

# Regional income convergence in Brazil and its socio-economic determinants\*

Álvaro Antônio Zini Júnior<sup>§</sup>

## RESUMO

Este estudo analisa a evolução da renda per capita real dos estados brasileiros, examinando se a divergência de renda cresceu ou diminuiu entre 1939 e 1994. São apresentadas evidências robustas de convergência de renda per capita entre estados, tanto no sentido absoluto como no sentido condicional, embora as velocidades verificadas sejam baixas. São também analisados fatores socioeconômicos que podem explicar as diferenças nos desempenhos dos estados. Observa-se que indicadores de capital humano, investimento na indústria e na infra-estrutura em geral induzem o crescimento, enquanto a concentração da propriedade da terra contribui para diminuir o crescimento dos estados.

**Palavras-chave:** desigualdade regional, crescimento econômico.

## ABSTRACT

This study looks at the evolution of real income per capita across states in Brazil to examine the question of whether regional divergence of income increased or diminished from 1939 to 1994. Robust evidences of per capita income convergence across states are reported under the *conditional* and the *unconditional* convergence hypotheses, although the speed of convergence was low. Socio-economic factors that may explain the differences in state performances are examined and indicate that human capital, investment in industry (and in infrastructure in general) induced growth while concentration of land property helped to deter growth.

**Key words:** regional inequality, economic growth.

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§ University of São Paulo.

## 1 Introduction

In the neoclassical growth model, differences in regional income per capita should decrease over time and evolve to a steady state equilibrium level, or, more realistically, to a situation where there is a narrow gap between regions. This study looks at the evolution of real income per capita across states in Brazil from 1939 to 1994 to examine the question of whether regional divergence of income increased or diminished in this period.

The interest on the issue of regional (or spatial) income distribution was revived in the 1990s because it serves to test some central predictions of the neoclassical model of growth and because it has implications on policy recommendations concerning the promotion of regional growth.

Barro and Sala-i-Martin (1991, 1992a and 1992b) extended the tests of income convergence associated with the controversy of growth models to the area of regional economics. In these works, the authors documented solid evidence of income convergence across states in the United States between 1880 and 1987 and among 73 regions of Western Europe from 1950 to 1985. They also found evidence of convergence within Japanese prefectures over the period 1930 to 1990. Statistically significant findings of convergence between regions and countries of the European Community have also been reported by Ben-David (1993).

These studies tested for *unconditional convergence*, that is, if there were a tendency for the dispersion of income across regions to narrow over time toward a common steady-state average, and for *conditional convergence*, that is, if different areas tend to a steady-state level of income that may be conditional on the area's specific endowments. In both cases, the rate of growth is dependent on the initial level of income, implying that the poorer areas grow faster than the richer ones.

Regarding developing countries, Jian, Sachs and Warner (1995) *did not* find convergence in their study of regions in China over the period 1952-1993, but found inconclusive evidence of income dispersion. This result is noteworthy given China's professed faith in income equality in this period. However, Bajpai and Sachs (1996) found evidence of income convergence using data for India from 1961 to 1993. Cashin and Sahay (1996) detected *unconditional convergence* for India during 1961-1993 but found income dispersion across states in *conditional convergence tests*.<sup>1</sup>

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1 *Unconditional (or absolute) convergence* is the hypothesis that income per capita in different countries or regions of a country converges to a long-run steady state level that is equal in all areas because all have the same production function (supposing equal access to technology). The test for *unconditional convergence* is known as the  $\sigma$ -test where  $\sigma^2$  represents the variance of a sample. *Conditional convergence* is the hypothesis that the long-run steady state level of per capita income is dependent on geographical, technological or institutional factors that may be different in different countries or regions. *Conditional convergence* is tested by the so-called  $\beta$ -test. See Barro and Sala-i-Martin (1992a and 1995) on these hypotheses and tests.

This study focuses on Brazil to test for convergence using data from 1939 to 1994. Robust evidence of income per capita convergence across states is reported under both the *conditional* and the *unconditional* convergence hypotheses using the tests proposed by Barro and Sala-i-Martin. Special attention was paid to the compilation of a “long” time series and to the socio-economic variables used in structural regressions.

Our main findings are that per capita income disparity across states decreased in Brazil for the period from 1939 to 1994, although the speed of convergence was low. Looking at sub-periods, disparity increased from 1939 to 1955, decreased from 1955 to 1965, went up again from 1965 to 1975, came down substantially from 1975 to 1985, and increased slightly from 1990 to 1994. Socio-economic factors that may explain the differences in state performances are examined and indicate that human capital, investment in industry (and in infrastructure in general) induced growth while concentration of land property helped to deter growth.

The paper starts with a summary of Brazil’s economic history in the 19<sup>th</sup> century to give a broad explanation for the income disparity across regions shown in 1939 when our time series begins. This background refers the reader to the charged political debate about the uneven regional development in Brazil - see Cano (1985) or Campolina Diniz (1995) on the topic. The paper presents solid evidence that, contrary to common belief, it was not the industrialization of the Southern states of the country, in particular that of *São Paulo* in the 50s and 60s, that explains regional discrepancies in income. Rather, these differences took shape in developments that happened around the turn of the century.

In the following section, the data set is presented, the growth rates of different states from 1939 to 1994 are discussed, and econometric tests to detect convergence are performed. The paper then examines some of the structural factors that may explain the differences in performance across states. In the concluding section, the main findings are reviewed and the issue of whether or not Brazil’s regional development agencies have been instrumental in diminishing the difference in per capita income is raised.

## **2 Regional income disparity in Brazil: historical roots**

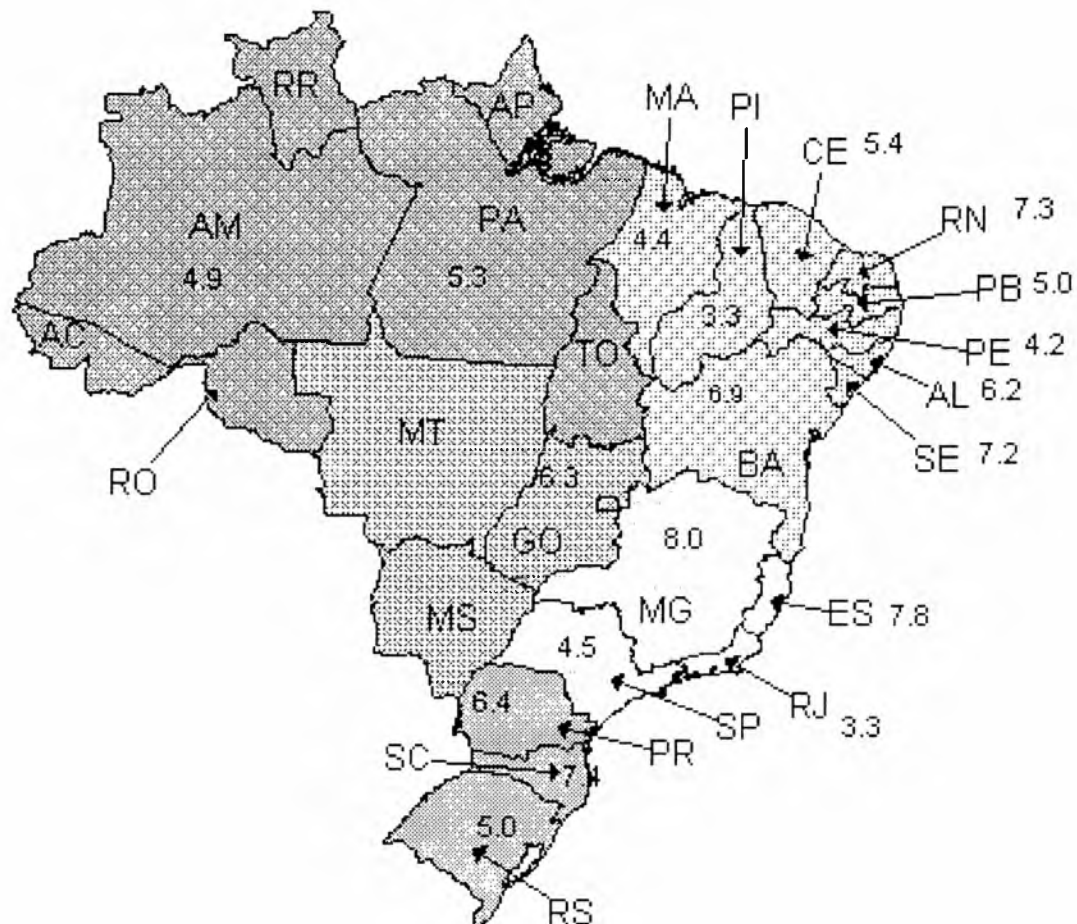
Considerable discrepancies in per capita income across regions of Brazil exist and have led to charges of policy discrimination against the Northeast in favor of the South.

**Table 1**  
**Distribution of Population and GDP Across Regions of Brazil**

	1939				1994			
	Share of territory (%)	Share of GDP (%)	Share of population %	Income p. capita / average (%)	Share of GDP (%)	Share of population %	Income p. capita / nat. average (%)	
North	42	3	4	73	5	7	72	
Northeast	18	17	35	48	14	29	49	
Southeast	11	63	44	141	56	43	133	
South	7	16	14	113	18	15	118	
Center-West	22	2	3	71	7	7	101	
<b>Brazil</b>	100	100	100	100	100	100	100	
<b>Size of variable</b>	8,547 Km <sup>2</sup>	R\$ 29.3 bi.	40 million	R\$ 721	R\$ 595.4 bi.	154 million	R\$ 3,873	

Obs. Values of GDP and of income per capita are expressed in constant prices of 1995. One real was worth approximately one dollar in 1995 (R\$ 1 = \$ 1).

**Figure 1**  
**Brazil: Division by States and Regions**



Although the roots of the problem are complex, the fact is that differences in income per capita across regions are high. Table 1 presents data on the proportion of GDP, the proportion of population and the ratio of GDP per capita compared to the national average for the five regions that make up the country. Figure 1 shows a map of Brazil and its geopolitical regions.<sup>2</sup>

According to IBGE, the North comprised 42% of the territory and had 7% of the population in 1994; the Northeast had 18% of the territory and 29% of the population; the Southeast accounted for 11% of the territory and 56% of the population; the South, 7% and 18%, respectively; and the Center-West 22% and 7%. Demographic density was 70 persons/km<sup>2</sup> in the Southeast, 40 in the South, 28 in the Northeast, 6 in the Center-West and 3 in the North.

<sup>2</sup> Brazil is divided in 26 states, one federal territory and one Federal District, where the city of *Brasília* is located. The map on Figure 1 shows a map of Brazil and the numbers inserted in each state are the number of times real income per capita grew from 1939 to 1994.

In 1994, income per capita in the Southeast was 1.33 times the national average, 1.18 in the South, about even in the Center-West, 0.74 in the North, but only 0.49 in the Northeast. Such disparity seems to have taken shape in the last years of the 19<sup>th</sup> century. It was slightly higher in 1939, when our series begins, than in 1994. There are good reasons to suppose that the difference in income was wider in the 1910s and 1920s than in 1939. It is important to remember that income was still very depressed in the Southeast in 1939 because the area's active export-oriented economy (coffee) suffered the full brunt of the disruption of international trade. To understand the roots of this income disparity, a summary of Brazil's economic history will be presented.

By 1808, Brazil had a huge territory (8.5 million Km<sup>2</sup>) but was sparsely populated: 2.4 million people, see Table 2. Except for decaying sugar plantations in the Northeast, tobacco in *Bahia*, scattered towns in the exhausted areas of gold extraction in *Minas Gerais*, government and commerce in *Rio de Janeiro*, very little economic activity was taking place elsewhere.

**Table 2**  
**Brazil: Distribution of Population by Regions, 1808-1994**

	1808	1872	1900	1939	1970	1994
<b>North</b>	4%	3%	4%	4%	4%	7%
<b>Northeast</b>	50%	47%	38%	35%	30%	29%
<b>Southeast</b>	35%	41%	44%	44%	43%	43%
<b>South</b>	7%	7%	10%	14%	18%	15%
<b>Center-West</b>	3%	2%	3%	3%	5%	7%
<b>Population (millions)</b>	2,4	10,1	17,3	40,1	93,1	153,7

Source: IBGE (1987), *Estatísticas Históricas do Brasil* and *Sinópsse Estatística*, 1995.

**Figure 2**  
**Brazil: Distribution of Population Across Regions**

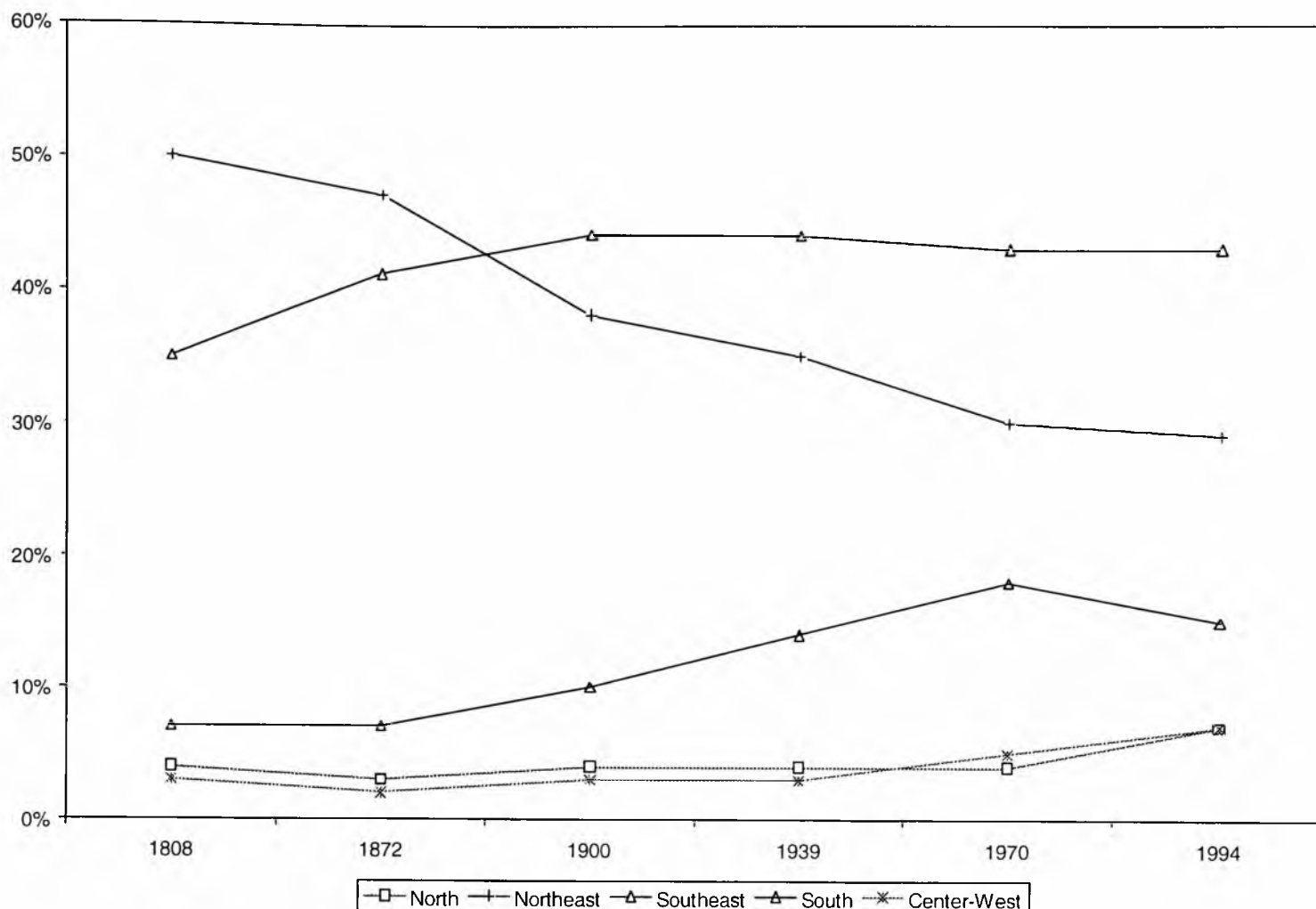


Table 2 and Figure 2 show the relative shares of population by regions. Some numbers are worth stressing:

- (i) The North had about 4% of the population from 1808 until 1970 and increased this share to 7% in the last two decades.
- (ii) The Northeast had 50% of the population in 1808 but has had a secular decline in its relative position, a trend that goes back to the early decades of last century.
- (iii) The Southeast had 35% of the population, mainly because of families that remained in *Minas Gerais* after the gold cycle (population of 350,000) and people living around *Rio de Janeiro* (235,000).
- (iv) The South had 7% of the population during most of last century but increased its relative proportion steadily from 1872 to 1970; in the past decades, however, it has become an exporter of people.

- (v) The Center-West had 3% of the population from 1808 until 1960 but has gained people since the inauguration of *Brasília* in 1960 and the opening of the agricultural frontier in the Central Plateau in the 1970s.

The first half of the XIX<sup>th</sup> century, was marked by the Independence of Brazil from Portugal, the organization of a national government that was able to keep the country united despite its low population, but on the economic front there was very little growth. By 1850 the country was governed by a conservative emperor backed by traditionalist land owners not very fond of the rapid changes and the way to organize the economy that was transforming England. Good and safe money was based on traditional farming with the use of slave labor. Those who ventured to use new capitalist methods like Irineu Evangelista de Souza (Visconde de Mauá) encountered suspicion and opposition.<sup>3</sup>

The growth of coffee exports started to transform this situation in the 1860s. By 1870 coffee farming reached the rich soils of the *São Paulo* plateau, and export-led growth profoundly changed the country. According to IBGE, gross domestic product grew 100 times from 1900 to 1994; population increased 9.0 times and real per capita income multiplied by a factor of 11.1.<sup>4</sup>

A sustainable growth process started in the Southern states of Brazil in the late 19<sup>th</sup> century, with the wealth generated by coffee, cattle raising in the South and the sizable inflow of free labor.<sup>5</sup> Immigrants from Italy, Spain, and Germany started to migrate to Brazil in very small numbers by the 1830s, adding to a small inflow that had been coming from Portugal since colonial times. European immigration grew enormously after 1870 to supply the demand for labor in the booming coffee plantations because the alternative supply of labor, slavery, had been prohibited in 1850.<sup>6</sup> By the 1910s, immigration became more diversified with people coming from Poland, Russia, Hungary, Syria, Turkey, Lebanon, and Japan. The inflow of immigration provided the basis for future urban and industrial growth.

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3 The fascinating book by Caldeira (1995) on Mauá and the way business were conducted in mid-19th century Brazil powerfully shows how distant the country was from capitalist institutions at this time.

4 As Maddison (1989) documented, from 1880 to 1980, Brazil was among the fastest growing economies in the World. But growth started from a very low basis and the country is still among the middle income group. Per capita income was \$3,870 in 1994.

5 For instance, the city of São Paulo had about 30,000 people in 1850, 200,000 in 1890 and jumped to 11 million in 1991.

6 For a general Brazil's history from the Portuguese navigations to the 1990s, see Fausto (1983, 1994), or the classical but dated books by Prado Jr. (1967) and Furtado (1968).



Most immigrants were farm laborers, but a significant fraction was made up of urban artisans, tradesmen and some future entrepreneurs. What is more important is that even these very poor European and Asian peasants had much better knowledge of diversified agriculture and other crafts than the local population of slaves and the small group of local wage earners. In terms of economic growth models, it can be said that the supply of human capital increased in quantity and quality.

Most of the immigrants went to live in the states of *São Paulo*, *Paraná*, *Santa Catarina*, *Rio Grande do Sul* and in *Espirito Santo*. The prosperity generated by coffee in *São Paulo* and by cattle raising in *Rio Grande do Sul* contrasted with the decay of the sugar plantations in the Northeast, and this is crucial to understand the income disparity that took shape around the turn of the century.

The Northeast was the first area to be colonized in Brazil. Sugarcane was the economic basis of the occupation of the regions with higher rainfall, starting late in the 16<sup>th</sup> century. The area became an important exporter of brown sugar in the 17<sup>th</sup> and the 18<sup>th</sup> centuries based on large plantations manned by slave labor. But, by 1800, the Northeast had lost its competitiveness because it did not modernize, and the Caribbean emerged as a greater producer of sugar. Big farm holdings (*latifúndios*), monoculture, slavery and strong political bosses (*coronéis*) did not lead to a capitalist development in the sense of engendering the creation of an industrious bourgeoisie and an urban capitalist order. The decline of the Northeast's proportion of the population, shown in Table 2, indicates that the area had become a net exporter of population, strongly suggesting its loss in economic vigor.

Meanwhile, the Amazon North was, and still is, a very vast but relatively empty economic area. The Center-West also had a low population, and its economy consisted of scattered cattle raising. The end of Monarchy and the beginning of the Republican era in 1889 brought hopes that the exercise of power would become less centralized and be shared with local governments. But this did not happen, and the period from 1889 to 1930 ended up being called "the coffee and milk Republic" because Presidents would come either from the state of *São Paulo* (coffee) or *Minas Gerais* (dairy products).

While the 1920s was a time of rising prosperity in Southern Brazil and in Bahia with its tobacco and cocoa, it was also a period of increasing political dissatisfaction. In 1930 Getúlio Vargas, an ex-Governor of *Rio Grande do Sul*, led a successful insurrection and took power. The 1930 Revolution was backed by different groups and could have degenerated into regional fights that could fragment the country, but its leaders were able to consolidate their control on power. Basically, the Vargas' era represented an exchange of the old elite by newer groups: young politicians, professionals, army officers and industrialists.

The new government, contrary to its stated credo, centralized decision making in part as a reaction to the international crisis. The disruption of international trade in the 1930s precipitated a fall in all export earnings (especially coffee), and Vargas was pressed to adopt interventionist policies to protect domestic income; thus import substitution policies were adopted and eventually became the strategy for industrialization - see Suzigan (1986). On another front, the first Vargas' period (1930-45) was instrumental in consolidating capitalist institutions and in turning the political backbone of the country into a predominantly urban society. To modernize economic relations, Vargas signed laws regulating the labor market and gave a new role to the Armed Forces, enabling them to oversee the construction of basic infrastructure and the integration of the different areas of the country.<sup>7</sup>

Vargas started his government as a democrat but became enamored with the Fascist doctrine. In 1937, he closed Congress and imposed an authoritarian Constitution. He was President until 1945, when the end of World War II brought a wave of democratization to the continent and was deposed. In 1950 he was elected President again by a large majority of the popular vote. He stayed in power until 1954, when he committed suicide due to increasing pressures on him to leave office.

Getúlio Vargas was the most important Brazilian politician this century; he had great qualities: a deep understanding of the nation's desire to become modern and prosperous and a skilled sense of how to run the government. He and his main advisers agreed that Brazil needed a steel mill to set the foundations of heavy industry, and they bargained hard with the US to rent the technology to produce steel in exchange for Brazil's joining the Allied forces in World War II. Finally, the city of *Rio de Janeiro* lived, with Getúlio, its most magnificent age. It was the undisputed political and cultural capital of Brazil.<sup>8</sup>

But he also had faults and a authoritarian bias. His suicide in 1954 shocked the country and could have ended in political instability because of his popularity. However, elections were held, and Juscelino Kubitschek was elected President in 1955. He proved to be a very skillful politician and defused the political crisis: from 1956 to 1960, Kubitschek was the "*Bossa*

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7 On the Vargas governments, see Carone (1965), Skidmore (1969), Levine (1970), Baer (1989) or Fausto (1994).

8 Starting in the Vargas period there is an ongoing debate on the uneven development of Brazil. The debate became politically charged in the 1960s and the Federal Government's policies were accused of benefiting the South in detriment of the North and the Northeast. In the 1930s, after some years of catastrophic drought in the Northeast, public works, like the construction of dams, were initiated in the area and migration to the Amazon was stimulated. In the late 1950s, fiscal incentives to locate industrial plants in the North and the Northeast were devised and Sudene and Sudam, two regional development agencies, were devised to plan the economic development of these areas.

*Nova*” President. By adopting *desenvolvimentismo* or *developmentalism* as his banner, he ignited Brazil’s imagination with an economic doctrine that combined import substitution, government-led industrialization and job creation.<sup>9</sup>

From 1956 to 1961, Brazil grew as never before, and confidence in the future of the country ran high. The auto industry built plants in São Paulo using the steel produced in *Volta Redonda* (where the steel mill negotiated by Vargas had been built). In a self-reinforcing process, factories for car components, electrical and mechanical equipment, and sundry consumer goods were set up, and many new jobs were created. An undervalued exchange rate provided a cross-subsidy for the importation of capital goods and helped to boost the formation of an emerging class of industrialists.

In the 1960s, the imbalances present in the previous period of booming growth became evident, but the difficulties to correct them with the existing institutions led to a period of political polarization. In 1964, the military took power, fearing that country was becoming socialist.

The policies of the military toward the North and Northeast were to strengthen the power of Sudene and Sudam in the hope that fiscal incentives would change the situation.<sup>10</sup> However, nothing was done to modernize the political system. In the 1970s, important investment projects, like the construction of the *Transamazon* road, the project of a national telecommunications system and the construction of a sizable network of federal roads linking the North, the Northeast to the Center-West and the South, were undertaken and played a role in preventing the increase in the income disparity by facilitating internal migration and the expansion of the economic frontiers to areas of difficult access. Also in the 1970s, subsidies geared to the promotion of industries in these areas increased many times. An assessment of the full effect of these policies is beyond the scope of this paper, but many of the favored investment projects never got off the ground, and the money was deviated to other activities.

The recent past - 1980/94 - has been a period of a difficult fiscal crisis and no growth in per capita income. The debt crisis and the external transfer of resources unbalanced the public budget in the early 1980s and dismantled the structure of savings-financing that existed in the

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9 On import substitution, see Furtado (1967) or Baer (1989). For an insightful and early analysis of the limitations of import substitution as a development strategy, see Tavares (1972). On the Kubitschek’s government, see Skidmore (1969), Benevides (1979), or Fausto (1983).

10 Sudene is a development agency responsible for granting fiscal incentives and managing the use of federal income-tax rebates to promote investments in industry and in services the Northeast; Sudam does the same for the North.

economy. High inflation and frustrated attempts to fight it marked these years. In 1994, the *Real Plan* ended a situation of almost hyperinflation.<sup>11</sup> On the positive side, a functioning democracy has taken root, and a new development strategy, less dependent on the public sector, is taking shape.

### 3 What does the data say?

The data set includes data on per capita income expressed in 1995 constant prices and other variables used in the structural regressions explained in the next section.

Data on GDP per state are present for 1939, 1947, and every five-year period from 1950 to 1994 (12 observations). Income per capita per state was obtained by dividing the state's GDP by its population. GDP per state for the period that goes from 1939 to 1985 comes from IBGE (1987 and 1992) and from 1985 to 1994 from IPEA (see Considera *et alii* (1996)). There are minor differences in the way state GDP has been computed by IBGE and IPEA but they do not affect the tests made because the dispersion of per capita income is not affected by these differences.<sup>12</sup> Nominal figures were corrected by the GDP price deflator, taking 1995 as the base year (1995 = 1), and values in *cruzeiros* were converted to *reais* using the rate of exchange of R\$ 1.00 equal to CR\$ 2,750.00 (in 1995, one *real* was approximately equal to one *dollar* thus the figures can be read as if they were expressed in dollar terms).

Brazil is presently divided into 26 States and one Federal District, where the city of *Brasília* is located. Until 1960 GDP per state was reported for 20 states and comprised of the whole country. This division was maintained for the subsequent period in this study because it would be virtually impossible to disentangle the data for former territories that are states now. Thus data for the states of *Acre*, *Roraima* and *Rondônia* were added to the state of *Amazonas* after they started being reported on an individual basis, data for *Amapá* was added to *Pará*, figures for the city of *Rio* were added to the state of *Rio de Janeiro* and the new Federal

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11 On Brazil's economic policies in the 1980's and the *Collor plan*, see Zini Jr. (1992); on the *Real Plan*, see Sachs and Zini Jr. (1996).

12 Computational procedures used by IPEA are explained in detail in Considera *et alii*. (1996).

District, *Brasília*, was added to *Goiás*. In 1985, *Mato Grosso* was split in two and so was *Goiás* in 1988, but the older state boundaries have been preserved in this study. This means that figures for the state of *Tocantins*, which now belongs to the Northern region, are reported as belonging to the Center-West, but this does not cause a problem for this study because the data base is constructed in terms of per capita ratios.

Table 3 has information on the growth of income per capita from 1939 to 1994 by states and regions. Brazil's total GDP grew 20 times in real terms since 1939· the population increased 3.7 times and income per capita increased 5.4 times. To have some perspective, the World Bank indicates that World GDP grew 7 times from 1940 to 1990 and income per capita increased 3 times.

Table 4 reports the proportion of GDP for each state. Looking at regions, the Southeast's proportion was lowered from 63% to 57%; the South gained two points, going from 16% to 18%; the Northeast went from 17% to 14%, while the North and the Center-West increased their shares from 3% to 5% and from 2% to 7%, respectively.

The recent strong growth of the Center-West has three main reasons: the moving of the capital to *Brasília* in the 1960s, the expansion of the agricultural frontier to *Mato Grosso* and the Central Plateau; and, more recently, by soybean farming in the *Cerrados*. The region's flatland favors mechanization and the use of calcareous stone from nearby mines corrects the soil's acidity.

Table 3 shows that the five states with greatest gains in real per capita income from 1939 and 1994 were *Minas Gerais* (8.0 times), *Espírito Santo* (7.8), *Santa Catarina* (7.4), *Rio Grande do Norte* (7.3) and *Sergipe* (7.2). The national average went up by a factor of 5.4. The five states with lowest growth were *Rio de Janeiro* (3.3 times), *Piauí* (3.3), *Pernambuco* (4.2), *Maranhão* (4.4), and *São Paulo* (4.5 times). All states at least tripled their income per capita during 1939-94 and six grew more than seven times.

**Table 3**  
**Income Growth by State and Income Per Capita**

	1939-94	1947-94	1939-50	1950-60	1960-80	1980-94	Income per capita	
							1939	1994
<b>BRAZIL</b>	5,4	5,1	1,2	1,4	3,2	1,0	721	3873
<b>North</b>	5,2	5,4	1,1	1,3	3,4	1,1	533	2785
Amazonas	4,9	4,9	1,1	1,1	4,2	1,0	623	3063
Pará	5,3	5,6	1,1	1,4	2,9	1,2	484	2574
<b>Northeast</b>	5,5	5,6	1,1	1,5	2,7	1,2	344	1883
Maranhão	4,4	6,7	0,7	1,7	2,6	1,4	301	1331
Piauí	3,3	4,0	0,9	1,0	2,9	1,3	315	1053
Ceará	5,4	6,0	1,0	1,7	2,7	1,2	300	1624
Rio Grande da Norte	7,3	6,0	1,4	1,5	2,4	1,5	308	2257
Paraíba	5,0	4,6	1,3	1,7	1,8	1,3	280	1397
Pernambuco	4,2	4,3	1,1	1,4	2,6	1,1	485	2021
Alagoas	6,2	5,1	1,4	1,4	2,8	1,1	278	1729
Sergipe	7,2	7,2	1,2	1,4	2,9	1,6	344	2468
Bahia	6,9	6,6	1,2	1,5	3,5	1,1	335	2320
<b>Southeast</b>	5,0	4,7	1,2	1,4	3,2	0,9	1019	5141
Minas Gerais	8,0	6,4	1,5	1,3	3,8	1,1	447	3572
Espírito Santo	7,8	7,7	1,2	1,4	4,4	1,1	461	3613
Ria de Janeiro	3,3	3,5	1,1	1,2	2,6	1,0	1672	5530
São Paulo	4,5	4,2	1,2	1,5	3,0	0,8	1297	5884
<b>South</b>	5,6	5,3	1,2	1,4	3,2	1,1	814	4560
Paraná	6,4	5,9	1,1	1,6	2,7	1,3	720	4633
Santa Catarina	7,4	5,7	1,5	1,2	4,0	1,0	581	4293
Rio Grande do Sul	5,0	4,9	1,1	1,3	3,4	1,0	930	4627
<b>Center West</b>	7,6	10,0	0,8	1,7	4,8	1,1	511	3907
Mato Grosso	5,1	6,1	1,0	1,5	3,3	1,1	662	3344
Goiás	6,3	8,5	0,8	1,8	3,6	1,2	433	2710
Federal District					35,1	1,1		8938

**Table 4**  
**Shares of GDP por State and Regions**

	1939	1980	1970	1980	1994
<b>North</b>	2,7	2,2	2,2	3,2	4,6
Amazonas	1,1	0,9	1,0	1,5	2,2
Pará	1,6	1,4	1,2	1,6	2,4
<b>Northeast</b>	16,7	14,8	11,7	12,0	14,0
Maranhão	1,2	1,1	0,8	0,8	1,2
Piauí	0,9	0,4	0,4	0,4	0,5
Ceará	2,1	2,0	1,4	1,5	1,6
Rio Grande do Norte	0,8	0,9	0,5	0,6	1,0
Paraíba	1,3	1,4	0,7	0,7	0,8
Pernambuco	4,4	3,5	2,9	2,5	2,7
Alagoas	0,9	0,8	0,7	0,7	0,8
Sergipe	0,6	0,5	0,4	0,4	0,7
Bahia	4,5	4,2	3,8	4,3	4,9
<b>Southeast</b>	62,9	62,8	65,5	62,3	56,5
Minas Gerais	10,3	10,0	8,3	9,4	9,8
Espírito Santo	1,2	1,0	1,2	1,5	1,7
Rio de Janeiro	20,3	17,0	16,7	13,7	12,2
São Paulo	31,1	34,7	39,4	37,7	32,8
<b>South</b>	15,6	17,8	16,7	17,0	17,5
Paraná	3,0	6,4	5,4	5,8	6,7
Santa Catarina	2,3	2,6	2,7	3,3	3,4
Rio Grande do Sul	10,3	8,8	8,6	7,9	7,4
<b>Center West</b>	2,1	2,5	3,9	5,6	7,3
Mato Grosso	1,0	1,0	1,1	1,7	2,3
Goiás	1,2	1,4	1,5	1,9	2,4
Federal District			1,3	2,0	2,6
<b>BRASIL</b>	100	100	100	100	100
GDP in R\$ bil. (constant 1995 prices)	29,274	85,364	179,292	464,402	595,361

*São Paulo, Rio de Janeiro, Rio Grande do Sul* and *Minas Gerais* are the four states where most of Brazil's GDP is produced, but their joint share fell from 72.0% in 1939 to 62,2% in 1994—see Table 4. *São Paulo* increased its participation slightly from 31.1% to 32.8% because of higher than average increase in population; *Rio*'s share went down from 20.3% to 12.2%, a drop that, to some extent, is due to the transfer of the Federal Government to *Brasília*; but the data also indicates that the state has been growing at a slower than average rate since the 1950s. *Rio Grande do Sul* lost in relative terms, going from 10.3% to 7.4%, and *Minas Gerais* kept its share around 10.0%, whereas *Paraná, Santa Catarina, Mato Grosso, Goiás, Amazonas, Pará, Bahia, Ceará* and *Espírito Santo* gained ground.

GDP data for 1939 is open to criticism because it was computed by IBGE in the late 1940s when the national accounts' methodology was being tested in Brazil. Annual calculation of the national accounts started being made only in 1948. The numbers for 1939, therefore, are not as good as later data. For this reason, Table 3 also reports the growth factor for 1947-94 and at later intervals. If 1947-94 is taken as the relevant time interval, the growth list changes a little: *Goiás* (8.5), *Espírito Santo* (7.7), *Sergipe* (7.2), *Maranhão* (6.7), *Bahia* (6,6) and *Minas Gerais* (6,5) come on top; at the other end, are *Rio de Janeiro* (3.5), *Piauí* (4.0), *São Paulo* (4,2), *Pernambuco* (4.3) and *Paraíba* (4.6). The list is almost the same as the one for 1939-94, except for *Goiás* and *Maranhão*, whose performances were much better in the second period (*Goiás* both because of the transfer of *Brasília* to its geographic center and the latter development of the *Cerrados Plateau* and *Maranhão* due to the high investments in the *Carajás* iron ores and the accompanying infrastructure).

Two tests to detect whether per capita income across states tended to converge were applied. One is the *unconditional convergence* or  $\sigma$  test, the other is the *conditional convergence* or  $\beta$  test.<sup>13</sup> The  $\sigma$  test consists of calculating the variance of the logarithm of income across states at different periods in time. If the index decreases, *convergence* is taking place in the sense that dispersion is going down. *Conditional (or  $\beta$ ) convergence* is a trend toward a steady state level of per capita income that is dependent on each region's specific endowment of factors, institutions and geography. If *convergence* holds, per capita income tends to grow faster in poorer than in richer areas, therefore, the speed of convergence depends on the initial level of income per capita.

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13 One limitation of the  $\beta$  test is that it takes into account the size of the sample. Thus, the larger the sample, the smaller the estimated coefficient of the independent variable. Also a decrease in dispersion shown by the  $\sigma$  convergence test is not equal to  $\beta$  convergence because the two indicators, although related, take into account different factors, see Barro and Sala-i-Martin (1995).

The  $\sigma$  test was performed for three measurements of dispersion: the sample variance, variance divided by the sample mean and the coefficient of variation (standard deviation divided by the mean). The reason is that when the sample mean increases, the variance can go up just because of this growth. The dispersion measurements are reported in Table 5.

Figures 3 and 4 show the coefficient of variation of the log of income per capita across states and across regions; a trend line was fitted in each graph. Table 6 reports the results of trend lines fitted for different indicators of dispersion across states and regions for 1939-94 and 1947-94. The coefficient of variation falls faster across regions than across states indicating that regional data show a faster convergence. But regions are not homogeneous sets. For instance, two of the high growth states are in the Northeast as well as three with the lowest growth ratios; thus it seems better to focus on states rather than at the regional aggregates when studying the factors that explain the differences in growth rates reported in Table 3.

Figures 3 and 4 are helpful to delineate sub-periods regarding the measurement of disparity. Disparity increased from 1939 to 1955, decreased from 1955 to 1965 (this includes the period of rapid industrialization in the Kubitscheck government), went up again in 1965-1975, came down substantially from 1975 to 1990, and increased slightly in 1990-1994. The increase in income disparity from 1965 to 1975, when the income tax rebates overseen by Sudene and Sudam reached their highest levels, suggest that the policy was ineffective in reducing the income gap between the North and the South.

The  $\beta$  test involves a non linear regression of the proportionate growth in per capita GDP between the two extremes of the series (dependent variable) against the logarithm of the initial per capita GDP (independent variable) plus a constant. The test comes from the neoclassical growth model discussed by Barro and Sala-i-Martin (1991 and 1995). In discrete time intervals, the average growth rate of per capita income over the interval from 0 to T is given by

$$(1/T) \cdot \log(Y_{iT}/Y_{i0}) = \alpha - [(1-e^{-\beta T})/T] \log(y_{i0}) + \mu_{i0,T} \quad (1)$$

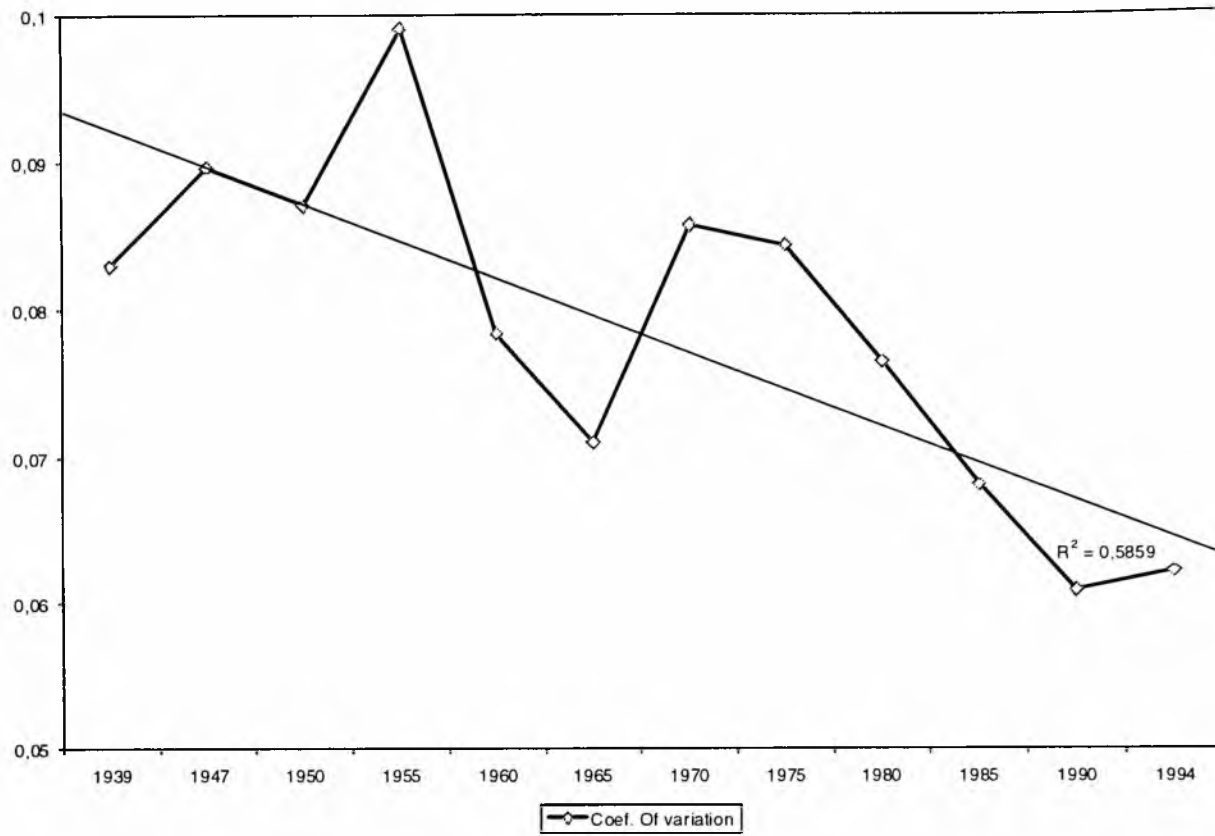
where  $\beta$  is the speed of convergence,  $\mu_{i0,T}$  is the average error between 0 and T (it is assumed that the random variable  $\mu_{it}$  has 0 mean and variance  $\sigma^2$ ), and is distributed independently of  $\log(y_{i,t-1})$  and of lagged or future disturbances. The constant term  $\alpha \equiv x + [(1-e^{-\beta T})/T] \log(y^*)$ , where  $y^*$  is the steady state level of the growth rate of  $y_i$  and  $x$  represents a shift parameter to allow for productivity or for exogenous shocks. Tables 7a and 7b show the results of the  $\beta$  test.



**Table 5**  
**Measurements of Income Dispersion**

	Log of y by States		
	Variance	Variance/Mean	Coefficient of variation
1939	0.0498	0.0185	0.0830
1947	0.0580	0.0216	0.0897
1950	0.0568	0.0208	0.0871
1955	0.0775	0.0276	0.0991
1960	0.0513	0.0178	0.0784
1965	0.0434	0.0148	0.0710
1970	0.0667	0.0221	0.0857
1975	0.0720	0.0226	0.0843
1980	0.0665	0.0197	0.0764
1985	0.0535	0.0157	0.0680
1990	0.0431	0.0126	0.0608
1994	0.0457	0.0132	0.0621
	Log of y by Regions		
1939	0.0341	0.0123	0.0665
1947	0.0485	0.0176	0.0797
1950	0.0493	0.0175	0.0789
1955	0.0637	0.0219	0.0867
1960	0.0410	0.0138	0.0683
1965	0.0369	0.0122	0.0636
1970	0.0512	0.0163	0.0720
1975	0.0617	0.0187	0.0751
1980	0.0455	0.0130	0.0609
1985	0.0327	0.0093	0.0515
1990	0.0284	0.0081	0.0479
1994	0.0314	0.0089	0.0501

**Figure 3**  
**Measurements of Dispersion Across States**  
**Coefficient of Variation of Log of y Across States**



**Figure 4**  
**Measurement of Dispersion Across Regions**  
**Coefficient of Variation of Log of y Across Regions**



**Table 6**  
**Regressions With a Trend line for Different Measurements of Dispersion of Per Capita Income Across States and Regions of Brazil**

	Period	Variable	Estimated trend coef.	Standard deviation	R <sup>2</sup>	DW
<b>States</b>	1939-94	variance/mean	-0.0007*	0.0003	0.30	1.69
		standard dev./mean	-0.0025*	0.0007	0.59	1.71
		variance	-0.0006	0.0010	0.04	1.53
	1947-94	variance/mean	-0.0009*	0.0004	0.42	1.90
		standard dev./mean	-0.0030**	0.0007	0.67	1.97
		variance	-0.0012	0.0011	0.11	1.67
<b>Regions</b>	1939-94	variance/mean	-0.0007*	0.0003	0.36	1.42
		standard dev./mean	-0.0027*	0.0007	0.58	1.36
		variance	-0.0012	0.0009	0.14	1.34
	1947-94	variance/mean	-0.0010**	0.0003	0.59	1.81
		standard dev./mean	-0.0035**	0.0006	0.77	1.80
		variance	-0.0021 <sup>+</sup>	0.0010	0.34	1.62

Obs.: \*\* indicates significance at 1% level; \* significant at 5% level; + significant at 10% level.

The computed  $\beta$  coefficient for 1939-94 was 0.0029 (Table 7a), much lower than the estimated speed of convergence for the U.S. However, the sign is correct, and the size of the coefficient increases to 0.0045 when 1947-94 is considered.

Barro and Sala-i-Martin (1995) show that when regions are subject to region-specific shocks (like droughts or excessive rainfall), the error terms show serial correlation. They recommend using dummy variables to take into account regional effects. This was done and the estimated  $\beta$  coefficient is reported in Table 7b. The speed of convergence increases when regional dummies are present; the estimated coefficient shows the right sign and increases to 0,008 for 1939-94 and reaches 0,009 for 1947-94 (both are statistically significant).<sup>14</sup> Barro and Sala-i-Martin estimated the speed of convergence for the US was 0.018 when dummy variables were introduced. An additional improvement would be to include variables representing the sector composition of GDP per state to account for the possibility of sector-specific shocks. Since the main interest of this paper is to detect whether convergence of income took place in Brazil, and as the answer is positive, the computations for sector-specific shocks were not undertaken.

14 The consistent negative sign on the dummy for the Northeast indicates a regional handicap that slows down growth. The dummy does not distinguish whether this is due to geographic or due to socio-economic factors or to both.

**Table 7.a**  
**Regressions of Personal Income Across Brazilian States:  $\beta$  Test - Part I**

	a	$\beta$	R <sup>2</sup>	regression standard error
1939-94	0.0221	0.0029 (0.0018)	0.12	0.0020
1947-94	0.0264	0.0037* (0.0015)	0.22	0.0019
1939-50	0.0238	-0.0008 (0.0075)	0.01	0.0073
1950-60	0.0393	0.0085 (0.0058)	0.10	0.0066
1960-70	-0.0128	0.0088 (0.0090)	0.002	0.0082
1970-80	0.0431	0.0024 (0.0048)	0.01	0.0056
1980-94	0.0469	0.0117** (0.0023)	0.56	0.0030

Obs: \*\* significant at 1% level; \* significant at 5% level; + significant at 10% level.

Non linear least square estimation of:  $[1/T] \log (y_{iT} / y_{i0}) = \alpha + (1 - e^{-\beta T})/T \log y_{i0} + \mu_{it}$  where i varies over 20 states and T is the time interval.

**Table 7.b**  
**Regressions of Personal Income Across Brazilian States:**  
 **$\beta$  Test With Dummy Variables - Part II**

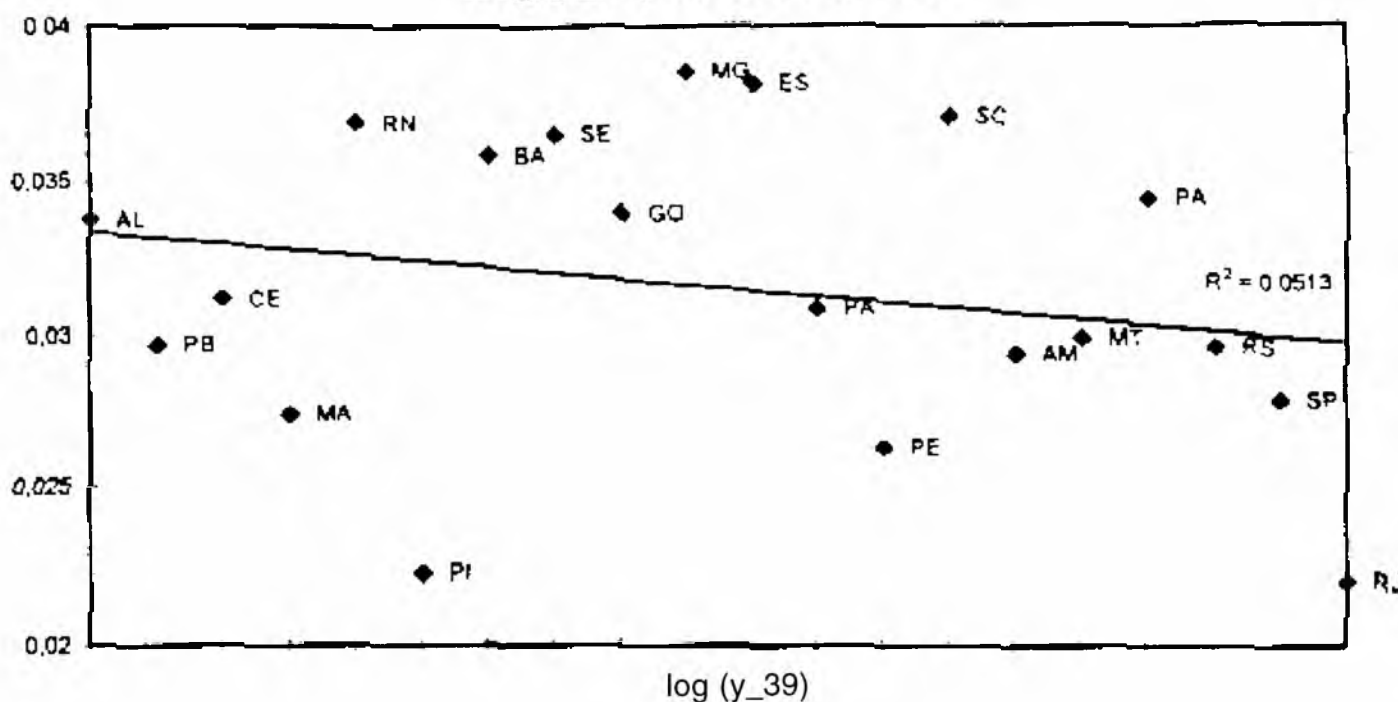
	a	$\beta$	d <sub>NE</sub>	d <sub>SE</sub>	d <sub>S</sub>	d <sub>CW</sub>	R <sup>2</sup>	regression st. error
1939-94	0.042	0.008** (0.0017)	-0.0021 (0.0014)	0.0025 (0.0015)	0.0028+ (0.0015)	0.0006 (0.0017)	0.54	0.0017
1947-94	0.042	0.009** (0.0018)	-0.0018 (0.0014)	0.0020 (0.0015)	0.0023 (0.0015)	0.0018 (0.0016)	0.59	0.0016
1939-50	0.031	0.010 (0.0101)	-0.0006 (0.0059)	0.0075 (0.0062)	0.0072 (0.0063)	-0.0079 (0.0067)	0.35	0.0067
1950-60	0.036	0.0087 (0.0105)	0.0038 (0.0058)	0.0046 (0.0065)	0.0048 (0.0066)	0.0011 (0.0069)	0.25	0.0068
1960-70	0.048	-0.0106 (0.0123)	-0.0090 (0.0067)	0.0051 (0.0079)	0.0005 (0.0080)	-0.0036 (0.0082)	0.27	0.0082
1970-80	0.101	0.187** (0.0060)	-0.0091* (0.0038)	0.0025 (0.0043)	0.0045 (0.0043)	0.0028 (0.0044)	0.52	0.0044
1980-94	0.062	0.0157** (0.0050)	-0.0006 (0.0030)	0.0016 (0.0032)	0.0038 (0.0032)	0.0013 (0.0032)	0.61	0.0032

Obs: \*\* significant at 1% level; \* significant at 5% level; + significant at 10% level.

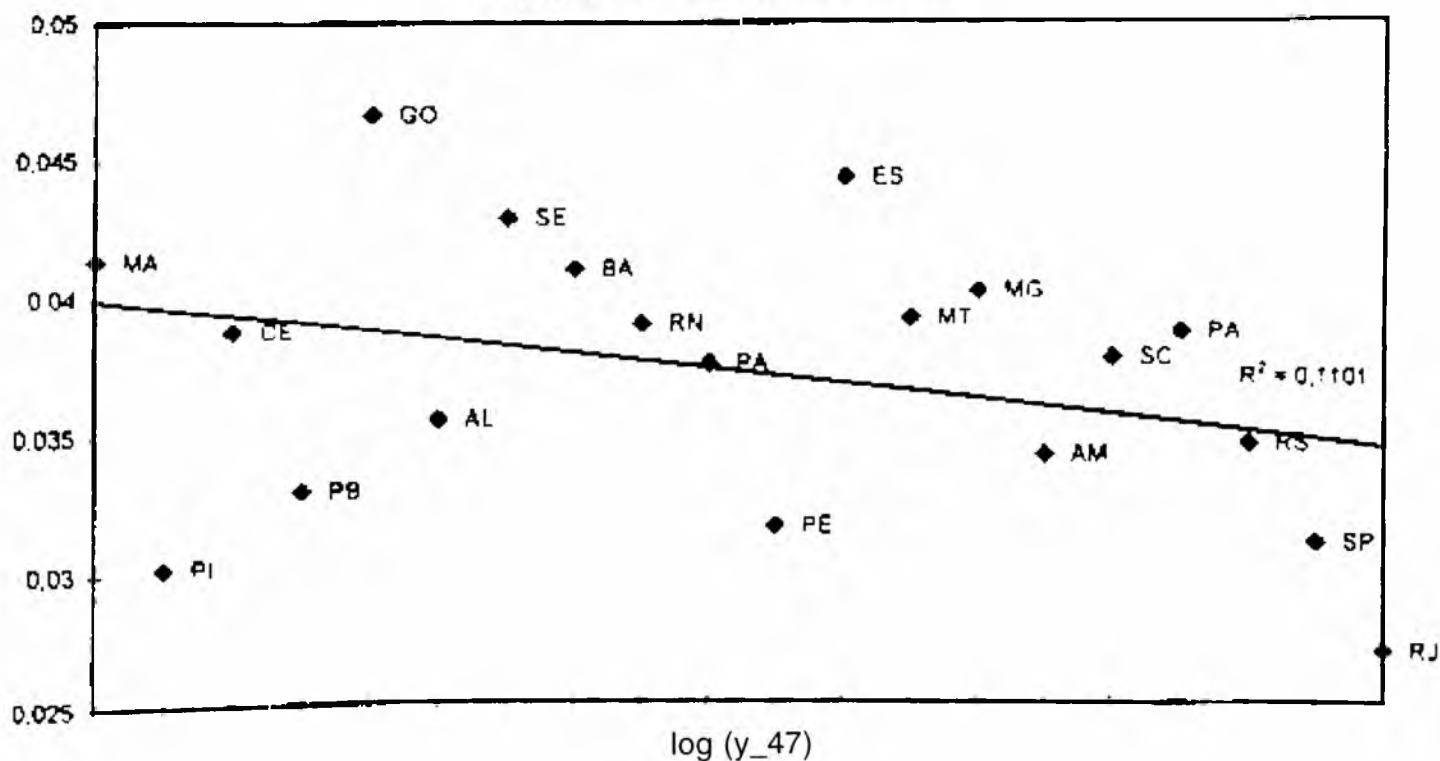
Non linear least square estimation of:  $[1/T] \log (y_{iT} / y_{i0}) = \alpha + (1 - e^{-\beta T})/T \log y_{i0} + d_j D_{jt} + \mu_{it}$  where D<sub>j</sub> is a dummy variable, j varies over 4 regions (NE, SE, S, CW) and T is the time interval.

The low speed of convergence reflects the dispersion of rates of growth across states. Figures 5 and 6 plot the rate of growth of each state against the log of the state initial income per capita income. The dispersion of experiences, which is indicated by the low  $R^2$  the fitted trend line, is reflected in the low speed of convergence. However, it should be stressed that the hypothesis of convergence cannot be rejected either by the  $\sigma$  or the  $\beta$  tests made in this study.

**Figure 5**  
Log (y\_39) vs. Growth Rate



**Figure 6**  
Log (y\_47) vs. Growth Rate



The low speed of convergence is also consistent with other studies made with Brazilian data. Ferreira and Ellery (1996) and Schwartzman (1996) report a weak tendency toward income convergence across Brazilian states using data from 1970 to 1990, but both studies have the limitation of testing for a long-run trend using a relatively short time interval. Azzoni (1996) found weak conditional income convergence and inconclusive findings relating to the s-test with data for 1939-90. However, his data set comes from heterogeneous sources, and nominal figures on income were deflated using the general price index rather than the more appropriate GDP deflator. Overall, the results reported here are more robust in not rejecting the convergence hypothesis.

#### 4 Structural Regressions

Structural regressions to explain the growth of per capita income using structural factors discussed in the modern literature on growth were then estimated. In a neoclassical growth model, it can be shown that the growth of per capita income depends on the growth of the ratio of capital per unit of efficient labor. The growth of this ratio can be decomposed into a quantitative factor (growth of capital/labor ratio) and a qualitative coefficient that captures the effects of improvements on human capital, technological gains embodied in the new capital and the role of socio-economic variables, like the organizational setup that may or may not be conducive to the more efficient use of inputs - see Jorgensen *et alii* (1987).

The importance of improvements in the supply of human capital is undisputed today. To try to gauge this factor, two non-complementary ratios were selected: the ratio of illiteracy in a state's population and the ratio of schooling, defined as the fraction of the population that had the junior high school diploma (implying at least 8 years of formal schooling).<sup>15</sup> To approach the change in quantity and quality of the capital stock, we constructed a variable that proxies the evolution of investments in industry in each state.<sup>16</sup>

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15 We tried to have data on the population with high-school diplomas but this information was not available in the 1940 and 1950 censuses. However, the proportion of junior high school diplomas seems an equally appropriate measure because for in many states this ratio was smaller than 1 percent in 1939.

16 The index divides the change in industrial GDP of each state at five year intervals by by the state's industrial GDP at time  $(t - 1)$ . The increase of industrial GDP over the initial GDP is a proxy for investment in the sector assuming that the capital-output ratio stayed the same during the five year interval. In some cases, negative numbers resulted, as would be the case with net investment. Then these fractional numbers were added to one to have an index that proxies changes in the capital-labor ratio. The additional assumption is that such an index is representative of equivalent capital formation in the other sectors of the economy; we take that as a valid working simplification.

Two other variables were devised to represent the socio-economic environment. An index of exports over state GDP to indicate the state export orientation (the hypothesis is that the more export oriented, the more prone to growth the state is because it is used to selling in competitive markets). This hypothesis is based on Sachs and Warner (1995), who report a robust association between export orientation and domestic growth in a cross-country study that controls for impediments to trade. The second variable is an index of property concentration (area of farms larger than 1,000 hectares divided by the area occupied by farms smaller than 50 hectares). The idea is that big, unproductive land holdings do not help growth whereas in those areas where rural property is more evenly split, more families have access to credit, and agriculture tends to be more diversified.

Since most of the socio-economic variables came from census data spaced at 10 year intervals, the following procedures were adopted to assemble the data set. The data on income per capita was fitted to start in 1940 (multiplying the numbers for 1939 by the rate of growth of GDP in 1940) and for every five year thereafter (this only required scaling back the data for 1947 to 1945 because from 1950 on the data was already at five year intervals). Figures on illiteracy, schooling and land ownership were gathered at ten year intervals, and the five year break was computed by interpolation. Numbers for 1994 were obtained from a preliminary estimate made by IGBE (PNAD). Data on state exports (in dollar terms) come from annual reports of the IBGE, but they have an important problem: the numbers reflect exports sent from ports or airports located in each state. Therefore, data for landlocked states (like *Minas*, *Goiás*, *Mato Grosso*) severely understates their exports. In the case of *Minas* (an important exporter of minerals, and of some industrial goods) this is a serious problem and inflates the numbers of *São Paulo*, *Rio de Janeiro* and *Espírito Santo*.

A log linear equation was estimated by the generalized least square to take advantage of all the information presented in the cross-section time-series data set. An equation with a fixed constant term was estimated first, and then an equation with varying constant terms for each of the states in the sample. The likelihood ratio test of the hypothesis that all constant terms were equal versus not equal resulted in an “*F*” of 12.502; thus the hypothesis that all constants were equal was rejected. The estimated coefficients are shown in Table 8. The different constant terms can be interpreted as the long term growth potential of each state, resembling the intercept coefficient in equation (1).

Table 8 reports a positive relation between gains in literacy and formal schooling and growth, and both are statistically significant. Investment in industry, as a proxy for improvements in the capital stock, had a positive and significant effect. The negative sign on the coefficient of land ownership indicates that a concentrated structure of land ownership is detrimental to growth;

the coefficient is statistically significant at a 5% level.<sup>17</sup> The coefficient on exports is positive, as expected, but its size and significance are small, probably due to data problems.

**Table 8**  
**Structural Equation for Brazil With Data by States**  
**(Generalized least square estimation: fixed structural**  
**coefficients but varying constant term)**

	Constant	Illiteracy	Schooling	Investment	Land Own	Exports	R <sup>2</sup>	S.E. regression
		-0.448** (0.08)	0.490** (0.02)	1.047** (0.14)	-0.053* (0.027)	0.007 (0.006)	0.98	0.141
Constants	A M 8.67	PA 8.22	MA 8.12	PI 7.93	CE 8.03	RN 5.28	D.W. n.a.	Log likel. 132.9
	PB 8.12	PE 8.20	AL 8.30	SE 8.30	BA 8.34	MG 8.47		
	ES 8.21	RJ 8.29	SP 8.61	PR 8.45	SC 8.30	RS 8.38		
	MT 8.63	GO 8.45						

Obs: All variables are in logs. Standard errors reported bellow estimated coefficients.

\*\* significant at 1% level; \* significant at 5% level; + significant at 10% level.

**Table 9**  
**Structural Equation with Regional Data and Varying Constant Coefficients**  
**(Seemingly unrelated regressions estimation: fixed structural**  
**coefficients but varying constant term)**

Region	Constant	Illiteracy	Schooling	Investment	Land Own	Exports	R <sup>2</sup>	S.E. regression
		-0.384** (0.09)	0.512** (0.03)	1.289** (0.15)	-0.116** (0.03)	-0.030* (0.016)	0.98	0.107
North	8.608							
Northeast	8.274							
South	8.452							
Southeast	8.578						D.W.	Log likel.
Center-West	8.685						1.61	94.2

**Structural Equation with Regional Data, Varying Constant and Explanatory Coefficients**  
**(seemingly unrelated regressions estimation)**

Region	Constant	Illiteracy	Schooling	Investment	Land Own	Exports	R <sup>2</sup>	S.E. regression
North	7.72	-0.617 (1.26)	0.901** (0.29)	1.113* (0.42)	0.667** (0.23)	-0.011 (0.07)	0.99	0.11
Northeast	9.30	0.054 (1.50)	0.678* (0.30)	0.557 (0.93)	0.182 (0.15)	0.103 (0.08)		
Southeast	10.02	-0.092 (0.48)	0.769** (0.24)	1.686** (0.26)	-0.108 (0.12)	0.152** (0.04)	DW 2.71	Log likel 138.3
South	13.09	1.475+ (0.81)	1.216** (0.33)	0.391 (0.42)	0.009 (0.06)	0.039 (0.05)		
Center-West	9.37	0.026 (0.40)	0.647** (0.15)	1.318** (0.54)	-0.137** (0.05)	-0.071+ (0.04)		

Obs: All variables are in logs. Standard errors reported bellow estimated coefficients.

\*\* significant at 1% level; \* significant at 5% level; + significant at 10% level.

17 A recent study of Bruno and Squire (1996) also report evidences in support of this hypothesis in a cross-country study.



Next, the data was grouped into five regions, and the growth equation was estimated using the seemingly unrelated regression technique. Estimation of the structural equation with fixed structural coefficients but varying constant term resulted in coefficients, shown in Table 9, which are comparable and consistent with those reported in Table 8. The negative coefficient on land concentration increased, and its standard error decreased. The sign on the index of exports, however, became negative. This may be due to faulty data or may indicate that the hypothesis of a positive effect does not hold in this case.

The second half of Table 9 reports the estimated parameters when both the constant and the structural coefficients are allowed to vary. The coefficients show much more variation, but one cannot make robust inferences with these numbers because they are based on regressions with only 4 degrees of freedom (11 observation).

Some other variables could improve our structural equation, and two natural candidates would be the size of federal transfers to each state and the growth of the transportation network (km of roads and railways). Time and resource limitations prevented us from doing this. Other variables such as *good governance*, exports and capital stock per state are can be studied with better data in future studies.<sup>18</sup> Notwithstanding those limitations, it seems appropriate to say that the results reported here are robust and the structural regressions have a good explanatory power.

## 5 Concluding remarks

This study adds to the literature on regional income convergence by studying Brazil with data from 1939 to 1994. The results of the  $\sigma$  and the  $\beta$  tests did not reject the hypothesis of income convergence across states, however, the speed of convergence is rather low (around 0.8 to 0.9 percent per year).

The net winners in income growth were *Minas Gerais, Espírito Santo, Sergipe, Rio Grande do Norte, Maranhão, Bahia, Paraná, Santa Catarina, Mato Grosso and Goiás*. The Center-West region had 3% of the population and produced 2% of Brazil's GDP in 1939; these numbers went up to 6% and 7%, in 1994.

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18 The higher than average growth of per capita income in states like *Minas Gerais, Espírito Santo, Sergipe* and *Maranhão* and the fact that they have benefited more than other states with the construction of federal roads, railways and ports either to export iron ore (*Companhia Vale do Rio Doce*) or oil (*Petrobras*), suggest that investments in the "national integration" network of roads and railways probably had a high social rate of return and induced growth.

Observing the growth of income and of population, one observes two dynamic areas in spatial terms. One “cone” starts in *São Paulo* and points to the Center-West-North. This area encompasses the Southern portion of *Minas*, the two *Mato Grossos* (*North and South*), *Goiás*, and *Rondônia*, where the new agricultural frontier is. The second “cone” goes from *São Paulo* to the South and Southwest (*Buenos Aires and Cordoba*) reflecting the expanding Mercosur market. Announced investment projects in transportation in these areas are consistent with the findings reported here.

On the issue of the income gap between the North and the South, income disparities remain large and troublesome. However, the numbers reported here indicate that the differences in per capita income have more to do with the economic transformation that took place in the latter part of the 19<sup>th</sup> century rather than with the industrialization process after 1940. In 1939, a year when *São Paulo*'s GDP was still depressed because of the breakdown of international trade (coffee exports suffered the brunt of the external shock), its income per capita was 1.8 times higher than the national average and *Rio de Janeiro*'s was 2.3 times bigger, whereas the North had an income per capita of 0.7 the national average and the Northeast's 0.5. In 1994, *São Paulo*'s income was 1.6 times the national average, *Rio*'s was 1.4, the North's was 0.7 and the Northeast's, 0.5 times.

*São Paulo* maintained a high income per capita, despite the high growth of its population resulting from internal migration (the population in Brazil grew 3.8 times from 1939 to 1994 and 4.7 times in *São Paulo*). The industrialization that took place after 1940, therefore, did not increase the difference in per capita income but rather the reverse occurred when the Center-South states are taken into account. It is relevant to stress that the popular view that the industrialization policies helped to increase the gap between the North and the South is faulty and remedies based on this perception are built on a wrong footing.

One such policy is the role devised for Sudene and Sudam. Although these two agencies have approved some billions of dollars of tax rebates and other fiscal incentives for investment projects (mainly in industries) in the past 30 years, they did not achieve their goal of bridging the difference between the North and the South. In states where personal income is highly concentrated, policies that favor capital intensive projects induce more concentration of income. Thus, these agencies have helped to preserve an archaic structure of power, creating few jobs, rather than trying to promote growth from the bottom up.

There are, however, signs of change. There is a new generation of politicians in many states in the area, independent of the old political bosses. The North and the Northeast need to modernize their political and social structures and remodel their growth strategy, moving from big projects financed by the Federal Government to grassroots oriented growth. Such strategy

would be based on empowering local talent and abilities. Land reform and programs like the minimum-income per family linked to keeping children in schools probably have a higher social rate of return by bringing new consumers to the market than the present income tax rebates for investment projects. More spending on basic education is needed because all educational indicators of the region are below national averages. Lastly, long-run sustained growth will largely depend on the capacity to create and improve the links with the international market and promote competitive export activities.

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