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CONVERGENCE IN BRAZIL: PAST AND FUTURE

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CONVERGENCE IN BRAZIL: PAST AND FUTURE

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CONTENTS

1. INTRODUCTION

This paper applies to the analysis of the interstate income distribution in Brazil some of the techniques developed in the recent empirical literature on growth and convergence. Since the theoretical and policy problems with which that literature is concerned are well known, they will not be reviewed here.

Economic activity in Brazil is still concentrated in a relatively small portion of the territory. In 1995, the four states located in the Southeast region, which occupy together only 11% of the country's area, accounted for 43% of the population and 57% of the Brazilian GDP (Table 1).

The differences in per capita incomes (PCIs) across states and regions are also significant. Brazil's per capita income, evaluated at the current exchange rate, amounted to US$ 3 953, in 1995. The PCI of the richest state (Distrito Federal), at US$ 7 946, was two times higher than the national mean and more than seven times higher than the per capita income of the poorest state (US$ 1 067, in Piaui). While the PCI of the Northeast, the poorest region, was less than half the country's mean, the Southeast had a PCI 34% higher than the national average (Tables 2 and 4).

Although, as indicated above, spatial concentration is still high, the geographical distribution of production changed significantly, in the last 25 years, with the GDP share of the Southeast region being reduced from 65% to 57%, while the shares of all other regions, especially the North and Centre-West, increased (Table 1).

The state and regional per capita incomes also displayed a clear trend toward convergence, in the same period. Evidence on this respect is discussed in Section 2.1 of this paper, while Section 2.2 presents the results of two exercises which attempt to predict the long run shape of the interstate income distribution in Brazil. Some conclusions are suggested in Section 3.

2. THE INTERSTATE INCOME DISTRIBUTION IN BRAZIL

2.1. Recent trends[1]

As shown in Figure 1, the growth rates of the state per capita incomes in Brazil, between 1970 and 1995, were inversely related to the PCI levels in 1970. The equation for the straight line adjusted to the data in Figure 1 is:

$$\begin{array}{rlll} \text{GROWTH} = & 9.789859 & - \; 0.903681 & \text{LPCI70} \\ & (5.798502) & (-3.833499) & \end{array}$$

$$R2 = 0.389851 \qquad N = 1.585004 \quad (0.452711)$$

$$W = 0.402149 \quad (0.673699) \qquad RESET2 = 1.692251 \quad (0.208260)$$

[1] Previous work on the interstate income distribution in Brazil includes Azzoni (1994, 1996), Ellery Jr. e Cavalcanti Ferreira (1994), Ferreira e Diniz (1995), Ferreira (1996) e Ferreira (1998).

where GROWTH = annual rate of growth of the state per capita incomes between 1970 and 1995, LPCI70 = natural logarithm of the state per capita income levels in 1970 (measured in dollars of 1995), N= Jarque-Bera's test statistic for normality of the residuals, W = White's test statistic for the presence of heterocedasticity and RESET2 = Ramsey's test statistic for model specification. The figures in parentheses bellow the regression coefficients and the test statistics are, respectively, the t-statistics and the probabilities of obtaining the corresponding values of the test statistics under the null.

The sign and statistical significance of the coefficient on the 1970 income levels suggest the existence of (at least as a first approximation, unconditional or absolute) β-convergence among the Brazilian states, in the period under analysis. This result is in line with the recent empirical literature, which, in general, has detected absolute β-convergence within sets of "more similar" economies, such as states or regions of the same country (Sala-i-Martin, 1996).

The states of Parana and Rio Grande do Norte and the Distrito Federal are positive outliers in the regression reported above, i.e. their actual rates of PCI growth, between 1970 and 1995, were substantially higher than the ones expected on the basis of their initial PCI levels. On the other hand, the states of Amapa, Rio de Janeiro, Rondonia and Pernambuco constitute the main cases of growth failures, with actual PCI growth rates far below the values predicted by the regression[2].

The speed of convergence of 1.0%, implied by the value of the coefficient on LPCI70 in the absolute convergence regression, is well below the estimates of Sala-i-Martin (1996) for the US states (2.1%), the Japanese prefectures (1.9%) and 90 regions in Europe (1.5%)[3]. The estimate of β increases to 1.8%, however, when regional dummies are included in the regression (Table 3). The null hypothesis that the regional dummies are jointly zero can be rejected at the 1% level, which implies that states with the same initial per capita incomes tend to grow at rates that differ according to the region where they are located (the signs and statistical significance of the regional dummies point out to higher rates of growth in the South and Centre-West than in the other three regions, when the initial state PCI level is held constant). These results are consistent with the hypothesis of conditional β-convergence (only states with similar structural characteristics, here accounted for by the regional dummies, converge to the same steady state level of per capita income).

Figure 2 shows that the dispersion of the state per capita incomes around the national mean has also been reduced, in the past 25 years. The variables RATIO70 and RATIO95 in that figure are the ratios of the state PCIs to the national mean, in 1970 and 1995, respectively, ordered according to their 1970 values. As can be readily seen from Figure 2, for 20 of the 25 states, RATIO95 is closer to 1 than RATIO70.

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[2] Note that low rates of GDP per capita growth are not necessarily a symptom of economic stagnation. Rondonia was the Brazilian state with the highest rate of total GDP growth, between 1970 and 1995 (11.8% p.a.). Its population, however, also increased at a fast rate, in the same period (9,5% p.a.), from this resulting a low per capita growth. Of the four "failures" mentioned above, only Rio de Janeiro and Pernambuco had rates of total GDP growth below the national average in this period.

[3] The speed of convergence β can be inferred from the coefficient b in the regression GROWTH = a + b LPCI70, since $b = [100/T] [e^{-\beta T} - 1]$, where T is the time interval between the two observations used to estimate the average annual rates of growth (25 years, in this case) (Sachs and Warner, 1997). Other country estimates of the speed of (absolute) convergence reported in Sala-i-Martin (1996) are: Germany (1.4%), United Kingdom (2.0%), France (1.6%), Italy (1.0%) and Spain (2.1%).

The information regarding the differences in state per capita incomes, shown in Figure 2, can be summarised in a single measure of the degree of inequality in the interstate income distribution - Theil's inequality index, given by:

$$L = \Sigma\ p_i \ln (p_i/y_i) \qquad (1)$$

where p_i = share of the i^{th} state in the country's population, y_i = share of the i^{th} state in the country's GDP, Σ = sum operator and ln = natural logarithm.

For a perfectly egalitarian income distribution, defined as the situation in which all states have the same per capita income, the value of Theil's L index will be zero. While this is the minimum value that can be taken by the index, there is no maximum value defined for it.

The estimated value of Theil's L index for the Brazilian interstate income distribution in 1995 is 0.116, with the ***inter***-regional differences in per capita incomes accounting for 75% of the total inequality among the states and the ***intra***-regional differences playing a relatively minor role (25%) in explaining the value found for the index (Ferreira, 1998).

Annual estimates of Theil's index, for the period 1970/1995, suggest that Φ-convergence took place among the Brazilian states, at a relatively fast speed, between 1975 and 1986. After 1986, the L index still tends to decline, but now only at a very slow pace (Table 4)[4].

Increased equality in the ***inter***-regional distribution (61%) and the convergence of per capita incomes within the Southeast region (31%) together account for more than 90% of the reduction in the L index, between 1970 and 1995. The remaining 8% are explained by the reduction in inequality which also occurred within the other four regions (Ferreira, 1998).

Further tests of the convergence hypothesis, reported in Section 2.2., although confirming the general trend toward a reduction in inequality in the interstate income distribution, suggest that the long run pattern of that distribution may be somewhat more complex than can be inferred from the test results presented so far.

2.2. Predictions

Jones (1997) suggests three different techniques to generate "predictions" about the long run shape of the world income distribution. Two of those procedures are adopted here to determine, *on the basis of the recent trends described in the previous section*, the likely future profile of the interstate income distribution in Brazil. Needless to say, the results reported below can be taken as "predictions" only in a very loose sense - policy changes and/or unforeseen events may obviously produce a future actual distribution quite different from the "forecasts" presented in this section (Quah, 1993a).

[4] The coefficient of variation (standard deviation normalised by the mean) of the state PCIs also fell, from 0.645, in 1970, to 0.462, in 1986, and increased slightly, afterwards, to reach a level of 0.494, in 1995. The coefficient of variation is the measure of Φ-convergence most commonly adopted in the literature. I have, however, opted for emphasising here the results based on the L index, because this index has the desirable feature of weighting the (relative) state per capita incomes by the states' shares in the total population. In any case, the evolution of the coefficient of variation was similar to that of the L index, during most of the period under analysis (Ferreira, 1998).

From the Solow growth model, it is possible to derive the result that the level of output per worker in an economy in the long run is a function of the rate of investment in physical capital, the growth rate of the labour force and the level of technology, i.e.:

$$(Y/L)_t = [s / (n + g + *)]^{\forall / (1-\forall)} A_t \qquad (2)$$

where Y = GDP, L = employment, s = investment rate, n = rate of growth of the labour force, * = depreciation, $\forall$ = capital share in production and A = level of labour-augmenting technology, assumed to grow at the constant and exogenous rate g, which is the same for all economies.

Jones (1997) uses data on current investment and population growth rates, estimates of A and standard assumptions about the values of g, $\forall$ and *, to calculate, from (2), the steady state values of Y/L, relative to the US level, for a sample of 74 countries[5]. Unfortunately, lack of data on the states' investment rates prevents the extension of this technique to the analysis of the Brazilian interstate income distribution.

The second procedure suggested by Jones (1997) is based on the *principle of transition dynamics*, the proposition according to which an economy's per capita income should grow at a rate proportional to the gap between its current and steady state values. Naming the factor of proportionality as the "speed of convergence", we have:

growth of state i's relative per capita income = speed
of convergence x percentage gap to own steady state (3)

where the relative per capita income is the ratio of state i's PCI to the highest state PCI.

This relationship constitutes the main pillar of the recent empirical literature on conditional β-convergence and has motivated a large volume of research, in which econometrics has been employed to provide estimates of the speed of convergence and to explain differences in growth rates.

In an alternative application, given data on growth rates and initial PCIs and some assumption regarding the speed of convergence, the expression in (3) could be used to calculate the distribution of the steady state (relative) per capita incomes.

The results of such an exercise, based on information available for the Brazilian states, are presented in Table 5. Given the idiosyncratic nature of employment and economic activity in the Distrito Federal (which roughly corresponds to the area of Brasilia, the nation's capital), it seemed more appropriate to use here the incomes relative to Sao Paulo (the largest and most successful state economy), instead of the DF.

[5] Per capita income levels depend not only on the level of output per worker, but, assuming full employment, also on the rate of participation in the labour force and the ratio of the working age population to the total population. However, differences in output per worker are usually, by far, the most important determinant of per capita income differences across economies, what could justify the focus on Y/L here.

The long run relative per capita incomes, in Table 5, were derived from data on the per capita income levels in 1970 and growth rates for the period 1970/1995, under the assumption of a speed of convergence of 4%.

Such a value for the speed of convergence is certainly too large, in view of the estimates reported in Section 2.1. of this paper. However, values of the speed of convergence below 4%, when applied to the expression in (3), resulted in implausibly high estimates of the long run relative per capita income for some of the Brazilian states and were, therefore, discarded[6]. Since they were derived on the basis of an apparently overestimated speed of convergence, the figures in Table 5 may be taken as a conservative or relatively "pessimistic" forecast of the future shape of the interstate income distribution, in Brazil.

The first two columns in the table present the (actual) relative state per capita incomes in 1970 and 1995, while the long run estimates appear in the third column. The exercise indicates that, compared to 1995, most states will improve their relative positions with respect to Sao Paulo in the long run. The per capita incomes of the states of Parana, Rio Grande do Norte, Sergipe, Mato Grosso and Goias, in particular, are expected to continue to grow at rates substantially above that prevailing in Sao Paulo, with the PCI of Parana even being predicted to surpass Sao Paulo's, in the long run. For a non-negligible number of states, including some of the poor states in the Northeast, however, the gains seem small (specially when contrasted to those of the period 1970/95), which means that the current relative PCIs in those states are already quite close to their steady state values.

The third procedure suggested in Jones (1997) is based on Markov transition analysis and was first applied to the study of convergence by Quah (1993a, 1993b)[7].

The Markov approach assumes that, given I possible income levels, each state has a probability $p_i(t)$ of being in level I at time t and a transition probability $m_{ij}(t)$ of being in level j at time t+1. Assuming, for simplicity, that the transition probabilities do not change over time and ordering them as the IxI transition matrix M, we get:

$$p(t+1) = p(t)M = p(0)M^t \qquad (4)$$

where p(t) is a 1xI row vector whose elements are the time-dependent probabilities $p_i(t)$ and M^t is the product of t identical M matrices.

The solution to this exercise consists in determining the 1xI row vector s such that:

$$s = s\,M$$

where s characterises the likely long run distribution of cross-state incomes (European Commission, 1997).

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[6] In this respect, see also Jones (1997). Note, from (3), that the lower the speed of convergence, the larger is the difference between the current and steady state PCI levels that is required to explain a given rate of growth. Thus, for states like Parana and Rio Grande do Norte, which experienced fast growth between 1970 and 1995, the long run relative per capita income, implied by (3), is considerably above its current level, even for a relatively large value of the speed of convergence such as 4%.

[7] This technique has also been recently employed to determine the impact of the Single Market Programme on the distribution of income and convergence among 169 regions in Europe (European Commission, 1997).

This approach has some advantages with respect to the conventional tests of β and Φ-convergence adopted in Section 2.1 as well as with respect to the exercise reported in Table 5. First, it provides information on what is happening to the entire cross-section of (state) economies, i.e. it does not focus on any particular economy but on the shape of the distribution as a whole (Quah, 1996; Jones, 1997). Second, "[it] provides evidence on persistence and stratification; on the formation of convergence clubs; and on the cross section distribution polarising into twin peaks of rich and poor" (Quah, 1996, pp. 1046)[8]. Finally, it does not assume that the states are growing toward constant targets, admitting, instead, shifts in the steady state positions. In this sense, it provides a prediction of the very long run income distribution (Jones, 1997).

To perform this exercise, I have assumed that, at any point in time, a state can be found in one of the following five situations, defined by its relative per capita income level: "very poor" (state PCI below 50% of the national mean); "poor" (state PCI between 50% and 80% of the national mean); "medium" (state PCI between 80% and 120% of the national mean); "rich" (state PCI between 120% and 150% of the national mean); "very rich" (state PCI above 150% of the national mean)[9].

The Markov analysis requires first the construction of the two way IxI cross-tabulation reproduced in Table 6, in which the counts are the number of states in the situation i in 1970 and situation j in 1995[10]. The second step is to derive, from the frequencies observed in Table 6, the estimates of the m_{ij} transition probabilities that appear in Table 7.

In the period 1970/1995, a majority of states (fourteen in a total of twenty five) were "movers". As shown in Table 6, five of the "very poor" and five of the "poor" states, in 1970, had moved to the immediately superior income category by 1995. Four states, on the other hand, descended in the per capita income ladder, to categories inferior to the ones in which they found themselves in 1970. The other eleven states (among them, five of the "very poor" and two of the "very rich" states, in 1970) were "stayers", remaining in the same situation throughout.

Using the transition probabilities in Table 7, the equilibrium probability vector, giving the proportion of states at each of the five income levels in the steady state, was estimated. The results are shown in Table 8, together with the 1970 and 1995 actual distributions.

Table 8 suggests a tendency for the Brazilian states to move towards the middle income categories. The proportion of "very poor" states, which fell from 40% to 20%, between 1970 and 1995, is predicted to become zero in the long run. Similarly, for the "very rich" and "rich" states, the figures in Table 8 add up to 16%, in 1970, 12%, in 1995, and, again, zero, in the steady state. The

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[8] According to Quah, this is the main deficiency of the Φ-convergence tests: on the basis of such tests, it is not possible to uncover intra-distribution movements, the existence of convergence clubs, "twin-peaks dynamics" etc. With respect to the β-convergence tests, Quah argues that "the cross-section correlation between growth rates and income levels reveals even less, its interpretation being plagued by a version of Galton's Fallacy" (Quah, 1996 and also 1993b).

[9] Since the per capita incomes of even the richest states in Brazil are well below those of the developed countries, the notions of "rich" and "very rich" adopted here, obviously, only make sense when related to the Brazilian context.

[10] The states in each entry a_{ij} in Table 6 are: a_{11} = Maranhao, Piaui, Ceara, Paraiba e Alagoas; a_{12} = Para, Rio Grande do Norte, Sergipe, Bahia, Goias; a_{22} = Acre, Roraima, Pernambuco; a_{23} = Amazonas, Minas Gerais, Espirito Santo, Parana e Mato Grosso; a_{32} = Rondonia e Amapa; a_{33} = Santa Catarina; a_{43} = Rio Grande do Sul; a_{54} = Rio de Janeiro; a_{55} = Sao Paulo, Distrito Federal.

percentages of states in the "poor" and "medium" income intervals, in turn, are expected to increase from 32% and 12%, in 1970, to 52% and 48%, respectively, in the very long run. Although a substantial reduction in the interstate income inequality is predicted by this exercise, absolute β-convergence does not result, i.e. the states are not expected to converge to an identical per capita income level in the long run.

Tables 6-8 were derived from data for the years 1970 and 1995 and, thus, refer to 25 year transitions. Tables 9-10 report the results of a similar exercise, based on the 5 year transitions observed for the periods 1970/75, 1975/80, 1980/85, 1985/90 and 1990/95. The two exercises, thus, differ in two respects: the number of observations (25, in the first case; 125, in the second) and the time horizon of the observed changes from which the transitions matrices were derived (25 year changes and 5 year changes, respectively). A third difference consists in that, in the second exercise, the "medium" income group was partitioned in two different categories ("below the national average" and "above the national average").

Comparing the entries in the main diagonals in Tables 7 and 9, we find, as expected, higher persistence in the latter table than in the former. Both tables suggest a tendency for the "very rich" and "rich" states to move toward lower levels of (relative) income and no tendency for the states in the "medium" or lower (relative) income levels to move in the opposite direction (i.e. toward the "rich" and "very rich" categories). Table 9, however, differs from Table 7 in that there is a 5% probability for the "poor" and "below average" states to fall to the "very poor" income group.

As a consequence, while the long run distribution in Table 10, as that in Table 8, does not display any "very rich" and "rich" strata, it does contain a "very poor" group of states. A second distinctive feature of the results in Table 10 is that the expected proportions of states in the two lower categories is quite similar to the actual proportions observed in 1995. The long run distributions, in both tables, are, in any case, characterised by the same concentration of states in the "poor" and "medium" income levels[11].

Finally, Table 11 shows the probability with which a state can be expected to move from one quantile of the income distribution to another, in a five-year period (Quah, 1993b). To construct that table, the 25 states were first grouped in five quantiles, according to their PCI levels, in the years 1970, 1975, 1980, 1985, 1990 and 1995. The 5 year transitions were then computed and used to estimate the probabilities shown in the table.

According to Table 11, there is a 92% probability that a state which is in quantile q_1 (i.e. among the five poorest states) in period t will remain in that same quantile in period t+1 and an 8% probability that it will move to quantile q_2. Persistence is also very high in the richest quantile: there is a 88% probability that a state belonging to this group in t will stay in it in period t+1. Middle income states, however, are less likely to remain where they are in the distribution, as can be inferred from the examination of the interior diagonal entries in Table 11.

[11] To check how the conclusions suggested by the preceding exercises are affected by the slowdown in the convergence process in the last ten years, a long run distribution was also derived from the changes in the relative state per capita income levels observed in the years 1985 and 1995 (10 year transitions). In this case, persistence is quite high (21 states are "stayers"), the long run distribution displays a "very rich" (with 8% of the states), instead of a "very poor" stratum, and the proportions of "poor" and "medium" income states are, respectively, 55% and 37%.

Table 11 suggests that there is a significant immobility over time in the states' relative positions in the income distribution, this being particularly the case of those states in the two extreme quantiles[12]. The distance between the poorest and richest quantiles, however, was reduced somewhat, between 1970 and 1995: the average PCI in q_1 increased from 28% to 37%, while in q_5 it fell from 154% to 145% of the national mean, in that period. In fact, the average per capita income in all four lower quantiles (q_1 to q_4) increased as a proportion of the national PCI, between those two years (data available from the author on request).

3. CONCLUSIONS

The main results derived in this paper are:

1) Rates of per capita income growth between 1970 and 1995 were inversely related to the per capita income levels in 1970: the poorer the state in 1970, the higher tended to be its average rate of per capita growth in the following 25 years.

2) Controlling for regional effects in the convergence equation improves the fit of the regression and increases the value and statistical significance of the coefficient on the initial income levels. The estimate of the speed of convergence rises from 1.0% to 1.8%, a value close to that usually found when similar tests were conducted for a broad set of countries (2.0%). All these results are consistent with the hypothesis of conditional convergence, i.e. with the proposition that (only) states with similar structural characteristics tend towards the same steady state per capita income level.

3) The usual measures of dispersion in the interstate income distribution suggest that Φ-convergence was an unequivocal feature of the regional growth experience in Brazil, between 1970 and 1986. The process of convergence seems, however, to have slowed down almost to a halt, after 1986.

4) Different estimates of the long run interstate income distribution pointed towards a tendency for the great majority of states to cluster in the interval between 50% and 120% of the national average (100% of the states, in Table 8; 82%, in Table 10; and 92%, in endnote 11 – against 44%, in 1970, and 68%, in 1995). Therefore, while we may expect, on the basis of the trends observed between 1970 and 1995, further reductions in the interstate income inequality, the data again do not support the hypothesis of absolute β-convergence.

5) Some exercises have suggested that the poorest states' relative per capita incomes (Table 5) or the number of "very poor" states (Table 10) were, in 1995, already quite close to their steady state values.

[12] Four states (Piaui, Maranhao, Paraiba e Ceara) always appeared in q_1 and another four states (Sao Paulo, Distrito Federal, Rio de Janeiro and Rio Grande do Sul) always formed in q_5, during the period under consideration.

6) Moreover, a significant persistence in the relative positions of the states in the income distribution was detected, particularly in the poorest and richest quantiles. The gap between rich and poor states, however, was somewhat reduced, in the last 25 years.

TABLE 1

Brazil - Regional Shares in Area, Population and GDP - 1970 and 1995 - (%)

Region	Area	Population		GDP	
		1970	1995	1970	1995
NORTH	42.0	3.9	6.4	2.2	4.7
NORTHEAST	18.2	30.2	28.6	12.0	13.7
SOUTHEAST	10.8	42.8	42.7	65.0	57.2
São Paulo	2.9	19.1	21.7	39.4	35.8
SOUTH	6.8	17.7	15.0	17.0	17.4
CENTRE-WEST	22.1	5.4	7.3	3.7	7.1
Total*	**100.0**	**100,0**	**100,0**	**100,0**	**100,0**

* the addition may not be exact due to rounding errors.
Area = 8,544,516 km^2; Population in 1995 = 154.9 million; 1995 GDP at current prices = US$ 612.2 billion.

TABLE 2

Brazil - Regional GDP Per Capita Relative To The National Average

Region	1970	1995
NORTH	0.58	0.72
NORTHEAST	0.40	0.48
Piauí	0.21	0.27
SOUTHEAST	1.52	1.34
Rio de Janeiro	1.66	1.22
Sao Paulo	2.06	1.65
SOUTH	0.96	1.16
CENTRE-WEST	0.68	0.97
Distrito Federal	1.79	2.01

GDP PER CAPITA in 1995, at current prices = US$ 3 953.

TABLE 3

Brazil - Tests of β-Convergence – 1970/95 (dependent variable = Growth)

RHS VARIABLES	Eq. 1	Eq.2[(1)]	Eq. 3	Eq.4
Constant	9.790*	-	13.662*	11.131*
LPCI70	-0.904*	-	-1.468*	-1.121*
dummy North	-	3.004	-	-
dummy Northeast	-	3.661	-0.362	-
dummy Southeast	-	2.677	0.364	-
dummy South	-	3.534	0.931**	0.852**
dummy Centre-West	-	3.724	0.959**	0.918**
β (speed of convergence)[(2)]	1.025	-	1.829	1.315
Adjusted R2	0.363	0.072	0.510	0.513
Wald[(3)]	-	-	12.130*	4.919**

(1)the coefficientes in this regression are averages of the PCI rates of growth in each region; (2)see endnote 3; (3)the Wald F-statistic tests the null hypothesis that the coefficientes of the "dummy" variables are jointly zero.
* statistically significant at the 1% level
** statistically significant at the 5% level

TABLE 4

Brazil - Interstate Income Distribution - 1970/1995

Year	Theil's L	Richest State PCI*/Poorest State PCI+
1970	0.216	9.75
1975	0.203	8.90
1980	0.164	8.44
1985	0.128	7.04
1986	0.119	6.33
1987	0.122	6.57
1988	0.123	7.03
1989	0.120	8.21
1990	0.119	7.16
1991	0.117	7.37
1992	0.119	7.56
1993	0.116	7.12
1994	0.111	6.99
1995	0.116	7.38

*Sao Paulo, until 1987; Distrito Federal, from 1988 to 1995 +Piaui.

TABLE 5

Brazil – Long Run Estimates of the States Relative Per Capita Incomes

States	Relative Incomes*		
	1970	1995	Long Run
Rondonia	0.42	0.47	0.47
Acre	0.28	0.47	0.58
Amazonas	0.34	0.52	0.59
Roraima	0.38	0.47	0.48
Para	0.24	0.39	0.47
Amapa	0.46	0.47	0.47
Maranhao	0.13	0.20	0.22
Piaui	0.10	0.16	0.19
Ceara	0.15	0.26	0.32
Rio Grande do Norte	0.16	0.35	0.67
Paraiba	0.14	0.22	0.25
Pernambuco	0.26	0.32	0.33
Alagoas	0.20	0.28	0.30
Sergipe	0.22	0.42	0.59
Bahia	0.23	0.34	0.39
Minas Gerais	0.33	0.53	0.63
Espirito Santo	0.35	0.55	0.65
Rio De Janeiro	0.81	0.74	0.74
Parana	0.36	0.70	1.07
Santa Catarina	0.43	0.66	0.75
Rio Grande Do Sul	0.59	0.72	0.74
Mato Grosso	0.32	0.54	0.68
Goias	0.24	0.42	0.55
Distrito Federal	0.87	1.22	1.31

*relative incomes=state i PCI/Sao Paulo's PCI.

TABLE 6

Brazil – Cross-Tabulation of the States According to Their GDP Per Capita Relative to The National Average – 1970 and 1995

		1995				
		Very Poor	Poor	Medium	Rich	Very Rich
1970	Very Poor	5	5	-	-	-
	Poor	-	3	5	-	-
	Medium	-	2	1	-	-
	Rich	-	-	1	-	-
	Very Rich	-	-	-	1	2

TABLE 7

Brazil – Interstate Income Distribution – Transition Probabilities* (25 year transitions)

	Very Poor	Poor	Medium	Rich	Very Rich
Very Poor	0.500	0.500	0.000	0.000	0.000
Poor	0.000	0.375	0.625	0.000	0.000
Medium	0.000	0.667	0.333	0.000	0.000
Rich	0.000	0.000	1.000	0.000	0.000
Very Rich	0.000	0.000	0.000	0.333	0.667

* estimated from Table 6.

TABLE 8

Brazil – Interstate Income Distribution – Equilibrium Probability Vector*

	1970	1995	Long Run
Very Poor	0.40	0.20	-
Poor	0.32	0.40	0.52
Medium	0.12	0.28	0.48
Rich	0.04	0.04	-
Very Rich	0.12	0.08	-

* estimated from Table 7.

TABLE 9

Brazil – Interstate Income Distribution – Transition Probabilities (5 year transitions)

Poor	Very	Poor	Below Average	Above Average	Rich	Very Rich
Very Poor	0.805	0.195	0.000	0.000	0.000	0.000
Poor	0.051	0.718	0.231	0.000	0.000	0.000
Below Average	0.053	0.263	0.474	0.210	0.000	0.000
Above Average	0.000	0.000	0.400	0.600	0.000	0.000
Rich	0.000	0.000	0.000	0.143	0.857	0.000
Very Rich	0.000	0.000	0.000	0.000	0.083	0.917

number of transitions with starting points in each income category: very poor = 41; poor = 39; below average = 19; above average = 7; rich = 7; very rich = 12.

TABLE 10

Brazil – Interstate Income Distribution – Equilibrium Probability Vector*

	1970	1995	Long Run
Very Poor	0.40	0.20	0.18
Poor	0.32	0.40	0.39
Below Average	0.12	0.16	0.28
Above Average	-	0.12	0.15
Rich	0.04	0.04	-
Very Rich	0.12	0.08	-

* estimated from Table 9.

TABLE 11

Brazil – Interstate Income Distribution – Transition Probabilities (5 year transitions)

	q_1	q_2	q_3	q_4	q_5
q_1	0.92	0.08	0.00	0.00	0.00
q_2	0.04	0.72	0.24	0.00	0.00
q_3	0.04	0.20	0.48	0.28	0.00
q_4	0.00	0.00	0.24	0.64	0.12
q_5	0.00	0.00	0.04	0.08	0.88

(1) the first quantil (q_1) refers to the five poorest states, while the five richest states are grouped in quantile q_5; (2) number of transitions with starting points in each quantile: 25; total number of observations: 125.

FIGURE 1

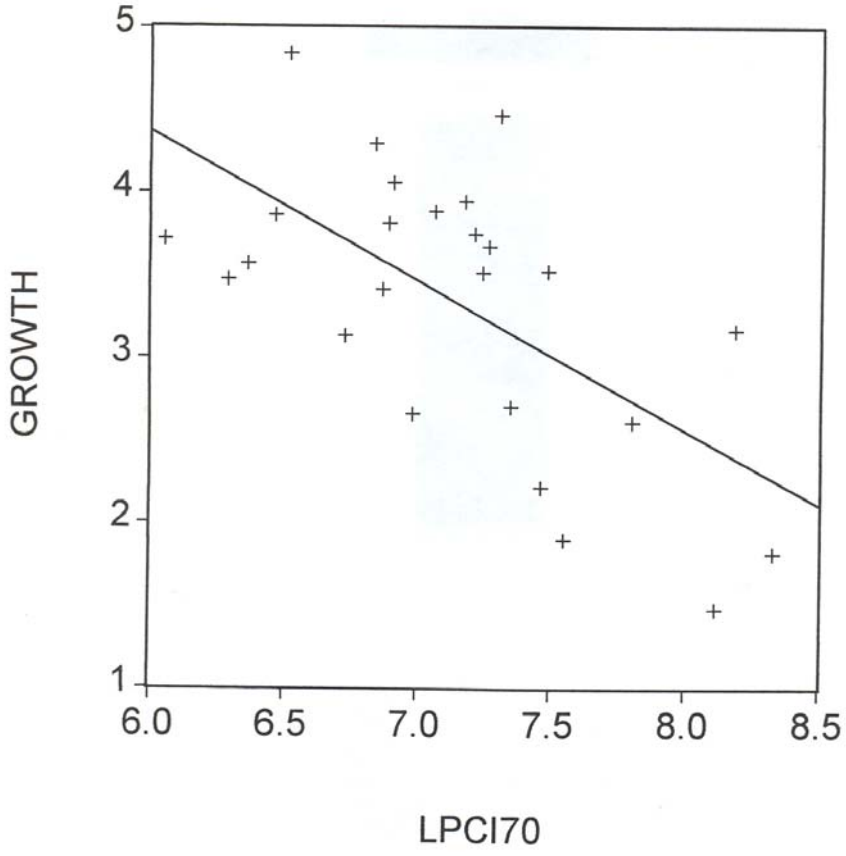
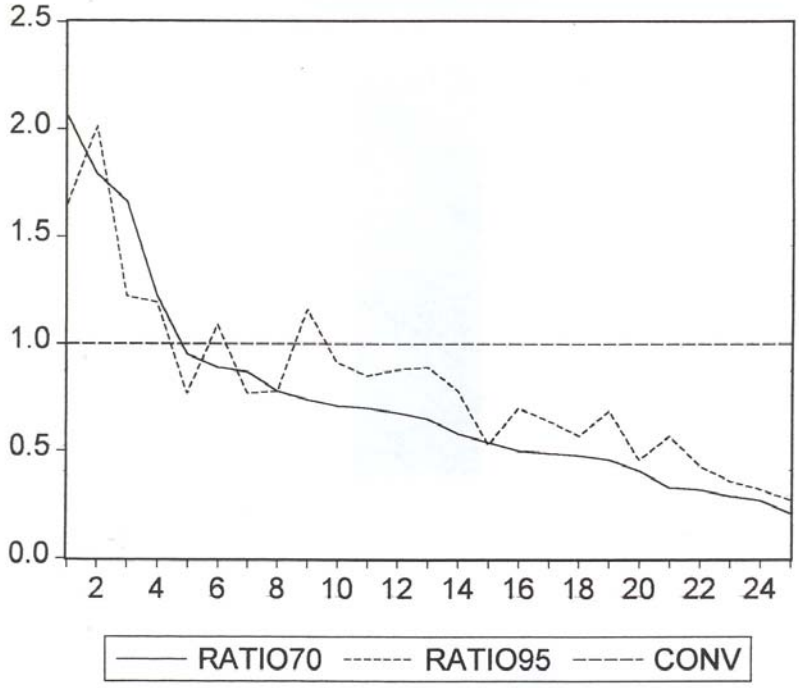


FIGURE 2



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