)	-0.021 (0.22)	0.092 (0.63)
Services	0.209** (1.97)	0.591** (4.00)	-0.080 (0.75)	0.074 (0.51)
Urban	-0.038 (0.32)	-0.324** (2.06)	-0.071 (0.59)	-0.223 (1.39)
Formal	-0.083 (0.74)	0.085 (0.54)	-0.156 (1.28)	-0.144 (0.79)
Lagged depvar	0.334** (12.76)	0.327** (9.31)	0.153** (4.19)	0.233** (5.32)
R squared from OLS	0.67	0.52	0.63	0.43
Number of obs.	2890	1853	2890	1853
Number of groups	190	190	190	190
Mean no. periods	15.2	9.8	15.2	9.8

4.5.2 – Income Growth among the Poor

Column III of Table 4.3 reports coefficient estimates using the sample from the whole period restricting to the poor.⁵⁷ The results are strikingly different from column I. First, education does not appear to be significantly correlated with income growth among the poor. We repeat here that education is undoubtedly correlated with income for this sample of households, but not necessarily with its subsequent rate of growth. Political uncertainty, however, appears with almost an identical negative coefficient to that in column I. Next, the infrastructure effects are attenuated, though similar in pattern to column I. Finally, there are no marked effects from the sector-composition of employment. All in all, for the period 1981-98, income growth among the poor seems harder to explain than it is among the population at large.

⁵⁶ All statistics are calculated from robust standard errors.

⁵⁷ The definition of poor in this section for the purposes of calculating income growth is the same as that used in the previous section, namely the poorest quartile of individuals in the data.

Column IV reports the same results for the period 1989-98. The education effect is again absent, while the effects of political uncertainty are heightened. The infrastructure variables seem to swap roles relative to column II, with electrification (*electric*) highly significant, *trash* less so. There is no significant effect among the sector variables, although the highest point estimate is on the industrial employment variable.

Taken together, these results suggest that there is far less systematic correlation between state-cohort characteristics and economic growth among the poor than there is in the economy as a whole. This is in itself an interesting finding. One may now ask is whether the differences between the coefficients for the two groups are significant. Since the *difference between income growth* among the poor and among the whole population is precisely our measure of the equality of growth from the previous section, this amounts to regressing our equality measure on the same variables.

This brings us back to the notion discussed earlier, and common in economic debates since Kuznets, that there may be tradeoffs between the pursuit of economic growth as an end in itself, and the distribution, or equality, of that growth. To the extent that individual variables appear with a significantly smaller coefficient in poor income growth regressions than in general income growth regressions, these variables may be thought of as micro-level incidences of such tradeoffs.

The first column of Table 4.4 shows the results from regressing growth equality on the RHS variables. As expected given the results so far, educational attainment appears with a highly significant negative coefficient. For the period 1981-98, improvements in education across the Brazilian states seem to have benefited the population as a whole more than they have benefited the poor. On the other hand, industrial employment appears with a significantly “better” positive coefficient than employment in either agriculture or services. Over the whole period industrial employment was significantly correlated with income growth (Table 3), and moreover its differential effects relative to agriculture and services have been greater among the poor. There is also a small but significant effect of policy stability on the income distribution. Finally, the quality of public administration seems also to have had a slightly inequitable incidence on growth, though the point estimate of this effect is very small.

The corresponding results restricting to the later period of 1989-98 are reported in Table 4.4, column II. The results are similar, suggesting that the effects reported in the last paragraph are not solely owing to the 1980s period in the data. In 1989-98, education again appears to have greater growth effects on average than among the poor. The main differences between the 1990s and the whole period lie in the sector and infrastructure effects. Services now appear with a significantly larger negative coefficient, that is, it appears that services income growth has not benefited the poor relative to the whole population. Finally the variable *trash*, proxying for local infrastructure, now appears with a significant negative coefficient.

Table 4.4
Coefficients (absolute Z-values) from Equality Equations

	I	II	III	IV
Period	1981-98	1989-98	1981-98	1989-98
Dependant Variable	Equality	Equality	Relative Equality	Relative Equality
Coefficients				
Educ	-0.114** (7.93)	-0.135** (7.44)	-0.113** (6.00)	-0.144** (6.05)
Public Admin	-0.0052** (2.62)	-0.0040 (1.59)	-0.0044* (1.86)	-0.0051 (1.60)
Political	0.0135 (0.65)	0.0136 (0.65)	-0.037 (1.01)	-0.0087 (0.24)
Policy	0.0117** (2.21)	0.0059 (0.48)	-0.015** (2.00)	-0.0008 (0.05)
Electric	-0.151 (1.62)	-0.131 (1.15)	-0.129 (1.08)	0.052 (0.29)
Trash	-0.124 (1.21)	-0.281** (2.17)	-0.271* (1.85)	-0.590** (2.74)
Industry	-0.118 (1.31)	-0.358* (1.72)	-0.145 (1.05)	-0.312 (1.23)
Agriculture	-0.299** (3.46)	-0.469** (3.35)	-0.667** (4.25)	-0.887** (3.44)
Services	-0.313** (2.78)	-0.559** (3.71)	-0.431** (3.09)	-0.608** (3.04)
Urban	-0.068 (0.50)	0.093 (0.46)	-0.309* (1.65)	-0.110 (0.42)
Formal	-0.066 (0.58)	-0.059 (0.34)	-0.063 (0.38)	-0.129 (0.52)
Lagged depvar	0.170** (4.60)	0.168** (3.93)	0.139** (3.13)	0.214** (3.93)
R squared from OLS	0.28	0.26	0.24	0.23
Number of obs.	2707	1685	2707	1685
Number of groups	171	171	171	171
Mean no. periods	15.8	9.9	15.8	9.9

Columns III and IV of Table 4.4 explore a further concept of income distribution: that of the equality of growth interpreted as its incidence among the poorest 25 percent *within each state*. This changes the emphasis from the income distribution at a national level to the distribution at the level of the individual states. The person at the 25 percent point of the income distribution in São Paulo, for example, is above the extreme poverty line used for this and other studies.⁵⁸ On the other hand, much more than 25 percent of the population of, say, Ceará fall below this poverty line (indeed more than half do). It is worthwhile to check whether the same broad results hold if one interprets poverty as “relative” rather than “absolute” in this sense. The answer seems to be that the results do not change very much, with two exceptions. As column III (Table 4) shows, for the whole period 1981–98, the policy uncertainty variable now appears with a significant negative coefficient. Also, relative to

⁵⁸ The poverty line is defined in absolute terms at R\$65 (measured in São Paulo in 1997), and adjusted for regional price variations (Azzoni and Menezes-Filho, 2000). Since the poverty rate measured this way varies a great deal across states, there is a significant difference between the concepts of absolute and relative poverty as defined in the text.

column I, agricultural employment was significantly less pro-poor (in our newly relative terms) than was industry.

For the period 1989-98 the picture is similar, even if the coefficients alter somewhat. Education and infrastructure (through garbage collection as opposed to electrification) again appear with negative coefficients. Agricultural employment again seems to be the precursor of inequitable growth, with an even higher negative coefficient than for the whole period.

4.5.3 – Distinguishing between Levels of Education

Since the results regarding education of the analysis so far are robust and also important from a policy perspective, we now proceed to assess differences by education level. Table 4.5 reports coefficients from equations that included measures of the development of different levels of the education system (primary, lower secondary, high school, and college). Since we are mainly interested in the *differential* effects of the various levels of education, the coefficients we report are the differences between the effects of secondary, high school, and college attendance measures and those related to no education or just some primary school attendance. Moreover, for digestibility we restrict to the period 1989–98 and omit mention of all the other coefficients. The results for the other coefficients are anyway very similar to those reported in Tables 4.3 and 4.4, and we wish to concentrate the remainder of this section on the analysis pertaining to education.

Column I reports the results of the general income equation estimation, while column II restricts to the (absolute) poor. Column III then reports the point estimates of the effects of the different levels of education on our measure of equality. Column IV (analogous to columns III and IV of Table 4) investigates the notion of relative equality defined above. Where the results are significant, they are what one might expect. College enrollments, despite their positive (though statistically insignificant) effect on income growth, increase subsequent income inequality in these data. This may not seem surprising, but taking the data at face value nonetheless reinforces the message that policy makers be aware of the distributive consequences of investments in tertiary education. Beyond this, the results of splitting education by levels are quite clear. Upper primary education enrollments correlate with subsequent improvements in the income distribution (the coefficients are relative to the omitted category of primary education enrollment). Secondary and tertiary enrollments correlate with subsequent deterioration in the income distribution, whether measured according to a national or a state-relative definition. There is a general pattern from positive distributive impacts towards negative as one moves up through the levels, as one would expect.

Table 4.5
Analyzing Levels of Education

	I	II	III	IV
Period	1989-98	1989-98	1989-98	1989-98
Dependant Variable	Growth	Poor Growth	Quality	“Relative” Equality
Coefficients				
Secondary	-0.018 (0.46)	-0.031 (0.68)	0.241** (1.97)	0.219 (1.39)
High school	-0.023 (0.36)	-0.0059 (0.08)	-0.391** (3.49)	-0.291** (2.39)
College	0.160 (0.80)	-0.143 (0.83)	-0.396* (1.68)	-0.278 (1.11)
... other coefficients not reported				
R squared (OLS-FD)	0.47	0.42	0.18	0.17
Number of obs.	1845	1845	1685	1685
Number of groups	190	190	171	171
Mean no. periods	9.7	9.8	9.9	9.9

4.5.4 – Location and International Trade

Three of the hypotheses enumerated at the beginning of the section concern trade, migration, and geographical location (climate, latitude, and altitude). Since these variables are fixed in time, or are so for practical purposes because they are only available for certain years in our data, the estimation strategy of the previous section, which relies on taking first differences of the data in consecutive years to control for all state-fixed effects (which simultaneously rules out identifying them), is inapplicable. However, following the approach of Holtz-Eakin, Newey and Rosen (1988), a workable alternative is at hand. The main element is that by allowing state-fixed effects to be non-stationary (time-variant), the model is generalized to encompass the state-fixed effects model as a testable restricted form. This more general specification is known as Quasi-First Difference estimation (QFD). If the restricted stationary fixed effects form is rejected (as it is in our data), this allows the effects of other time-invariant variables (such as geographical location) to be identified by the estimation.

Table 4.6 gives the coefficients from a QFD specification including location and trade variables. There is evidence of trade and climate effects in income growth overall, though not among the poor. Most noticeable is the negative effect of distance from the sea on income growth, an effect that became more marked in the 1990s. We interpret this effect as possibly one of international trade, and it suggests that the importance of trade for income growth has increased for Brazil, a result that is intuitive given the lowering of tariff barriers in the early 1990s. However, the incomes of the poor do not show sensitivity to trade access, giving some succor to the view that opening to trade has not helped the poor. The result is confirmed in the inequality regressions (columns III and VI): the positive coefficient on distance in our interpretation implies that access to markets has increased inequality in Brazilian household income, with the effect larger and more significant in the 1990s. It must be admitted that distance from the sea in Brazil may be capturing factors other than access to foreign markets, given the proximity of all the main metropolitan centers to the coast.

Table 4.6: Coefficients (absolute t-statistics) from QFD Growth Equations

	I	II	III	IV	V	VI
Period	1984-98	1984-98	1984-98	1989-98	1989-98	1989-98
Dep. Variable	Growth	Poor Growth	Growth Equality	Growth	Poor Growth	Growth Equality
Coefficients						
Temp	0.116 (0.66)	0.0157 (0.94)	-0.0142 (0.85)	-0.0048 (0.16)	-0.0231 (0.86)	-0.0470 (1.60)
Rain	-0.0017 (0.10)	0.0018 (0.10)	0.0080 (0.48)	0.0545* (1.66)	0.0645* (1.71)	0.0074 (0.17)
Latitude	0.0133 (0.83)	0.0006 (0.03)	-0.0043 (0.31)	0.038 (1.31)	0.0455 (1.57)	0.0044 (0.15)
Altitude	0.0005 (0.10)	0.0010 (0.21)	-0.0073 (1.39)	0.0057 (0.74)	-0.0033 (0.48)	-0.0165* (1.82)
Distance from the sea	-0.0072* (1.77)	-0.0016 (0.41)	0.0103** (2.61)	-0.0187** (2.96)	0.0001 (0.01)	0.0281** (3.53)
Number of obs.	2550	2550	2550	1695	1695	1695
Number of groups	171	171	171	171	171	171
Mean no. periods	14.9	14.9	14.9	9.9	9.9	9.9

There is a weak effect of rainfall on income in the 1990s (column IV), in the direction one might expect (higher rainfall raises income growth). This effect is approximately equal for poor and non-poor alike (columns IV and V), reflected in the absence of any relation between rainfall and inequality (column VI). Turning this around, this suggests that low rainfall hurts the poor proportionately (or even a little more than the average if one uses the point estimates, although the difference between them is not at all statistically significant), justifying public interventions in times

of drought on the equity grounds. We would not make too much of this result: it probably did not require sophisticated econometrics to draw this conclusion.

4.5.5 – Migration

Estimates of the effect of migration in these data suffer from two problems. First, migration figures have only been calculated for two years of the data, so much of the time variation in this variable remains unobserved. Second, as a consequence, it is not possible to structure a convincing specification that sorts out the particularly severe problems of endogeneity that this variable poses. Migration is clearly a choice that is made in response to incentives, part of which are the relative expected economic opportunities offered by point of departure and destination. This induces correlation between future economic activity and inward migration, even in the absence of a causal effect running from migration to subsequent growth.

We nevertheless ran one specification of the regressions including the migration variable, and found that migration into a state is not correlated with subsequent growth in average household per capita income in the period.

4.6 – Conclusions

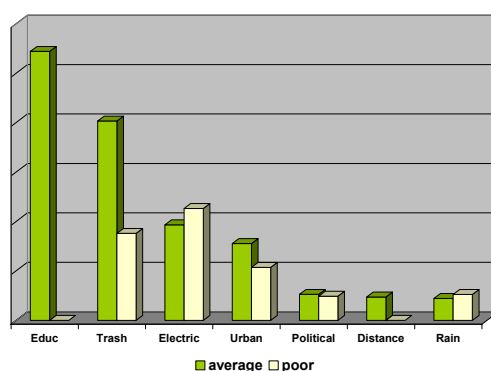
Household data reveal that within 1980–2000, only since the *Real* Plan stabilization has significant convergence occurred between the poorer and richer Brazilian states, and that a large part of the convergence pattern is owing to the pro-poor impact of eradicating inflation. International evidence suggests that any growth strategy that jeopardizes this central achievement is likely to fail. This section suggests that, furthermore, it is likely to hurt the poor most.

Comparison of the income growth of the average household with that of the average *poor* household reveals that the poor do benefit from economic growth, although their incomes do not rise proportionally with the rest: that is, a general income rise of one percent corresponds to an income rise of less than one percent for the poor. Moreover, this effect tends to increase as growth increases, implying that higher growth has tended to raise income inequality between households. These effects have been attenuated in the late 1990s, however.

Panel regression analysis of differences in household income growth by state and age cohort reveals the primacy of education as an influence on income growth in Brazil. However, the effect of *average* education on the income growth of the poor is nil: improvements in basic education among the poor have not (yet) significantly fed into income growth. Further analysis suggests that investments in basic education and lower secondary education are central both to increasing income growth and attacking inequality.

Finally, other factors are important growth determinants for household income. Local infrastructure (e.g., electrification, trash collection) plays a significant role in subsequent income growth. And international trade and political stability also help income growth. These factors vary in their importance to the poor relative to the average. Electrification seems to have been particularly important for the income growth of the poor.

Figure 4.10: Representation of Effects of RHS Variables
(Response of Income Growth to a One Standard Deviation Improvement in the Variable)



5 – POLICY CONCLUSIONS

5.1 – Looking Back: Resolving the Paradox of the Economic Miracle

Brazil was one of the world's fastest growing economies of the 20th century, yet seemed to achieve this with a mix of policies frowned upon by orthodox modern economics. A closer look at events and econometrics, however, suggests that Brazil's achievements were less paradoxical than this broad statement at first suggests.

First, the stage was set in 1964 for economic growth by a subset of policies that were in fact remarkably orthodox when set against the economic debates alive at the time. Despite benign external conditions that had helped the centrally planned efforts of the 1950s (notably Kubitschek's *Plano de Metas*)—in particular favorable terms of trade and low import growth—domestic economic fundamentals deteriorated substantially with the large increase in the public deficit, and its financing through monetary expansion, bringing inflation to a new historical threshold. By 1963 investment was stagnant, the public deficit half of fiscal revenues, and inflation accelerating. The new military government adopted a stabilization program to lower inflation, reduce the public deficit, and correct relative prices. The exchange rate was devalued and a tax reform implemented, greatly reducing tax distortions, raising revenues dramatically, and improving the current account. The government also implemented monetary and capital market reforms, with the establishment of the indexation mechanism, which, despite its later shortcomings, restored domestic and foreign confidence in long-term contracts in capital and credit markets. Lastly, the government established a crawling-peg exchange rate regime with small devaluations at randomly determined moments.

After a time, investment reacted positively to the more stable environment, rising quickly, and by 1967 the economy contained a large amount of idle capacity, which was to prove key in the successful performance of the Brazilian economy in the late 1960s. It can be seen, therefore, that, despite a high degree of central planning in the economy, the macroeconomic management that set the scene for Brazil's economic miracle of the late 1960s and early 1970s was in fact fairly orthodox.

The second half of the explanation is less optimistic but in fact no less orthodox. Brazil's continued growth after the first oil shock of 1973 was simply unsustainable. Repressed inflation and the need for structural adjustment in the foreign accounts were legacies of the miracle years. Yet the government opted to sustain the pace of economic growth, with inflation as a second priority and the external accounts being left as an adjustment variable, partly under the belief that the oil shock would be transitory. The substantial liquidity in international capital markets, created by the recycling of petro-dollars, provided the means to sustain this course for a while, although Brazil's external debt had already begun to rise. Again, in the mid 1970s, favorable shifts in terms of trade helped Brazil stick to its guns, but Brazilian export quantities remained virtually constant. In the late 1970s, Brazil's current account deficit widened again, and its rapidly growing external debt, largely contracted at floating interest rates, then set the scene for the lost decade of the 1980s.

In agreement with other studies, physical capital accumulation and TFP growth explain most of the growth dynamics of the Brazilian economy since 1930. The higher the value of the capital elasticity of output used for decomposing growth, the higher the contribution of capital and the lower that of TFP. However, TFP growth seems to have been systematically associated with growth in the stock of machinery and equipment, suggesting that some TFP growth was gained through capital-embodied technological progress.

This suggests a further reason for the eventual faltering of Brazil's high growth performance in the 1970s. Part of the government response to external imbalances in the early 1970s had been to increase import barriers applying to capital goods, and the subsequent fall in capital goods imports created further negative effects through decreased embodied technological progress.

A final legacy of the macroeconomic imbalances inherited from the 1980s has been the dramatic decline in Brazilian infrastructure investment, mostly undertaken under the aegis of the state until the 1990s. Fiscal constraints have ruled out a concerted campaign of public investment in the 1990s, while residual macroeconomic uncertainty, scarce credit, and a regulatory regime that has until recently still been in its formative stages (*viz.* the energy sector) have limited the extent to which the private sector has been willing or able to step into the breach.

5.2 – Looking Forward: Policies for the Next Century

In contrast to the broad pattern since 1930, macroeconomic growth accounting exercises suggest that the acceleration of GDP growth after price stability in 1994 was entirely due to higher TFP growth. Under most assumptions, TFP growth was higher in 1994–2000 than at any time since 1930. Indeed, the reason why low inflation and the nineties market reforms have failed to bring output growth back to pre-1980 levels has been the failure of those reforms to generate factor accumulation, with the contributions of both labor and capital to output growth actually declining in comparison to 1981–93. This TFP recovery proves slightly elusive in firm-level data, where TFP growth in the 1990s seems somewhat anaemic. The broad pattern of TFP decline through the 1980s and recovery in the 1990s is nonetheless present.

More helpful for policy formulation are the differential patterns of TFP growth observed across firms of differing characteristics. Less technological sectors—food, textiles, leather, and non-metallic minerals—showed the worst performance and actually declined in productivity during the 1990s, while more technological sectors—automotive sectors and electrical equipment—were more dynamic. And the industrial composition of the manufacturing sector in the North and Northeast of Brazil led to lower TFP growth in these regions relative to the South and Southeast.

Trade opening has had a positive effect on industrial productivity, and may have contributed to raise average TFP by about 6 percent. Market penetration by foreign competitors raised the level of TFP, though export orientation does not raise TFP in the Brazilian data; indeed this relationship is negative. Other findings suggest the importance of technological innovation: higher shares of IT in physical capital raised both TFP and its growth rate. To complement this result, firms employing more skilled labor, in the form of a higher white-to-blue collar ratio, showed faster TFP growth, suggesting that Brazilian human capital investments contribute to TFP growth. Foreign machinery, on the other hand, had no significant effect, questioning the role of this as a conduit of embodied technological change in recent Brazilian growth. Given evidence from firms elsewhere on the importance of international knowledge flows, this result raises the concern that Brazil's integration into international production is not generating all its potential benefits, perhaps owing to a bias towards regional trade, perhaps owing to impediments to technology transfer. Finally, new firms possessed higher and faster-growing TFP, suggesting that measures to ease their entry may be a source of future productivity gains for Brazil.

It is important to cast these observations about the importance of knowledge flows and the vibrancy of new entrants in the light of Brazil's present business environment. The directed credit schemes that reflect the centrally planned approach of Brazil's past, a heavy regulatory environment involving three levels of government (for example applying to firm licensing and site development), cascading taxes, pervasive labor regulations, controls on foreign licensing and technology transfer, and a slow process of intellectual property protection, are all candidates for public scrutiny given the empirical evidence presented here.

Household evidence supports strong conclusions, already suggested by the firm-level data, regarding human capital investments in Brazil. Macroeconomic analysis suggests that human capital accumulation has not, so far, been the driver of the country's economic growth. And Brazil's human capital levels, particularly education indicators, still lag behind the region's. Yet in the 1990s, education emerges in household data as the strongest determinant of income growth.

Moreover, the expansion of basic education, in particular lower secondary, is the single most powerful tool at the government's disposal to improve the distribution of the gains from economic growth among the population. A further important finding from household data in this regard is the fundamental role played by the elimination of inflation under the Real Plan in improving the incidence of income growth among the poor. This is a key policy conclusion: any return to the inflationary environment of the past would above all hurt Brazil's poor. By continuing with these two basic policies—expanding high-quality basic education and keeping inflation low—Brazil can avoid facing the growth-inequality tradeoff that the data suggest it has faced in the past.

It becomes clear that a return to the policies that Brazil pursued in the 1960s and 1970s is neither feasible nor desirable. Scrutiny of the Brazil's most successful period of economic growth suggests that macroeconomic fundamentals were not ignored, and that when they were this was not without consequences. And attention to present-day macroeconomic and microeconomic data suggest the primacy of trade, enterprise, innovation, knowledge flows, and human capital as the drivers of growth for the country in the next century.

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APPENDIX: VECTOR ERROR CORRECTION MODEL

$$Y = AK^\alpha L^{1-\alpha}$$

Vector Error Correction Estimates		
Sample(adjusted): 1933-1999		
Included observations: 67 after adjusting endpoints		
Standard errors in () & t-statistics in []		
Cointegrating Eq:	CointEq1	
LY(-1)	1.000000	
LKL(-1)	-0.709671	
	(0.01923)	
	[-36.8992]	
C	6.139549	
	(0.20220)	
	[30.3638]	
Error Correction:	D(LY)	D(LKL)
CointEq1	-0.230796	-0.019307
	(0.05925)	(0.02339)
	[-3.89541]	[-0.82529]
D(LY(-1))	0.267711	0.109657
	(0.11714)	(0.04625)
	[2.28537]	[2.37081]
D(LY(-2))	0.394475	0.106968
	(0.11707)	(0.04622)
	[3.36969]	[2.31418]
D(LKL(-1))	0.150799	0.866719
	(0.35487)	(0.14012)
	[0.42495]	[6.18568]
D(LKL(-2))	-0.048860	-0.057031
	(0.31686)	(0.12511)
	[-0.15420]	[-0.45584]
D81	-0.090956	-0.015216
	(0.03246)	(0.01282)
	[-2.80200]	[-1.18719]
R-squared	0.342000	0.835520
Adj. R-squared	0.288065	0.822038
Sum sq. resids	0.062505	0.009745
S.E. equation	0.032011	0.012639
F-statistic	6.341031	61.97322
Log likelihood	138.6672	200.9276
Akaike AIC	-3.960214	-5.818736
Schwarz SC	-3.762779	-5.621301
Mean dependent	0.030122	0.038607
S.D. dependent	0.037938	0.029961
Determinant Residual Covariance		1.34E-07
Log Likelihood		346.2347
Log Likelihood (d.f. adjusted)		339.9488
Akaike Information Criteria		-9.699964
Schwarz Criteria		-9.206377