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Poverty Reduction without Economic Growth?

Explaining Brazil's Poverty Dynamics, 1985-2004

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Abstract

Brazil's slow pace of poverty reduction over the last two decades reflects both low growth and a low growth elasticity of poverty reduction. Using GDP data disaggregated by state and sector for a twenty-year period, this paper finds considerable variation in the poverty-reducing effectiveness of growth—across sectors, across space, and over time. Growth in the services sector was substantially more poverty-reducing than was growth in either agriculture or industry. Growth in industry had very different effects on poverty across different states and its impact varied with initial conditions related to human development and worker empowerment. The determinants of poverty reduction changed around 1994: positive growth rates and a greater (absolute) elasticity with respect to agricultural growth contributed to faster poverty reduction. But because there was so little of it, economic growth played a relatively small role in accounting for Brazil's poverty reduction between 1985 and 2004. The taming of hyperinflation (in 1994) and substantial expansions in social security and social assistance transfers, beginning in 1988, accounted for a larger share of the overall reduction in poverty.

This paper—a product of the Poverty Team, Development Research Group—is part of a larger effort in the department to understand pro-poor growth and the determinants of poverty dynamics in developing countries. Policy Research Working Papers are also posted on the Web at http://econ.worldbank.org. The authors may be contacted at fferreira@worldbank.org; pleite@worldbank.org; and mravallion@worldbank.org.

Poverty Reduction without Economic Growth?
Explaining Brazil's Poverty Dynamics, 1985-2004

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1. Introduction

The recent literature on poverty and growth has asked two main questions: How much do the poor share in aggregate economic growth? And what factors explain differences (across space or over time) in the impacts of economic growth on poverty? The literature, which we briefly review in the next section, provides a robust answer to the first question, but has only begun to shed light on the second. Most existing within-country studies of the relationship between poverty and growth focus on two determinants of differences in the effect of growth on poverty: the "pattern of growth" (sector composition and geographic variation) and "initial conditions" (human capital levels, urbanization rates, the prevalence of infrastructure, etc.). Little attention has been given to the role of contemporaneous changes in government policy, whether in the realms of macroeconomic stabilization, trade reform, or redistribution. These are all aspects of considerable interest to policymakers who, in addition to looking for policies that lay the foundations for faster and more poverty-reducing growth in the long run, often also ask what the impacts of policy reform on poverty are likely to be in the short run.

This paper seeks to add to the existing evidence on this issue, by studying the macroeconomic determinants of poverty dynamics in Brazil: a large, slow-growing, highly unequal middle-income country that underwent substantial policy reforms mid-way through the study period. In keeping with past work in the literature, we explain the evolution of poverty measures in terms of the aggregate growth rate, the sector and geographical composition of aggregate growth and differences in initial conditions across states interacted with growth. However, we also find that changes in the rate of inflation and changes in the extent of income redistribution (through reforms in the social security and social assistance systems) were at least as important as the growth process. Policy reforms can have non-trivial impacts on poverty reduction even in the short run.

It must be acknowledged that Brazil's poverty reduction record between 1985 and 2004 was mediocre at best: the poverty rate fell a mere four percentage points: from 33% to 29% of the population. This can be contrasted with the mean performance of developing countries. To make that comparison it is probably best to fix the initial poverty rate. Conveniently, the proportion of the developing world's population living below about $1 per day (at 1993 purchasing power parity) was also 33% in 1984. Over essentially the same period (1984-2004), the proportion of the population of the developing world living below $1 a day fell from 33% to

18% (Chen and Ravallion, 2007).[2] Brazil's disappointing record in poverty reduction was due both to very low growth rates, and to a low growth elasticity of poverty reduction. Annual growth in per capita GDP averaged just under 0.5% over this period, while the average growth elasticity of poverty reduction was -1.09; just over half the norm for developing countries.[3]

In this paper, we do not address the question of why Brazil's growth rate was so low. Although this is a matter of first-order importance for poverty reduction, it has been discussed elsewhere and is not our object here.[4] We focus, instead, on the second piece of the puzzle, and seek to shed light on why Brazil's growth *elasticity* of poverty reduction was also so disappointingly low. This is not a second-order issue either: had Brazil had the world's average elasticity, even the low growth rates in GDP per capita over 1985-2004 would have reduced the poverty rate from 33% to 23%; a ten percentage-point reduction, instead of the four points actually observed. While there are reasons to be cautious about this calculation, it is at least suggestive.[5]

The paper tries to help understand why this elasticity was so low. One explanation concerns the role played by the pattern of growth—notably its sector composition—in determining the pace of poverty reduction and how this has changed over time with changes in the overall policy regime. As indicated, we also analyze the influence of different initial conditions at the state level. Brazil is of special interest for this enquiry given the diversity found in both the policy environment (over time) and initial conditions (over space). Intertemporally comparable household survey data exist for Brazil since 1976, on a quasi-annual basis. GDP growth data disaggregated by sector and state are available since 1985. Combining the two sources of data with information on initial conditions from the 1970 Census, we model poverty dynamics in Brazil at state level over the period 1985-2004.

We find that growth in the services sector was substantially more poverty-reducing than growth in either agriculture or industry, echoing the findings of Ravallion and Datt (1996) for

[2] Note that the figure for Brazil uses its national poverty line, which is more than $1 a day. In 1985, 8% of Brazil's population lived below $1 a day, which fell to 7% by 2004. However, the comparison made in the text is still of interest given that the initial poverty rate is the same.

[3] Using cross-country comparisons for developing economies, Ravallion (2001) estimates an elasticity of poverty incidence (based on the "$1 a day" poverty line) to growth in mean household incomes of -2.1. This was computed using an instrumental variable approach exactly analogous to the one used to estimate the Brazilian figure. See Table A2 in Appendix II for details.

[4] See, e.g. Bacha and Bonelli (2001) and Ferreira and Rossi (2003).

[5] It is not clear that the elasticity can be changed independently of the growth rate. It should also be noted that the international "$1 a day" poverty line is lower than Brazil's own poverty line.

India. While the poverty impact of agricultural and service sector growth did not vary significantly across states, the impact of industrial growth did vary appreciably (similarly to the findings of Ravallion and Datt, 2002, also for India). Elasticities were significantly higher in states where health conditions (as proxied by lower initial infant mortality rates) were initially more favorable. Higher elasticities were also found in states with higher initial levels of political participation (as measured by union membership rates in relation to the labor force), suggesting that worker empowerment may have played a role in translating manufacturing growth into poverty reduction.[6]

But our results are also consistent with the view that the contemporaneous policy environment plays an important role in three ways: by affecting the sectoral composition of growth, by affecting the sensitivity of poverty to growth in each sector and, finally, by changing macroeconomic conditions and the redistributive role of the State. The sectoral pattern of growth changed markedly after the change in policy regime around 1994, when Brazil successfully stabilized prices and concluded a process of trade liberalization that favored sectors producing tradable goods. Aggregate growth became a more important factor against poverty, outweighing the poverty-increasing effect of the changing composition of growth (away from the service sector). This was helped by the fact that agricultural and industrial growth became relatively more poverty-reducing after the reforms. Another two important consequences of policy reforms were price stabilization and changes in social policy. With the Real Plan of 1994, Brazil ended almost two decades of sustained hyperinflation which, as we show, was not distribution neutral. In addition, the reform period included a progressive reform of the social security and social assistance systems, which we show had an independent pro-poor redistributive effect on poverty, helping to compensate for generally weak economic growth.

The paper is organized as follows. The following section reviews the recent literature on growth and poverty in other countries, while section 3 provides more detailed background information on changes in poverty and economic reforms in Brazil over the study period. Section 4 describes our data while Section 5 presents the econometric analysis and results. Section 6 concludes.

[6] The view that initial political inequalities may have been more important for subsequent development paths than economic inequality is advocated by Acemoglu et al. (2007).

2. Background on the literature

The literature has found that growth in average income is correlated with reductions in the incidence and depth of poverty. Looking at 67 countries, Ravallion and Chen (1997) find that inequality changes were uncorrelated with growth rates between 1981 and 1994, implying that poverty declines were strongly correlated with growth in mean incomes. They estimated that the elasticity of poverty incidence (at the "$1-a-day" line) to mean household income was about -3. Ravallion (2001) finds a lower elasticity of -2.1, when an econometric correction is made for measurement errors in surveys.[7] Dollar and Kraay (2002) also find that "growth is good for the poor:" in a sample of 92 countries, over four decades, the mean incomes of the poorest 20% of the population grew on average at the same rate as overall mean incomes.

Although the poor generally benefit from a growing economy, there is (of course) variation around the average benefits. The share of the variance in poverty changes that is accounted for by the variation in growth rates depends quite heavily on the sample and on the decomposition method used, with a wide range of R^2's reported for regressions of the proportionate rate of poverty reduction on the growth rate of mean income. An early estimate with observations for only 16 countries indicated that 64% of the variance in proportionate rates of poverty reduction across countries could be explained by differences in rates of economic growth (Ravallion, 1995). Using a larger sample, World Bank (2005) finds that 52% of the variance is accountable to growth alone. Using analysis of variance and a range of poverty measures, Kraay (2006) finds shares ranging between 46% and 70% for all spells, and between 71% and 97% when only longer spells are considered.[8]

So economic growth is strongly associated with poverty reduction and accounts for a large share of the variance in performance against poverty. But the impact of a (say) one percentage point growth in mean incomes on poverty is *not* the same across countries or even in the same country in different periods. What makes some growth processes more pro-poor than

[7] The measurement error problem is that both the poverty measures and mean consumption or income are calculated from the same household surveys. Ravallion (2001) uses national accounts data on private consumption as the instrumental variable for the mean from the survey.

[8] The higher R^2 found for spells of longer duration is consistent with the empirical observation of Bruno et al. (1998) that very few developing countries have experienced significant long-term trends in inequality; the inequality measure for a given country may rise (fall) for a period, but then fall (rise). This does not (of course) mean that inequality does not change, or that the changes that occur are of little consequence for poverty or social welfare more generally.

others? Is the growth elasticity of poverty reduction fully determined by historical preconditions, or can policymakers influence it by current policy choices?

Intuitively, any standard measure of poverty (such as the proportion of the population living below a poverty line with constant real value) is a function of the mean and of the distribution around that mean, which can be thought of as "inequality."[9] The "partial elasticity of poverty reduction to growth" can be defined as the point impact on the specific poverty measure of an increase in mean income holding inequality constant (Kakwani, 1993). At an almost mechanical level, given the shape of most empirical income distributions, (the absolute value of) the partial elasticity rises with initial mean income, and declines with initial inequality (for a given poverty line).[10]

It is not, however, the partial elasticity that is of greatest interest, but rather the total elasticity, defined as the total proportionate impact on poverty divided by the proportionate change in the mean.[11] This does not hold inequality constant, and it is known that the way inequality changes during the growth process matters a lot to the outcomes for the poor (Ravallion, 2001). On *a priori* grounds, it is unclear how either initial inequality or the initial mean will influence the total elasticity, although there is evidence that higher initial inequality yields a lower (absolute) elasticity (Ravallion, 1997, 2007; World Bank, 2005).

But can one go further? Are there systematic characteristics of certain growth spells that make them more pro-poor? Recent research has highlighted two main sources of variation in growth incidence: the sector composition of output growth, and initial conditions related to asset distribution, urbanization, and the levels of human capital and technology available in the economy. For India, Ravallion and Datt (1996) found that growth in the agricultural and (especially) services sectors had a higher impact on poverty than manufacturing growth. Using state-level data over time for India, Ravallion and Datt (2002) found that the elasticity of poverty to non-agricultural growth varied significantly across states, and was greater in states with higher initial literacy and farm productivity, and lower landlessness and infant mortality. In the case of

[9] More precisely, most poverty measures are fully determined by the poverty line, the mean income and the Lorenz curve of a given distribution. See Datt and Ravallion (1992) and Kakwani (1993).

[10] For specific income distribution functional forms, such as the lognormal, the relationship between poverty, growth and inequality holds as an identity. Assuming log-normality, the relationships implied by that identity are also borne out in the cross-country data; see Bourguignon (2003). However, that is less evident when one does not assume log-normality; the results of Ravallion (1997) are inconsistent with that assumption.

[11] This distinction has been a source of some confusion in the literature; for further discussion see World Bank (2005) and Ravallion (2007).

Brazil, Menezes-Filho and Vasconcellos (2007) also highlight the role of education in assuring a more pro-poor (poverty-reducing) growth process. For China, Ravallion and Chen (2007) found that agricultural growth had a far higher poverty-reducing impact than did growth in either the manufacturing or services sectors. There is also evidence of large regional differences in the impact of growth on poverty in Ghana (Aryeetey and McKay, 2007). And cross-country evidence also suggests that rates of poverty reduction depend on the sectoral composition of economic growth (Loayza and Raddatz, 2006; Christiaensen and Demery, 2007).

We add to this literature in a number of ways. Firstly, we find some common elements between Brazil and India (chiefly the importance of growth in the service sector for poverty reduction), and between Brazil and both China and India (the contribution of initial levels of human capital to future poverty reduction via the growth elasticity). Secondly, we find evidence that initial levels of political participation (through unions) is positively correlated with higher subsequent growth elasticities. Third, and perhaps most importantly, our study of Brazil allows us to explore how poverty responds to large changes in the policy regime, including the demise of inflation and the introduction of more progressive social spending policies.

3. Growth and poverty in Brazil, 1985-2004

After growing rapidly in the 1970s, Brazil's economy stagnated in the 1980s, during the Latin American debt crisis. The average annual growth rate of GDP per capita from 1985 to 1992 was -0.54%. After that reasonably long period of contraction, growth in GDP per capita resumed in 1992-93, although average annual growth over the period 1992 to 2005 was a still modest 1.25%. Table 1 presents the time series for growth, the sectoral composition of output, poverty, inequality and inflation.

As the Table indicates, the period of economic stagnation in the 1980s and early 1990s was also marked by hyperinflation, as a result of accumulated fiscal deficits and an accommodating monetary policy. Through a combination of de-indexation of contracts and an exchange-rate based stabilization policy, known as the Real Plan, the government finally managed to control inflation in 1994; the inflation rate fell from 2269% in 1994 to 24% in 1995 (and kept falling to 4.3% in 1997).[12] These same years marked the conclusion of a process of

[12] The initial stabilization of the price level in 1994 did rely on an appreciating currency and a substantial increase in the debt to GDP ratio. Nevertheless, the transition to a floating exchange rate regime and the adoption of inflation targets by the Central Bank was managed (after 1999) without a substantial resumption of inflation.

trade liberalization, which had begun with the removal of quantitative restrictions and tariff reductions in 1988.[13] Average effective rates of protection fell from 56% in 1988 to 14% in 1994, before slowly edging up again (Kume et al., 2000).

The 1990s also saw a substantial expansion of Brazil's social security and social assistance systems, driven both by increases in coverage and in the average benefit levels. In the late 1980s and early 1990s, these increases were motivated to a large extent by the implementation of benefit reforms mandated by the 1988 Constitution, which extended non-contributory pension rights to former agricultural workers who became elderly or disabled (among others). As a result, the total monthly benefit bill in Brazil's rural areas rose from US$180 million in 1991 to US$750 million in 1998. Coverage almost doubled, and the average monthly benefit rose from US$44 to US$109.[14] Since most minimum pensions are set at the level of the official minimum wage, benefit levels (in both urban and rural areas) also rose with the real value of that wage, which increased sharply in 1994.[15] Towards the end of the decade, it was social assistance transfers that increased and became better targeted, with the national adoption and gradual expansion of conditional cash transfer programs: first there was the program called *Bolsa Escola*, from 1999-2002, and then *Bolsa Família* from 2004 onwards (See Figure 1).[16]

There is evidence that this increase in social spending helped reduce poverty and inequality. Ferreira et al. (forthcoming) note a substantial increase in the number of families that report receiving transfers from the government, and point to some evidence that transfers have become better targeted. The same authors also note that, since 1993, falling inequality accounts for between one third and one half of the decline in poverty. Barros et al. (2006) estimate that about half of the decline in inequality (between 2001 and 2005) stemmed from improvements in the distribution of non-labor income, associated largely with larger and better-targeted social

[13] Kume et al. (2000) and Abreu (2004) describe and discuss Brazil's process of trade liberalization during 1988-1995 in detail. Gonzaga et al. (2006) and Ferreira et al. (2007) analyze its impact on skill differentials and wage inequality.
[14] See Delgado and Cardoso Jr. (2000, p.21).
[15] See Neri (1997).
[16] Between 1985 and 1994 the Federal Social Expenditure with Social Security and Social Assistance increased from 1.3% to 5.1% of GDP. By 2004, it had reached 10% of GDP. The bulk of these expenditures are with social security, mostly pensions. Within the combined total, the share of social assistance was only around 4.5-5.5% between 2000 and 2003, rising to 9.5% in 2007.

transfers.[17] Soares et al (2006) also highlight the importance of the pension system changes over the period 1995-2004 for poverty and inequality reduction in Brazil.

These various changes suggest a plausible division of the period under study into two sub-periods with distinct policy regimes. The first sub-period corresponds to the classical stereotype of Latin American macroeconomic populism, with persistent budget deficits, high inflation, ubiquitous trade distortions, extensive government ownership of productive enterprises in certain sectors and, ironically, an inefficient and poorly targeted social security system that did not reach the poor.[18] The second sub-period corresponds to what critics characterize as "neo-liberal reform": inflation was brought under control; fiscal balance restored; quotas were replaced by tariffs, which were then harmonized and lowered; some state-owned enterprises were privatized. In the Brazilian case, as indicated above, these policies were accompanied by a significant expansion of social security and assistance transfers, at least some of which also became better targeted over time. As we will see, this component of the policy reforms (which did not figure among the standard recommendations of the so-called "Washington consensus") played a key role.

As with any binary division of a period into two, the choice of the precise cut-off point is inevitably somewhat arbitrary. Some of the policy reforms of the mid-1990s—notably trade liberalization, privatization and expansion of the social security system—were implemented over a number of years, beginning in the late 1980s. Nevertheless, if a single year has to be chosen, 1994 was in a number of ways the obvious point of the regime change. This was the year of the *Plano Real* and also the year when effective rates of protection reached their lowest level. After describing our data sources in the next section, we turn to an econometric assessment of whether the growth-poverty relationship in Brazil changed between these two sub-periods.

4. Data sources and descriptive results

We study the poverty impacts of economic growth in Brazil using state-level information on poverty, output by sector and a number of controls disaggregated at the state level, for a period spanning 20 years. Four main sources of data were used for this study. Firstly, the poverty statistics were computed from Brazil's national household survey (*Pesquisa Nacional por*

[17] Similar results are obtained from a different methodological approach by Kakwani et al. (2006).
[18] Dornbusch and Edwards (1991) described "economic populism" in Latin America as a combination of policies relying on "deficit financing, generalized control, and a disregard for basic economic equilibria" (p.1).

Amostra de Domicílios, PNAD), which is fielded quasi-annually by the National Census Bureau (*Instituto Brasileiro de Geografia e Estatística*, IBGE). The PNAD is fielded every year in September, except in Census years and in 1994. We also excluded 1986 from our sample, since poverty statistics in that year are not comparable with other years.[19] This left sixteen surveys: every year between 1985 and 2004, except for 1986, 1991, 1994 and 2000. The PNAD is nationally representative and representative at the level of each state, except for the rural areas of the Northern Region (minus the state of Tocantins), which roughly corresponds to the Amazon rainforest. The excluded rural areas accounted for 2.3% of Brazil's population in the 2000 Census. Sample sizes ranged from 291,000 to 525,000 individuals over the period.

Although there are a number of caveats about the precision with which rural and informal sector incomes are captured through the PNAD questionnaire, recent comparisons between PNAD income and consumption expenditure distributions from other surveys (such as the POF and the PPV) suggest that the income distribution from the PNAD contains some noise, but substantial signal as well; see Ferreira et al. (2003) for further discussion.

Poverty measures were constructed using total household per capita income as the individual welfare indicator.[20] Incomes were deflated spatially using the Ferreira et al. (2003) regional price index, and temporally using the Corseuil and Foguel (2002) price deflator series from the national consumer price index (INPC/IPC) for the PNAD reference months. Incomes are expressed in Brazilian Reais (R$) in September 1996 prices.

We constructed two poverty measures from the PNAD surveys, namely the headcount index (H) and the poverty gap index (PG). The headcount index is the percentage of the population living in households with income per person below the poverty line. The poverty gap index gives the mean distance below the poverty line as a proportion of that line (when the mean is taken over the whole population, counting the non-poor as having a zero gap).

[19] In the aftermath of a price freeze in early 1986 (the "Cruzado Plan"), shortages and rationing became widespread during August–November 1986. As a result, the monetary incomes deflated by official prices, which are reported in the PNAD 1986, overstate real purchasing power and welfare. While GDP grew 7.5% in 1986, the mean household income in the PNAD was 46% higher in 1986 than in 1985, implying a 40% decline in poverty. This was largely reversed by 1987, after rationing was abandoned. See Ferreira et al. (forthcoming) for a more detailed discussion.

[20] The use of per capita income is a common but fairly extreme assumption about equivalence scales. While a poverty profile can be sensitive to this assumption (Lanjouw and Ravallion, 1995), the aggregate dynamics of poverty in Brazil are reasonably robust to variation in the equivalence scale (see Ferreira and Litchfield, 2000).

The second main data source was the *Regional Accounts Statistics*, which contains GDP levels disaggregated by state and sector, from 1985 onwards.[21] Output statistics are presented in fourteen broad sectors, which we grouped into primary (largely agriculture), secondary (largely industry) and tertiary (largely services), according to the classification described in Appendix I. These state-level GDP statistics were not spatially deflated, since the spatial price deflator used for the PNAD differentiates between rural, urban and metropolitan areas, and the GDP statistics do not provide a breakdown of output by those areas within states. They were temporally deflated using the INPC/IPC consumer price index, which was also used to deflate household incomes, as noted above.[22]

Table 2 gives growth rates for GDP and for each of its three sector components, for each year in our sample. All three sectors contributed to a slightly higher and more sustained growth in the period after 1994. Figure 2 gives the evolution of the implied sector shares in GDP. The most notable feature of the series in Figure 2 is that the services sector generally experienced a rising share of total GDP in the period up to about 1994, but that its share declined (from about 63% to about 53%) after that date. The other two sectors followed roughly the opposite pattern.

When controlling for time-varying correlates of poverty reduction, we use state level public expenditure statistics, disaggregated by type. These come from our third main data source, the *State and Municipal Expenditure Accounts (Despesas Municipais e Estaduais por Função)* of the Treasury Department of the Ministry of Finance. We grouped a subset of the expenditure types presented there into "social expenditures" (including education, health, sanitation and social security) and "investment expenditures" (including equipment, installation, real estate and infrastructure purchase and construction). A detailed classification is provided in Appendix III. Moreover, we collected data on *Federal* expenditures on Social Security and Social Assistance, to control for the rapid changes in these transfers over the period, as depicted in Figure 1. We

[21] The state of Tocantins (TO), which was created as a split-off from Goiás (GO) in 1992, is merged with Goiás throughout the analysis.

[22] Although the choice of the consumer price index for deflating both the household incomes that underlie the poverty statistics and the sectoral output series that underlie the growth statistics appears natural, it did require a validation process. The Census Bureau (IBGE) recommends that the GDP deflator, rather than the CPI, be used to deflate the GDP series. However, since the poverty statistics used as dependent variables in our main analysis are based on incomes deflated by the CPI, avoiding biases requires correcting for the ratio of the two deflators. When this is done, one can not reject the hypothesis that the resulting model is identical to a model that deflates the GDP series by the CPI directly. Details of these procedures are recorded in Appendix II.

also control for changes in the inflation rate, using the main IBGE consumer price index, the INPC/IPC.

Our fourth data source is the set of published *summary statistics of the 1970 Census*, published by IBGE (1972), from which we obtained state-level information on infant mortality rates, the distribution of years of schooling on the population, the prevalence of various forms of infrastructure, the rate of labor unionization, and a number of other variables of interest, all disaggregated at the state level. When using these data, the Rio de Janeiro and Guanabara states (in 1970) were combined (into present-day Rio de Janeiro, RJ).

Descriptive statistics for the main variables during the study period are presented in Table 1. These include mean household income per capita from the PNAD survey, GDP per capita (with alternative deflators); the participation of each sector in GDP per capita; the inflation rate; effective rates of protection; and the national poverty and inequality indicators, over the 1985-2004 period. We use a region-specific poverty line, designed to cover the cost of a "minimum food basket" that would generate 2,288 calories per day, on the basis of the observed consumption bundles for deciles 2-5 in the Living Standards Measurement Survey (PPV) of 1995-6. This standard, which varied spatially to allow for cost of living differences, was interpreted as an "extreme" poverty line, and corresponded to R$65.07 in 1996 prices (in the São Paulo metropolitan area).[23]

Unsurprisingly, given the country's mediocre growth performance, poverty reduction over this twenty-year period was modest. National poverty incidence fell from 33% to 29%. Almost all of this reduction arose in rural areas, where the incidence fell from 59% to 54%. The decline in the urban headcount was less than one percentage point. Inequality, here measured by the Gini coefficient, rose between 1985 and 1989; became volatile until 1993; and then started a gradual decline which lasted to the end of the period.

5. Econometric analysis and results

We exploit the spatial, temporal and sectoral variation in these data to shed light on the determinants of poverty dynamics in Brazil. Since we have a panel of 26 states by 16 surveys, we allow the regression coefficients to vary by state. We control for the mechanical effect of initial poverty rates by including state-level fixed effects. As always, the inclusion of fixed

[23] See Ferreira, Lanjouw and Neri (2003) for the construction of the poverty line, and the corresponding poverty profile.

effects also means that any time-invariant component of the error term which is correlated with state output will not bias the coefficients of interest. We also allow for state-specific time trends, and for differential poverty reduction effects of the growth rate in different sectors of the economy.

5.1 Poverty and the sectoral composition of growth

To motivate our specification choice, consider first the following model in levels:

$$\ln P_{it} = \beta_i^P \ln Y_{it}^P + \beta_i^S \ln Y_{it}^S + \beta_i^T \ln Y_{it}^T + \pi_i t + \eta_i + \varepsilon_{it} \quad (i=1,\ldots,N;\ t=1,\ldots,T) \qquad (1)$$

Here P_{it} denotes a poverty measure (either H or PG) in state *i* on year *t*. The superscript *P* denotes primary (agricultural) sector output; *S* denotes secondary (industrial) sector output; and *T* denotes tertiary (services) sector output. Thus Y_{it}^k is GDP per capita for sector *k=P,S,T* in state *i* at year *t*. A time trend in included in the regression, and the error term includes a state fixed effect (η_i) as well as a time-varying component (ε_{it}), which might be auto-correlated.

As written, equation (1) embodies an implausible property of constant elasticities over time. As in any developing country, one expects the composition of GDP to change over time, as economic activity switches from the primary to secondary and tertiary sectors. One cannot expect growth in a given sector to have the same proportional impact on poverty when it accounts for a small share of overall output as when it accounts for a large share (Ravallion and Datt, 1996). Similarly, the differential poverty impact of growth in one sector over another, at a given point in time, will naturally depend on the sector's size.

To deal with this problem in the specification of equation (1), and to eliminate the fixed effect in the error term, we adopt instead a first-differences specification, in which the growth rates are weighted by initial output shares (following Ravallion and Datt, 1996):

$$\Delta \ln P_{it} = \beta_i^P s_{it-1}^P \Delta \ln Y_{it}^P + \beta_i^S s_{it-1}^S \Delta \ln Y_{it}^S + \beta_i^T s_{it-1}^T \Delta \ln Y_{it}^T + \pi_i + u_{it} \qquad (2)$$

where $s_{it_{-1}}^J = Y_{Jit_{-1}} / Y_{it_{-1}}$ is the output share of sector *J* at the beginning of each period, and $u_{it} = \rho(\varepsilon_{it-1} - \varepsilon_{it-2}) + v_{it} - v_{it-1}$.[24] On noting that $\Delta \ln Y_{it} \cong \sum_{J=P,S,T} s_{it_{-1}}^J \Delta \ln Y_{Jit}$, it is evident that the specification found in past literature on growth and poverty reduction in cross-sections of country data is a special case of (2) in which $\beta_i^P = \beta_i^S = \beta_i^T$. Thus, equation (2) allows us to test whether the (sectoral and geographic) "pattern of growth" matters, as would be implied by a rejection of the null hypothesis that $H_0 : \beta_i^P = \beta_i^S = \beta_i^T = \beta$. Note that when the model is written in the form of (2), rather than (1), the regression coefficients can no longer be interpreted as

[24] We allowed the auto-correlation coefficient to vary so as to take into account the presence of missing years (1986, 1991, 1994, 2000). The results are almost identical with and without that correction, and we present those with a constant ρ.

estimates of the elasticities, which are given by the products of the regression coefficients and the output shares.

To capture the pattern of growth as comprehensively as possible, equation (2) was initially estimated in its most flexible form, with no pooling restrictions, which is equivalent to running a separate regression for each state, except for a common residual variance restriction. The null hypothesis that the pattern of growth does not matter is easily rejected at the 1% level (the specific test statistics are reported on Table 3). The data are consistent, however, with some degree of pooling. At the 5% confidence level, we could not reject the hypothesis that the coefficients for primary and tertiary sector outputs were constant across states in both the H and PG regressions. The hypothesis that the time trend is constant across states was also rejected in both specifications. We could not reject the null that the autocorrelation coefficient ρ is constant across states in both specifications.

Once these pooling restrictions are imposed, the results in Table 3 were obtained. We find that growth in the output of the tertiary (services) sector had the greatest impact on poverty, measured both by incidence and by depth, with coefficients considerably greater than for growth in agriculture.[25] The latter are, in fact, not significantly different from zero for H, suggesting that agricultural growth had, on average, no significant impact on poverty incidence in Brazil during 1985-2004. For PG, the coefficient on agricultural growth was ¼ of that for tertiary sector growth. The coefficient on industrial growth varies considerably across states (with point estimates ranging from 2.50 in Maranhão to -26.22 in the Distrito Federal for H and ranging from 15.64 in Rio de Janeiro to -23.25 in the Distrito Federal for PG), but it was only significant for eight states (Amazonas, Ceará, Maranhão, Piauí, Minas Gerais, São Paulo, Distrito Federal and Goiás) for H. It was also significant for eight states for PG: the list is the same as for H, except that Bahia replaces Minas Gerais. Half of the significant coefficients for H and PG were positive (i.e. had the "wrong" sign) and all of them were quite substantial.

5.2 Determinants of the distributional effects

Although the first-differences specification controls for any time-invariant omitted variables, and the (potentially) state-specific time trend controls for strongly trended time-varying correlates, it is possible that our estimates are biased by the presence of omitted poverty determinants that vary non-linearly over time. In particular, there may well be distributional

[25] Note that we report the estimated coefficients, not their product with sector shares of GDP per capita.

effects that are correlated with growth. One likely candidate is changes in state-level public expenditures which may directly affect the welfare and income generating capacity of the poor. Two other time-varying poverty determinants (that do not vary across states) are Federal social security (and social assistance) expenditures; and the rate of inflation, which is a regressive tax and also distorts investment decisions in a number of ways.

State and municipal government spending is a mixed category. We choose to omit interest payments and administrative cost rubrics, and include only items classified as "social expenditures" or "investment expenditures". The Appendix (section III) lists the specific line-items that are grouped under these headings. In addition, we include a dummy variable for years prior to 1994 (and interactions), in order to capture the effect of the various reforms undertaken or completed around that time, as discussed in Section 3.

Once these variables are added to the model, the specification in (2) changes to:

$$\begin{aligned}\Delta \ln P_{it} &= \beta_{iB}^{P} s_{it-1}^{P}(1-I_t)\Delta \ln Y_{it}^{P} + \beta_{iB}^{S} s_{it-1}^{S}(1-I_t)\Delta \ln Y_{it}^{S} + \beta_{iB}^{T} s_{it-1}^{T}(1-I_t)\Delta \ln Y_{it}^{T} + \\ &+ \beta_{iA}^{P} s_{it-1}^{P} I_t \Delta \ln Y_{it}^{P} + \beta_{iA}^{S} s_{it-1}^{S} I_t \Delta \ln Y_{it}^{S} + \beta_{iA}^{T} s_{it-1}^{T} I_t \Delta \ln Y_{it}^{T} + \\ &+ \gamma_1 \Delta \ln SOC_{it-1} + \gamma_2 \Delta \ln INV_{it-1} + \gamma_3 \Delta \ln SSA_{it-1} + \gamma_4 \Delta^2 \ln CPI_t + \pi_i + \gamma_5 I_t + u_{it}\end{aligned} \qquad (3)$$

where I_t is a dummy variable that takes the value 1 if the year is pre-1994. Correspondingly, the subscripts *B* and *A* on the coefficients respectively denote "before" and "after" 1994. The three public spending variables are "state social expenditures" (*SOC*), "state investment spending" (*INV*) and "federal social security and social assistance" (*SSA*). The rate of growth in the consumer price index (*ΔlnCPI*) is our measure of inflation. Since inflation came to an abrupt halt in 1994, a linear specification has a poor fit, and we interpret the pre-1994 dummy as part of the inflation term. Note that the impacts of the public spending variables, the inflation rate and the change in the policy environment in equation (3) can all be interpreted as distributional effects on poverty, given that the regression controls for the growth effect. The terms in the sector-specific growth rates embody both a purely growth effect and a distributional effect associated with the pattern of growth.

As before, we test a number of pooling restriction hypotheses on the fully flexible model. In this case, in addition to testing whether the coefficient estimates across states are significantly different for each of the three sectors, we also test the individual null hypotheses of constant coefficients before and after 1994. As in Table 3, we could not reject constant coefficients with respect to tertiary sector output for either poverty measure, whether across states or time.

Industrial sector coefficients varied by state, but not over time; while primary sector coefficients varied before and after 1994, but not by state. Then, equation (3) collapses to the more parsimonious specification:

$$\Delta \ln P_{it} = \beta_B^P s_{it-1}^P (1 - I_t) \Delta \ln Y_{it}^P + \beta_A^P s_{it-1}^P I_t \Delta \ln Y_{it}^P + \sum_i \beta_i^S s_{it-1}^S \Delta \ln Y_{it}^S + \beta^T s_{it-1}^T \Delta \ln Y_{it}^T + \\ + \gamma_1 \Delta \ln SOC_{it-1} + \gamma_2 \Delta \ln INV_{it-1} + \gamma_3 \Delta \ln SSA_{it-1} + \gamma_4 \Delta^2 \ln CPI_t + \pi_i + \gamma_5 I_t + u_{it} \quad (4)$$

The results are presented in Table 4. The poverty impact of service sector growth remains significantly negative, constant across states, and the largest in absolute value (both for the headcount and for the poverty gap). There is a notable change in the agricultural coefficient estimate before and after 1994. For the headcount, the agricultural coefficient was positive before the reforms—implying that growth in the sector was associated with increases in poverty—but shifted to a negative coefficient post-1994, albeit insignificant in both cases. For the poverty gap, the coefficient of agricultural sector varies from a statistically insignificant and small negative coefficient pre-1994, to a significantly negative estimate post-1994. These results are particularly interesting in light of the fact that we separately control for the impact of inflation, which is positive and significant for both poverty measures (implying an independent additive poverty-increasing effect).

We also control for Federal spending in social security and social assistance, which was much higher in the second sub-period (Figure 1), and whose growth is known to have been particularly intensive in rural areas (see the discussion in Section 3). Federal social assistance spending actually had a statistically significant and powerfully poverty-reducing impact in both periods, although it was somewhat higher in the second period. This result is consistent with other accounts in the literature about recent poverty dynamics in Brazil, including by Barros et al. (2006), Ferreira et al. (forthcoming) and Soares et al. (2006). The resilience of the changes in the β^P coefficient to these various controls suggests that the greater sensitivity of poverty with respect to agricultural growth after 1994 is really picking up an effect that operates through market incomes in the primary sector, and which can thus be well described as a change in the incidence of growth in Brazil.

State social spending (SOC) had an adverse distributional effect on poverty (interpretable as a regressive incidence), although only statistically significant at the 5% level for PG. State investment spending had no significant effect. By contrast, social security and assistance (SSA)

spending by the Federal government had a significant poverty-reducing distributional effect. Recall that the regressions in Table 4 include state-specific trends (state fixed effects in the changes in log poverty measures). We also estimated the same regressions without the state-specific trends. The results were quite similar to those in Table 4.

Because we reject the pooling hypothesis across states for the coefficient on industrial output growth in both regressions, it is somewhat difficult to gauge the magnitude of the 1994 break in the sector-specific coefficients in Brazil from Table 4. By aggregating the GDP-share adjusted elasticity ($\beta_i^J s_{it-1}^J$) across states with the appropriate weights, Figures 3a and 3b help visualize the evolution of the poverty responses to growth in each sector over time. Although each 1% growth in the service sector still reduces both H and PG by much more than the same growth rate in the other two sectors, the difference has been slightly reduced over time, and this reduction is more pronounced for PG than for H.

The temporal pattern can be seen in the growth incidence curves (GIC). The GIC gives the rate of growth at each percentile of the distribution (ranked by income per person).[26] Figure 4 gives the GIC for the whole period (1985-2004), and for each sub-period.[27] Not only was average annual growth clearly higher in 1993-2004 than during 1985-1993, but its incidence was quite different. The incomes of the poor fell faster than those of the rich in the first sub-period (causing inequality to increase, and reducing the growth elasticity of poverty), and rose faster in the second sub-period, causing inequality to fall and increasing the growth elasticity of poverty.

Figure 4 makes it clear that the pattern of poverty reduction in Brazil was very different between the periods 1985-1993 and 1993-2004. The results reported in Table 4 suggest four candidate explanations for these differences: First, growth was somewhat higher in the second period than in the first (when it had actually been negative). Second, after 1994 growth became more effective in reducing poverty across all three sectors. (Although this may have been offset by a "composition" effect: growth became slower in services, which has the highest growth elasticity of poverty reduction.). Third, inflation was poverty-increasing in both periods, but we know that the rate of inflation was much lower in the second sub-period. Fourth, social security

[26] The GIC is obtained by calculating growth rates on the date-specific quantile functions (obtained by inverting the cumulative distribution function); see Ravallion and Chen (2003). If the GIC is normalized by the growth rate in the mean then one obtains a curve giving the (total) elasticity to growth at each level of income; for further discussion see Essama-Nssah and Lambert (2006).

[27] Since the PNAD survey was not carried out in 1994, we use 1993 as the watershed year in this figure.

and social assistance transfers were poverty-reducing in both periods. Although transfer levels began rising in the first period, they continued to grow substantially in the second.

Since the final effects of each of these candidate factors on Brazil's poverty dynamics depend not only on the magnitude of the coefficients (or of the elasticities, in the case of sectoral outputs), but also on changes in the levels of the independent variables, the next subsection presents a decomposition of the observed poverty changes that is based on equation (4). By holding each right-hand-side variable constant at a time, we decompose average poverty changes in each period into its various components.

5.3 Decomposition of the rate of poverty reduction

When the rate of poverty reduction is given by equation (4) one can decompose its mean ($E(\Delta \ln P_{it})$) into a pure growth component, a component due to the sectoral composition of growth and components due to other factors and the state-specific trends. The pure growth component is defined as:

$$G \equiv E[(\beta_B^P s_{it-1}^P (1 - I_t) + \beta_A^P s_{it-1}^P I_t + \sum_i \beta_i^S s_{it-1}^S + \beta^T s_{it-1}^T)\Delta \ln Y_{it}] \quad (5)$$

This is the contribution to poverty reduction of a (hypothetical) balanced growth process in which $\Delta \ln Y_{it}^P = \Delta \ln Y_{it}^S = \Delta \ln Y_{it}^T = \Delta \ln Y_{it}$. The sectoral component of the mean rate of poverty reduction is given by:

$$\begin{aligned} S = E[&\beta_B^P s_{it-1}^P (1 - I_t)(\Delta \ln Y_{it}^P - \Delta \ln Y_{it}) + \beta_A^P s_{it-1}^P I_t \Delta \ln Y_{it}^P (\Delta \ln Y_{it}^P - \Delta \ln Y_{it}) \\ &+ \sum_i \beta_i^S s_{it-1}^S (\Delta \ln Y_{it}^S - \Delta \ln Y_{it}) + \beta^T s_{it-1}^T (\Delta \ln Y_{it}^T - \Delta \ln Y_{it})] \end{aligned} \quad (6)$$

This term can be interpreted as the contribution to changes in poverty of changes in the sectoral composition of output, during the growth process. The contribution of Federal social assistance is simply $\gamma_3 E(\Delta \ln SSA_{it-1})$, while the contribution of inflation is given by:

$$INF = \gamma_4 \Delta^2 \ln CPI_t + \gamma_5 I_t \quad (7)$$

Changes in the level and composition of state-level public spending contribute:

$$SPS \equiv \gamma_1 \Delta \ln SOC_{it-1} + \gamma_2 \Delta \ln INV_{it-1} \quad (8)$$

The contribution of the state time trends is simply $E(\pi_i)$. It is readily verified that:

$$E(\Delta \ln P_{it}) = G + S + INF + SPS + \gamma_3 E(\Delta \ln SSA_{it-1}) + E(\pi_i) \quad (9)$$

(given that $E(u_{it}) = 0$).

Table 5 gives the decomposition in (9) for both the period as a whole and for the two sub-periods: before and after 1994. Poverty rose during 1985-1993, driven by a negative growth rate (which shows up through the pure growth component) and by high rates of inflation. Rising social security and social assistance, particularly after 1988, helped offset the effects of stagflation, but only in part. The net result was an average rate of increase in poverty incidence of 4.2% per annum; and an average rate of increase in the poverty gap of 5.9% per annum, in the first sub-period.

The trend reversed in the period after 1994, for which we see that the pure growth component became poverty reducing. However, since both the growth rates and the elasticity of poverty with respect to growth remained unimpressive, the overall contribution of the balanced growth component was modest, at around 1% per year. The sectoral component remained very small, but became slightly more poverty-increasing, reflecting a decline in the importance of the services sector (the most poverty-reducing sector) in GDP; see Figure 2. Federal social assistance expenditures continued to make substantial contributions to poverty reduction in this second period (similar in magnitude to the contribution of economic growth). The effect of inflation, which had been a strong driver of rising poverty before 1994, became very small (and negative), as one would have expected from the dramatic reduction in the inflation rate.

State (and municipal) level public spending, which had been unimportant prior to the reforms, became moderately poverty-increasing. In the case of state-level social spending, this reflects a positive coefficient (see Table 4), which suggests the need to re-appraise the contribution of sub-national social expenditures to poverty reduction in Brazil. In the case of investment expenditures, the coefficient was negative, so it is likely that the contribution to poverty arises from a reduction in the level (or a deterioration in the composition) of these investments over the period. Unexplained state-specific effects were poverty-reducing, and rather large in the PG decomposition.

When the period is taken as a whole, only Federal social security and social assistance (and unexplained state-specific effects) turn out to have had a substantially poverty reducing effect, which was generally offset by high inflation, changes in the level and composition of state-level public spending, and the growth effects. The poverty-reducing nature of state-specific effects reflects the geographical composition of growth, and is consistent with the evidence on state-level convergence in Brazil during this period; see, for example, Ferreira (2000).

The results of the above decomposition, as presented in Table 5, relate to the average rate of poverty reduction. We can also calculate the implied trajectories for the levels of the poverty measures by partialing out the observed changes over time in each of the key explanatory variables. We do this by fixing the initial (1987) poverty measure.[28] Figure 5 gives the trajectory implied by closing off the growth effects. In one of the series, the pure growth effect is set to zero at all dates, but everything else (including the sectoral pattern of growth) is left unchanged. The resulting trajectory describes a counterfactual poverty dynamic, which corresponds to the changes that would have occurred if Brazil's growth had been exactly zero throughout the period, but all other variables in equation (4) were unchanged. Another series in Figure 5 gives the implied trajectory when only the sectoral component of growth is set to zero. This case corresponds to the counterfactual of perfectly balanced growth, where the economy grows at the actually observed aggregate growth rate, but with no sectoral differences. A third series gives the combined effect.

We see clearly that a zero pure growth effect would have meant appreciably lower poverty measures in the early 1990s (given that this was a period of aggregate economic contraction), but made little difference in later years. The sectoral effect worked in the opposite direction, given that the pattern of growth was pro-poor, notably in the earlier period. For example, in 1992 and 1993 the pro-poor sectoral composition of growth had brought the poverty rate down by about 2% points, as compared to a balanced growth scenario at the same aggregate rates.

However, these growth effects had largely "washed out" by the end of the study period. With zero growth in all sectors (and hence in the aggregate as well) over the entire period, the poverty headcount index would have been 28% in 2004, only slightly lower than the observed value of 29%. Growth in Brazil has thus had only a very small overall impact on poverty, reflecting primarily the lack of sustained growth, but also the low growth elasticity of poverty reduction.

Turning to Figure 6, we see two other notable features. Firstly, a stable price level (zero inflation) would have meant lower poverty measures over the period, with a poverty rate about 2% points lower in 2004 than that actually observed. Secondly, the increases in Federal social

[28] Our data set begins in 1985. The use of two lags to construct the inflation variable implies that the decomposition must start in 1987.

assistance spending brought the poverty rate down appreciably. Without the increases in social assistance, the poverty rate by the end of the period would have been 5% points higher than that actually observed (34% versus 29%). The cumulative effect of changes in the rate of inflation on poverty over this period, as well as the cumulative effect of the expansion in social security and social assistance—both of which reflect deliberate policy decisions taken by successive governments—were larger in magnitude than the effects of changes in the level and composition of economic growth, as depicted in Figure 5.

5.4 On the role played by state-level initial conditions

Lastly, we investigate whether the responsiveness of poverty to sector-specific growth depends on initial conditions, and whether our results on the importance of transfers and inflation, as well as the broader policy regime change around 1994 are robust to that dependence. We do this by replacing the state-specific β_i^J coefficients in (4)—which were previously estimated as a linear function of a set of state dummy variables—with the coefficients of the following function on a set of initial characteristics of the state:

$$\beta_i^J = \beta^J + \sum_k \beta_k^J \ln X_k^{70} \qquad (10)$$

We start by restricting our initial conditions to state-level GDP per capita and a measure of household income inequality (the Theil index) in 1970. As shown in Table 6, we find a negative coefficient for initial GDP per capita but the effect of initial inequality is insignificant for both H and PG regression.[29] For H, other results are largely maintained: the impact of inflation remains positive (poverty increasing) and significant; federal social security and assistance remains negative and significant, but state-level public social spending becomes insignificant. For PG, the only result that does not survive is a negative and significant agricultural elasticity post 1994, but the direction of the change remains as before.

Restricting the model with initial conditions to initial output and inequality levels is not terribly informative, however. In the next step, we replace these variables by what we hypothesize to be their likely determinants, notably the initial levels of human capital, initial infrastructure prevalence or access to public services, and variables related to the distribution of political power and voice at a local level. In Table 7, we replace 1970 per capita GDP and

[29] The income measures used to compute the Theil indices are from the 1970 Census, and thus measured with even greater error than in standard household surveys. The lack of significance might reflect this greater measurement error.

inequality with a measure of the level of human capital (the average education of adult population in 1970, measured in years of schooling), an (inverse) measure of health conditions in the state (infant mortality rate in 1970) and a measure of "local empowerment" (the rate of unionization within the manufacturing sector). Measures of initial physical infrastructure stocks in each state, including paved road extension and railway lengths, were also included, but were insignificant in all specifications and were dropped. All of these variables come from the 1970 Census, and are thus measured fifteen years prior to the beginning of our study period, making exogeneity rather plausible. Table 8 gives the values of the initial conditions at state level.

As reported in Table 7, the coefficients on two out of the three initial conditions are significant, and all three have the expected signs in the headcount regression. A larger proportion of the population with at least some schooling, a lower rate of infant mortality and greater unionization (initially) were all associated with a greater subsequent elasticity of poverty reduction to industrial growth. For the poverty gap equation, only the unionization rate is significant (with the expected sign) but the other two variables have the expected sign. The effect of the changes around 1994 is roughly as before. Growth in the tertiary (services) sector remains more effective in reducing poverty than growth in either agriculture or manufacturing, in both sub-periods. The coefficient on agricultural growth in explaining changes in the headcount index is insignificant in both sub-periods, but the point estimate still falls (i.e. growth becomes less poverty-increasing) after 1994. The coefficient on inflation remains positive, large, and statistically significant. The coefficient on federal social security and social assistance transfers remains negative (i.e poverty-reducing) and statistically significant in both periods.

6. Conclusions

Brazil's disappointingly low rate of poverty reduction over the last two decades was not only due to its low rate of economic growth. It also reflected a low growth elasticity of poverty reduction, consistent with the country's high level of inequality. The sectoral and geographic pattern of growth, and the limited initial ability of the poor to participate in, and to benefit from, that growth, have all helped attenuate the pace of poverty reduction, even when moderate growth was achieved. There were marked differences in the poverty-reducing effect of growth across different sectors, with growth in the services sector being consistently more pro-poor than either agriculture or industry. The lower growth rates in the services sector after 1994 (compared to the

period prior to 1994) had a (small) negative effect on the rate of poverty reduction, despite a small improvement in the elasticity of poverty with respect to agricultural growth.

However, higher overall growth rates after 1994 more than offset this composition effect, and what little poverty reduction has occurred in Brazil in the study period has taken place since 1994. While slightly higher growth after 1994 did contribute to poverty reduction, the rate of growth and its composition were not sufficient to make a major dent on poverty. Quantitatively larger effects came from the substantial reduction in inflation rates and from the expansion in social security and social assistance spending by the federal government.

The poverty-reducing effect of growth in the industrial sector varied markedly across states. Some of this variation was associated with differences in initial conditions in health and in empowerment levels (and possibly also in education). Growth was more pro-poor between 1985 and 2004 in states where, in 1970, infant mortality was lower and workers were more likely to belong to a trade union. While we have not been able to estimate these effects with much precision, our results are at least consistent with the view that investment in human capital today will contribute to lower poverty tomorrow, not only through the expected impact on growth rates, but also by increasing the poverty-reducing power of growth. The finding that the sensitivity of poverty to manufacturing growth appears to rise with initial rates of union membership would appear to be consistent with theories of development that emphasize the role of political equity and empowerment.

The gains to Brazil's poor from economic growth were also affected by contemporaneous changes in government policies. One of our most robust findings concerns the role of Federal transfers—through rising social security and social assistance payments—in lowering both the poverty headcount and the poverty gap. Increases in social security and social assistance—under reforms that substantially increased the benefits to poor households—helped reduce poverty at given growth rates across sectors. In the absence of these transfer policies, and given the poor performance in terms of economic growth, we estimate that the poverty rate in Brazil would have been about 5% points higher in 2004. Federal social assistance more than compensated for overall effects of economic contraction and macroeconomic instability.

It should be noted that poverty rates appear to have declined more rapidly in Brazil during 2005 and 2006 (Barros et al., 2006), reflecting both an increase in the rate of economic growth and a continued decline in inequality, which is partly due to the ongoing expansion in

social assistance. When GDP data disaggregated by state and sector becomes available for these years, it will be interesting to investigate whether the growth elasticities of poverty have also changed.

Do these findings generate any policy lessons, whether for Brazil as it goes forward, or for other countries? The relatively limited role of economic growth in reducing Brazilian poverty between 1985 and 2004 reinforces the importance of attaining higher rates of economic growth. Even with Brazil's low growth elasticity, more "normal" growth rates could have made a big difference to the extent of poverty. Changes in the sectoral composition of output during these two decades had a statistically significant effect, but were not quantitatively important.

Perhaps the two broadest lessons from the Brazilian experience are as follows. Firstly, when a country can afford it, a well-designed expansion in social protection can play an important role in sustaining poverty reduction during a period of economic stagnation and, secondly, that sensible macroeconomic and trade policies may not hurt the poor and, in the specific case of taming hyperinflation, are likely to make a substantial contribution to contemporaneous reductions in poverty, even when that is not the primary objective. In the long run, sustained poverty reduction requires sustained economic growth. In the short-run, distributionally-aware public policy can make important contributions to poverty reduction.

Appendix

I. Classification of economic activities

The classification of output categories into sectors in this paper follows Brazil's National Classification of Economic Activity Tables (Classificação Nacional de Atividades Econômicas - CNAE). Table A1 below summarizes the one-digit level headings of the CNAE.[30]

In the Regional Account Statistics, GDP data is presented in fourteen sub-sectors, based on Table A1. We grouped these fourteen sub-sectors into three broad sectors:

Primary sector

1. Agriculture, livestock production, extractive agriculture and forestry (CNAE section A).

Secondary sector

2. Mining industry (section B of CNAE).
3. Manufacturing industry (section C of CNAE).
4. Construction industry (section F of CNAE).
5. Electricity, gas and water provider industries (sections D and E of CNAE).

Tertiary sector

6. Domestic service (section T of CNAE).
7. Collective, social and individual services not provided by public administration (sections M, N, R, S and U of CNAE).
8. Financial institution (section K of CNAE).
9. Real state institution (section L of CNAE).
10. Public administration (section O of CNAE).
11. Education and health (sections P and Q of CNAE).
12. Lodging and food (section I of CNAE).
13. Commerce (section G of CNAE).
14. Transport and communications (sections H and J of CNAE).

II. Regional accounts

Brazil's Census Bureau (IBGE) publishes GDP series disaggregated at the state level since 1985. At present, however, there is a discrepancy between the Regional Account Statistics, and the aggregated *National Accounts*. This arises because a 2006 update of the aggregated *National Accounts*, setting 2000 as the new reference year, has not yet been applied to the Regional Accounts.[31] This should have no impact on our analysis, since the we do not use any information arising from the National Accounts.

[30] The CNAE is produced by the *Secretaria da Receita Federal* (within the Ministry of Finance), in consultation with IBGE. This latest version of the Table was published in the *Diário Oficial da União - Resoluções IBGE/CONCLA nº 01* on September 4th, 2006 and in Resoluções IBGE/CONCLA nº 02, on December 15th, 2006.

[31] In the 2006 update of the aggregate National Accounts, IBGE has: (a) updated weights of each economic activity within the GDP; (b) reorganized the main source of data; and (c) changed concepts, algorithm and the reference framework. The main change, which is aimed to bring Brazilian National Accounts statistics in line with international best practice, is to adopt a "mobile-base price deflator", which uses the previous year as the reference period for quantities. The Annual Industrial Survey (PIA), Annual Services Survey (PIS), Annual Commerce Survey and Annual Construction Survey are now used as the basis for measuring current value contributions for the GDP. The 2002/03 Expenditure Survey (POF) becomes the main reference for family consumption. And Income Tax Data collected by the government is used to complement and construct data from enterprises. Unfortunately this new methodology has not yet been applied retrospectively to the *Regional Accounts Statistics*.

Table A1: CNAE 2.0

		Divisions	Groups	Classes	SubClasses
A – 01 .. 03	Agriculture, Livestock production, Extractive agriculture and Forestry	3	12	34	122
B -05 .. 09	Mining Industry	5	8	16	45
C - 10 .. 33	Manufacturing Industry	24	103	258	410
D – 35	Electricity and Gas Industry	1	3	6	7
E - 36 .. 39	Water and Sewer Industry	4	6	11	14
F - 41 .. 43	Construction Industry	3	9	21	47
G – 45 .. 47	Commerce and Auto/Motor repair shops	3	22	95	222
H – 49 .. 53	Transport, storage and mail services	5	19	34	67
I - 55 .. 56	Lodging and Food	2	4	5	15
J - 58 .. 63	Communication	6	14	32	44
K – 64 .. 66	Financial activities	3	16	37	63
L – 68	Real state activities	1	2	3	5
M – 69 .. 75	Professional, Scientific and Technical activities	7	14	19	39
N – 77 .. 82	Administrative activities	6	19	34	53
O – 84	Public Administration	1	3	9	9
P – 85	Education	1	6	14	23
Q – 86 .. 88	Health and social services	3	11	13	52
R - 90 .. 93	Arts, sports and recreation	4	5	13	28
S - 94 .. 96	Other services	3	7	16	34
T – 97	Domestic services	1	1	1	1
U – 99	International Organization	1	1	1	1

Source:http://www.ibge.gov.br/concla/pub/revisao2007/PropCNAE20/CNAE20_Subclasses_EstruturaDetalhada.zip

Brazil's Census Bureau recommends that the GDP deflator, rather than the consumer price index (INPC/IPC), be used to deflate national (or regional) accounts data. Indeed, as Figure A1 (panel A) indicates, the choice of deflator affects the national GDP series substantively, prior to 1994. This reflects the large difference observed between the Consumer Price Index (CPI) and GDP deflators around this time, though in normal times (and in other countries) they are generally not so different. Essentially, the main difference is that the new GDP deflator does not rely on a fixed basket of goods and services as does CPI. Changes in consumption patterns or the introduction of new goods and services are automatically reflected in the new GDP deflator, measuring changes in both prices and the composition of the basket. The evolution of the ratio of the GDP deflator to the CPI presented in panel B of Figure A1 implies that CPI-deflated GDP would underestimate the "true" (GDP deflator-based) series.

Table A2: Growth elasticity of poverty reduction at the aggregate level

	Headcount index						Poverty gap index					
	β	s.e.		γ	s.e.		β	s.e.		γ	s.e.	
(1) $\ln(H_t)= \alpha+ \beta \ln(\mu_{CPIt})+ \varepsilon_t$	-0.66	0.18	**				-0.82	0.24	**			
(2) $\ln(H_t)= \alpha+ \beta \ln(Y_{CPIt}) + \varepsilon_t$	-0.43	0.07	**				-0.58	0.08	**			
(3) $\ln(H_t)= \alpha+ \beta \ln(Y_{GDPIt}) + \varepsilon_t$	-1.35	0.26	**				-1.67	0.35	**			
(4) $\ln(H_t)= \alpha+ \beta \ln(Y_{GDPIt}) + \gamma R_t + \varepsilon_t$	-0.28	0.32		-0.39	0.10	**	-0.07	0.36		-0.59	0.11	**
H_0: $\beta= \gamma$	*F(1,13)=*	*0.08*					*F(1,13)=*	*1.32*				
	p-value=	*0.78*					*p-value=*	*0.27*				
(5) $\ln(H_t)= \alpha+ \beta \ln(\mu_{CPIt})+ \varepsilon_t$ (using $\ln(Y_{CPIt})$ as the IV)	-1.09	0.29	**				-1.46	0.40	**			

Note: $R = \ln(GDP_{def}/CPI_{def})$; Source: Table 1 data and author's calculation.

Figure A1a: Evolution of per capita GDP and household per capita income

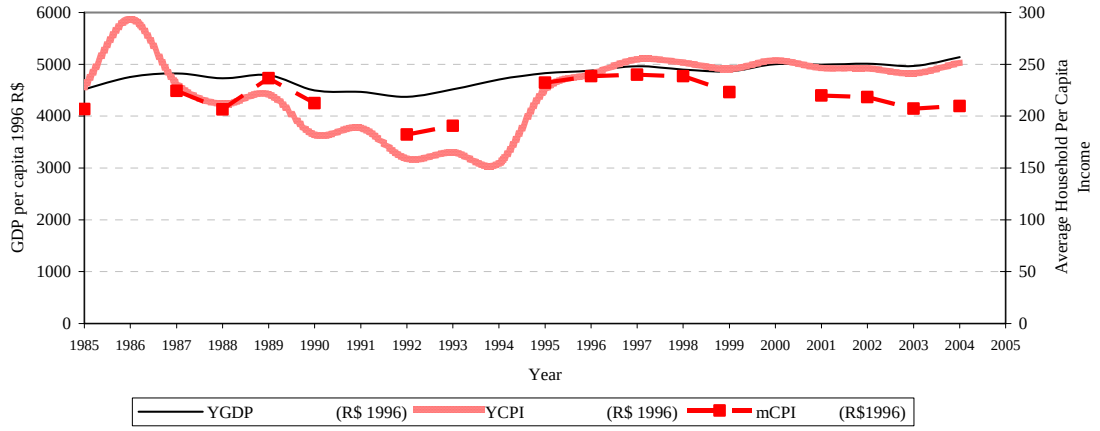
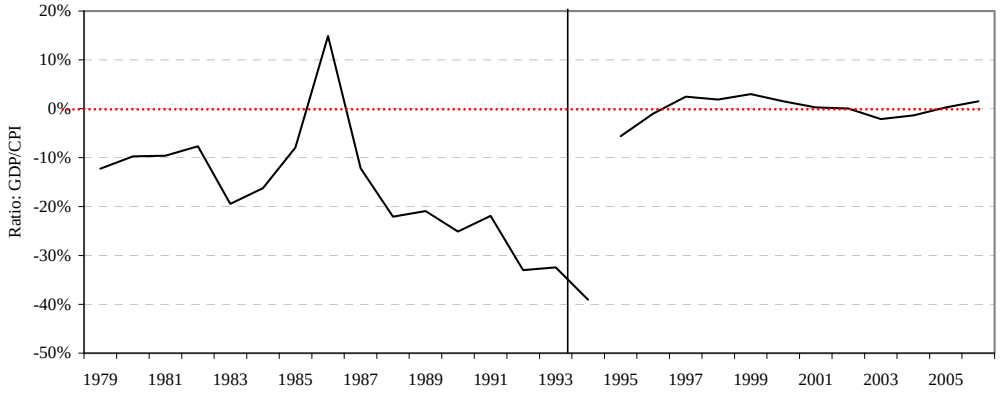


Figure A1b: Evolution of CPI and GDP deflator: 1979-2006, (Sept 1996=100)



In order to test for the effect of using different deflators in our elasticity estimations, we regressed the poverty headcount on three different measures of "average output". Since the GDP deflator is only available for the national aggregate, these regressions use the pooled model, with no state variation. The results are reported in Table A2. The first line reports the regression on mean household income per capita, from the PNAD household surveys. It is a less than ideal

measure, since measurement error in the dependent and independent variables are likely to be correlated. The second (third) line regresses poverty on GDP from the national accounts, deflated by the CPI (GDP deflator). It is evident that the choice of deflator has a large effect on the estimated elasticity.

However, the use of different deflators on the dependent and independent variables might also be a source of bias in the estimated coefficient (if the ratio is temporally correlated with poverty). To control for that, the log ratio of the deflators is included in line 4. Testing the null hypothesis that the two parameters in this specification are identical corresponds to testing the hypothesis that the complete model is well-represented by Model 2 (using the CPI deflator).[32] Since the hypothesis can not be rejected, we use the CPI as our deflator for the Regional GDP statistics throughout the paper.

For an estimate of the aggregate national growth elasticity of poverty reduction, however, the preferred specification is that reported on line 5, where the CPI-deflated national GDP is used as an instrument for the mean income from the survey (Ravallion, 2001).

III. State and municipality expenditures statistics at state level

For these data the main source of information is the IPEADATA website (www.ipeadata.gov.br), which provides state-level expenditure data from the Treasury Department of the Ministry of Finance.

Social expenditures (SOC) comprise:

1. All expenditures of State and Municipality governments for Health and Sanitation purposes, on the basis of the municipality identification from IBGE. Includes expenditures on maintenance and development of the health and sanitation system.
2. All expenditures of State and Municipality governments for Education or Culture purposes, on the basis of the municipality identification from IBGE. Includes expenditures on maintenance and development of the educational system.
3. All expenditures of State and Municipality governments for Social Security purposes, on the basis of the municipality identification from IBGE.

Investment expenditures (INV) comprises all expenditure of State or Municipality government for the acquisition or capital property considered, and classified, as common use of the people. Besides, they must integrate the state or municipal public patrimony. It includes all investments, financial inversions and transferences of capital.

Social security and social assistance (SSA) comprises all expenditure of Federal government for the payment of individual pensions, insurance, social assistance and transfers to municipalities related to social programs, including *Bolsa Familia* and the *Beneficio de Prestacao Continuada (BPC).*

[32] Note that the coefficients reported in line (2) of Table A2 differ from those reported in Section 5, under the restriction that $\beta_i^P = \beta_i^S = \beta_i^T = \beta$. The reason is that, even under the pooling restriction, the state-level regression does not adjust for changes in the relative weight of each state in national GDP over time.

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Table 1: Descriptive statistics for Brazil, 1985-2004

Year	Headcount index (%)			Poverty gap index (%)	μ_{CPI} (R$1996)	Y_{GDP} (R$ 1996)	Y_{CPI} (R$ 1996)	Contribution of each sector to Y_{GDP} (%)			Gini index	$Inflation_{CPI}$ (%/year)
	Total	Urban	Rural					Primary	Secondary	Tertiary		
1985	32.96	22.94	59.12	13.91	206.68	4,518.71	4,561.20	11.2	43.8	45.0	0.589	187.57
1986	-	-	-	-	-	4,756.49	5,869.49	11.5	45.8	42.6	-	104
1987	30.98	20.73	58.37	13.30	224.41	4,825.91	4,625.62	9.9	42.9	47.1	0.592	257.19
1988	35.54	25.21	62.75	16.17	206.59	4,729.94	4,235.02	9.5	44.3	46.1	0.609	499.96
1989	33.54	24.42	58.91	15.12	236.52	4,788.45	4,425.19	9.1	40.7	50.2	0.625	863.46
1990	34.59	24.80	62.05	15.76	212.53	4,499.06	3,641.18	7.9	40.2	51.9	0.604	2783.7
1991	-	-	-	-	-	4,469.20	3,775.78	7.3	38.3	54.5	-	317.03
1992	35.01	27.29	61.15	16.47	182.32	4,372.97	3,176.45	6.5	38.1	55.3	0.573	884.51
1993	35.55	28.38	60.15	16.56	190.69	4,515.66	3,303.66	6.6	37.0	56.4	0.595	1378.37
1994		-	-			4,705.24	3,091.53	9.7	39.0	51.3	-	2268.68
1995	29.84	22.68	56.55	12.94	232.28	4,828.54	4,513.08	8.5	37.3	54.2	0.591	24.07
1996	29.34	22.36	55.65	13.31	238.47	4,881.68	4,806.07	8.1	37.6	54.3	0.591	12.96
1997	29.39	22.32	56.01	13.03	239.94	4,965.74	5,096.35	7.6	37.9	54.5	0.593	4.28
1998	28.53	21.56	54.68	12.59	238.59	4,898.35	5,035.40	7.9	36.8	55.3	0.591	3.49
1999	30.22	23.68	54.91	13.13	223.26	4,863.65	4,907.38	7.8	38.1	54.1	0.585	5.57
2000	-	-	-	-	-	5,000.84	5,076.47	7.4	40.3	52.2	-	6.54
2001	30.54	25.67	55.30	13.78	219.93	4,992.26	4,931.13	8.3	40.2	51.5	0.586	6.85
2002	30.37	25.58	54.87	13.00	218.48	5,014.49	4,925.38	9.5	40.1	50.3	0.580	8.68
2003	31.08	26.61	54.02	13.72	207.20	4,968.74	4,826.42	10.3	42.3	47.4	0.575	16.56
2004	29.21	24.20	54.03	12.72	209.85	5,139.34	5,035.42	9.5	44.0	46.6	0.564	5.78

Source: Author's Calculation using IpeaData time series and PNAD's. μ_{CPI} denotes mean per capita household income from the PNAD survey. Y_{GDP} is gross domestic product deflated by the GDP deflator. Y_{CPI} is gross domestic product deflated by the consumer price index.

Table 2: National GDP growth rates by sector: Brazil, 1985-2004

Year	GDP Growth	Primary Sector Growth	Secondary Sector Growth	Tertiary Sector Growth
1987	2.6%	-0.6%	-1.1%	4.4%
1988	-8.7%	-1.5%	-1.8%	-5.4%
1989	17.6%	0.6%	1.2%	15.9%
1990	-26.3%	-5.5%	-8.9%	-11.8%
1991	-2.1%	-0.7%	0.0%	-1.4%
1992	-11.1%	-1.7%	-2.4%	-7.1%
1993	9.7%	1.1%	3.1%	5.6%
1995	7.9%	2.8%	3.3%	1.9%
1996	6.7%	0.3%	2.4%	3.9%
1997	5.6%	-0.4%	1.9%	4.1%
1998	-0.1%	-0.1%	-0.8%	0.8%
1999	-4.2%	0.2%	0.0%	-4.4%
2000	4.5%	0.2%	2.5%	1.8%
2001	-2.0%	0.0%	0.5%	-2.5%
2002	2.6%	1.4%	0.8%	0.4%
2003	-2.2%	0.9%	1.1%	-4.2%
2004	4.5%	-0.3%	2.7%	2.1%

Source: Author's Calculation from the National Accounts data reported in Table 1.

Table 3: Regressions for poverty at state level allowing coefficients to vary across sectors and states

		Headcount index			Poverty gap index		
Regressions		Coeff	se		Coeff	Se	
Real Agricultural Sector Output		-0.02	0.09		-0.25	0.14	*
Real Industrial Sector Output		**k_i**			**ki**		
Real Tertiary Sector Output		-0.75	0.08	**	-0.99	0.12	**
State specific time trend		yes			yes		
		k_i			**k_i**		
		Coeff	se		Coeff	Se	
North	Acre	-1.74	1.63		-1.85	2.23	
	Amapá	1.88	2.39		0.42	2.62	
	Amazonas	-0.94	0.56	*	-1.40	0.74	*
	Pará	-0.57	0.55		-1.06	0.88	
	Rondônia	-1.28	0.95		-1.24	1.27	
	Roraima	-8.44	5.32		-8.66	5.51	
Northeast	Alagoas	-0.26	0.36		-0.27	0.67	
	Bahia	-0.23	0.19		-0.60	0.34	*
	Ceará	0.56	0.17	**	0.62	0.32	**
	Maranhão	2.50	0.87	**	4.11	1.55	**
	Paraíba	0.52	0.47		-0.09	0.76	
	Pernambuco	-0.08	0.22		-0.63	0.46	
	Piauí	1.24	0.39	**	1.26	0.60	**
	Rio Grande do Norte	0.13	0.18		0.32	0.29	
	Sergipe	0.00	0.11		-0.05	0.22	
Southeast	Espírito Santo	-0.36	0.57		-0.81	0.90	
	Minas Gerais	-0.50	0.23	**	-0.56	0.38	
	Rio de Janeiro	0.81	0.71		0.77	0.84	
	São Paulo	-1.28	0.72	*	-1.41	0.72	**
South	Paraná	-0.25	0.48		0.08	0.70	
	Rio Grande do Sul	1.01	0.63		0.96	0.91	
	Santa Catarina	-0.43	0.50		-0.31	0.65	
Center-West	Distrito Federal	-26.22	11.38	**	-26.44	14.36	*
	Goiás	0.71	0.42	*	1.09	0.65	**
	Mato Grosso	-0.28	1.27		0.60	1.79	
	Mato Grosso do Sul	-0.88	1.01		-0.66	1.56	
	ρ	(-0.3727)			(-0.3183)		
Number of observations		390			390		
Number of groups		26			26		
Time periods		15			15		
Log likelihood		366.2			212.3		
Hypothesis tests		χ^2(df)	df	p-value	χ^2(df)	Df	p-value
Pattern of Growth does not matter							
H_0: $\beta_i^j=\beta\ \forall$ j=P,S,T		153.10	77	0.000	116.36	77	0.003
Sectoral Growth matter but geography does not							
H_0: $\beta_i^j=\beta^j\ \forall$ j=P,S,T		121.22	75	0.001	107.22	75	0.009
Sectoral Growth does not matter but geography does							
H_0: $\beta_i^j=\beta_i\ \forall$ j=P,S,T		88.89	52	0.001	72.39	52	0.032
Pooling restrictions							
H_0: $\rho_i=\rho$		24.06	25	0.516	29.06	25	0.261
H_0: $\beta_i^j=\beta^j\ \forall$ j=P,T		52.64	50	0.372	61.37	50	0.130
H_0: $\beta_i^j=\beta^j\ \forall$ j=S,T & $\pi_i=\pi=0$		-	-	-	96.16	76	0.059

Source: PNAD 1985-2004; Author's calculation.
Note: ** significant at 5%;* significant at 10%.

Table 4: Regressions for state poverty allowing for elasticity differences across sectors and states and sub-periods

		Headcount index			Poverty gap index		
Regressions		Coeff	se		Coeff	se	
Real Agricultural Sector Output							
	Before 1994	0.077	0.14		-0.030	0.18	
	After 1994	-0.112	0.19		-0.499	0.07	*
Real Industrial Sector Output		$\mathbf{k_i}$			$\mathbf{k_i}$		
Real Tertiary Sector Output		-0.623	0.08	**	-0.843	0.11	**
State specific time trend		yes			yes		
Dummy if before 1994 (I)		0.024	0.01	**	0.050	0.01	**
Social Expenditure (SOC)		0.030	0.02	*	0.075	0.03	**
Investiment (INV)		-0.004	0.00		-0.003	0.01	
Inflation rate (CPI)		0.015	0.00	**	0.024	0.00	**
Social Security (SSA)		-0.060	0.01	**	-0.077	0.02	**
		$\mathbf{k_i}$			$\mathbf{k_i}$		
		Coeff	se		Coeff	se	
North	Acre	-1.216	1.39		0.068	0.04	
	Amapá	-2.471	5.43		0.077	0.08	
	Amazonas	-1.001	0.58	*	0.074	0.06	
	Pará	-0.813	0.82		0.028	0.04	
	Rondônia	-0.695	0.79		0.032	0.04	
	Roraima	-8.180	4.91	*	0.076	0.10	
Northeast	Alagoas	-0.194	0.31		0.010	0.02	
	Bahia	-0.428	0.27		0.003	0.02	
	Ceará	0.439	0.17	**	-0.026	0.01	*
	Maranhão	2.076	1.00	**	-0.048	0.02	**
	Paraíba	0.455	0.50		-0.018	0.02	
	Pernambuco	-0.224	0.18		0.011	0.01	
	Piauí	0.879	0.41	**	-0.039	0.02	**
	Rio Grande do Norte	-0.157	0.42		-0.016	0.02	
	Sergipe	0.063	0.15		-0.013	0.02	
Southeast	Espírito Santo	-0.340	0.47		-0.036	0.02	*
	Minas Gerais	-0.703	0.21	**	-0.030	0.01	**
	Rio de Janeiro	0.564	0.71		-0.015	0.04	
	São Paulo	-1.347	0.69	**	0.013	0.03	
South	Paraná	-0.540	0.52		-0.039	0.03	
	Rio Grande do Sul	0.455	0.54		-0.019	0.03	
	Santa Catarina	-0.525	0.50		-0.058	0.03	*
Center-West	Distrito Federal	-25.372	10.24	**	0.022	0.05	
	Goiás	0.570	0.42		-0.045	0.03	*
	Mato Grosso	0.118	1.08		-0.029	0.03	
	Mato Grosso do Sul	-0.832	1.02		0.014	0.04	
	ρ	(-0.3854)			(-0.3530)		
Number of observations		364			364		
Number of groups		26			26		
Time periods		14			14		
Log likelihood		372.11			242.62		
Hypothesis tests		χ^2(df)	df	p-value	χ^2(df)	df	p-value
Pooling restrictions[1]							
H_0: $\beta_{iB}^S=\beta_{iA}^S=\beta_i^S$ & $\beta_B^T=\beta_A^T$		30.27	27	0.302	23.39	27	0.664

Source: PNAD 1985-2004; Author's calculation.
Note: ** significant at 5%;* significant at 10%; 1 - Base model for pooling restriction tests is presented in equation 3.

Table 5: Decomposition of overall poverty reduction

	Pre 1994	Post 1994	Total
Rate of reduction in headcount index	0.042	-0.022	-0.001
Components			
Pure Growth (G)	0.025	-0.008	0.002
Sectoral Pattern of Growth (S)	0.000	0.002	0.002
Social Security and Assistance (SSA)	-0.015	-0.007	-0.010
State-level Public Spending (SPS)	0.000	0.003	0.002
Inflation (INF)	0.024	-0.002	0.006
State specific trends ($E(\pi_i)$	-0.004	-0.003	-0.004
Residual	0.012	-0.006	0.000
Rate of reduction in poverty gap index	0.059	-0.027	0.001
Components			
Pure Growth (G)	0.034	-0.010	0.004
Sectoral Pattern of Growth (S)	0.004	0.004	0.004
Social Security and Assistance (SSA)	-0.019	-0.009	-0.013
State-level Public Spending (SPS)	-0.001	0.008	0.005
Inflation (INF)	0.050	-0.004	0.014
State specific trends ($E(\pi_i)$	-0.010	-0.009	-0.009
Residual	0.001	-0.006	-0.004

Source:PNAD 1985-2004; Author's Calculation

Table 6: Regressions for state poverty with initial conditions for GDP and inequality

		Headcount index			Poverty gap index		
		Coeff	se		Coeff	se	
Real primary sector output							
	Before 1994	-0.030	0.11		-0.097	0.16	
	After 1994	-0.043	0.19		-0.428	0.29	
Real secondary sector output		**k**			**k**		
Real tertiary sector output		-0.595	0.08	**	-0.772	0.11	**
State specific time trend		yes			yes		
Dummy if before 1994 (I)		0.023	0.01	**	0.048	0.01	**
State social expenditure (SOC)		0.022	0.02		0.067	0.03	**
State investment (INV)		-0.003	0.00		-0.002	0.01	
Inflation rate (CPI)		0.017	0.00	**	0.026	0.00	**
Social security and assistance (SSA)		-0.067	0.02	**	-0.082	0.02	**
1970 Census Variables at State Level		Coeff	se		Coeff	se	
k		3.651	1.29	**	3.076	1.77	*
k * Per Capita GDP		-0.487	0.16	**	-0.475	0.23	**
k * Theil index of household per capita income		0.535	0.43		-0.259	0.72	
ρ		(-0.3450)			(-0.3346)		
Number of observations		364			364		
Number of groups		26			26		
Time periods		14			14		
Log likelihood		348.68			222.37		

Source: PNAD 1985-2004; Author's Calculation

Note: ** significant at 5%;* significant at 10%; 1 - Base model is presented in equations 4 and 5.

Table 7: Regressions for state poverty with initial conditions for human development, infrastructure and political participation

	Headcount index			Poverty gap index		
Regressions	Coeff	se		Coeff	se	
Real Agricultural Sector Output						
Before 1994	0.061	0.12		0.161	0,18	
After 1994	-0.007	0.19		-0.130	0,27	
Real Industrial Sector Output	**k**			**k**		
Real Tertiary Sector Output	-0.603	0.08	**	-0.861	0.11	**
State specific time trend	yes			yes		
Dummy if before 1994 (I)	0.023	0.01	**	0.048	0.01	**
Social Expenditure (SOC)	0.014	0.01		0.027	0.03	
Investment (INV)	-0.003	0.01		0.002	0.01	
Inflation rate (CPI)	0.017	0.01	**	0.033	0.01	**
Social Security (SSA)	-0.058	0.01	**	-0.051	0.02	**
1970 Census Variables at State Level	Coeff	se		Coeff	se	
k	-4.100	1.64	**	-3.165	2.73	
k' * Average years of schooling of adult population	-0.176	0.30		-0.123	0.46	
k' * Infant Mortality Rate per 100,000 people	0.766	0.30	**	0.579	0.51	
k' * Share of labor force employed in Industry associated to Union	-0.299	0.18	*	-0.449	0.25	*
ρ	(-0.3499)			(-1.1222)		
Number of observations	364			364		
Number of groups	26			26		
Time periods	14			14		
Log likelihood	350,41			152,39		

Source: PNAD 1985-2004; Author's Calculation

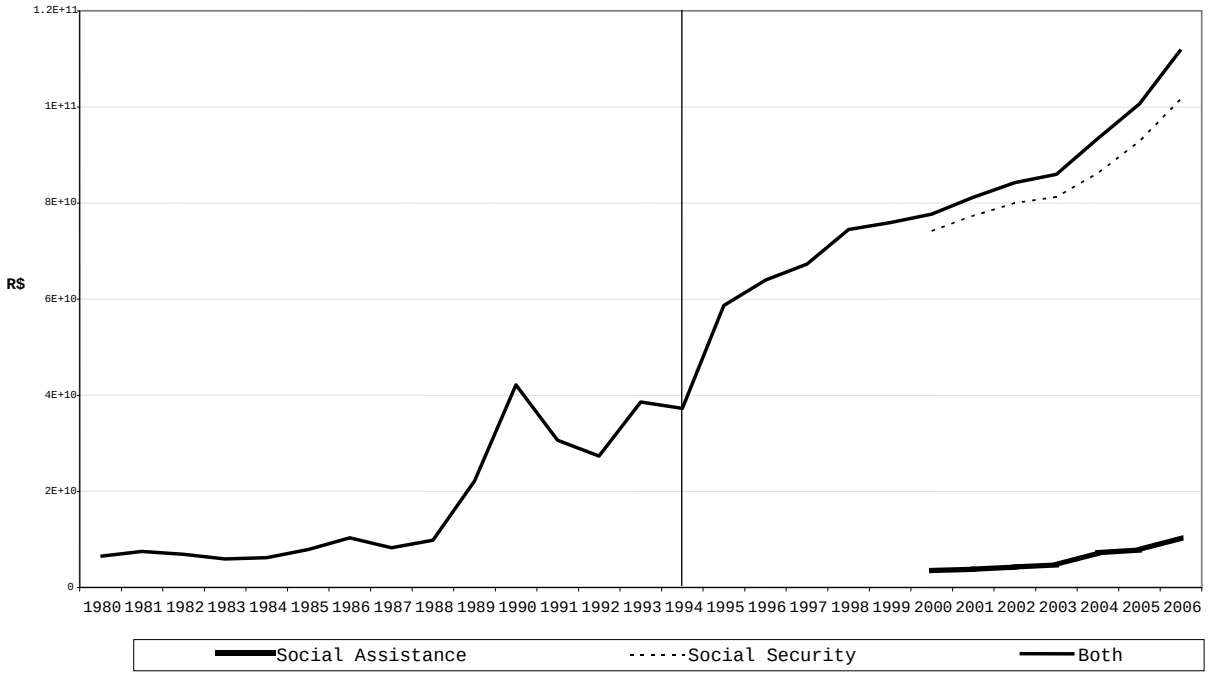
Note: ** significant at 5%;* significant at 10%; 1 - Base model is presented in equations 4 and 5.

Table 8: Initial conditions at state level in 1970

State	Share of the population with at least 0-4 years of schooling (%)	Illiteracy Rate (%)	Infant mortality rate per 100,000 people	Household per capita income as share of minimum wage	Theil index	GDP per Capita	Urbaniz-ation rate (%)	Share of households with access to electricity (%)	Labor force unionization rate in manufacturing (%)
Rondônia	86.4	42.4	156.1	0.68	0.440	2,396.64	54.6	25.2	0.0
Acre	93.5	63.7	120.7	0.42	0.400	1,547.56	27.6	14.3	0.0
Amazonas	86.5	48.3	112.1	0.45	0.480	1,877.14	42.5	27.6	52.2
Roraima	81.0	44.3	113.3	0.55	0.410	2,077.20	43.0	28.8	0.0
Pará	85.2	41.2	110.8	0.41	0.440	1,312.50	47.2	28.1	59.5
Amapá	81.0	41.1	113.3	0.49	0.350	2,528.06	54.8	37.0	69.0
Maranhão	93.1	64.3	149.6	0.27	0.330	711.90	25.2	6.2	40.6
Piauí	92.9	67.6	148.2	0.19	0.460	555.92	32.1	9.1	45.1
Ceará	62.7	61.3	192.8	0.26	0.600	841.51	40.9	20.2	34.3
Rio Grande do Norte	89.4	59.3	235.6	0.26	0.570	873.66	47.5	22.4	65.9
Paraíba	90.8	60.6	207.3	0.23	0.580	764.23	42.1	26.3	65.2
Pernambuco	86.3	56.1	203.4	0.38	0.630	1,454.38	54.4	38.0	52.6
Alagoas	93.4	65.9	199.8	0.30	0.520	1,111.07	39.8	24.8	80.9
Sergipe	93.3	58.6	166.0	0.31	0.530	1,243.72	46.0	31.2	60.9
Bahia	89.4	57.0	148.5	0.36	0.580	1,317.78	41.0	22.7	62.5
Minas Gerais	88.6	40.4	105.3	0.47	0.630	1,870.69	52.5	40.5	63.3
Espírito Santo	85.6	39.3	91.7	0.43	0.560	1,908.09	45.0	38.7	30.8
Rio de Janeiro	60.6	21.8	86.0	1.20	0.360	4,797.33	87.9	82.1	41.0
São Paulo	80.1	21.4	89.2	1.15	0.560	5,722.22	80.3	80.5	69.4
Paraná	89.9	36.3	98.6	0.51	0.500	2,030.61	35.8	32.0	60.7
Santa Catarina	87.3	24.4	85.4	0.48	0.440	2,398.51	42.6	49.0	76.2
Rio Grande do Sul	69.4	23.3	62.8	0.69	0.570	3,346.05	52.9	51.7	65.9
Mato Grosso	90.1	42.2	97.3	0.45	0.45	1,723.06	40.8	21.6	10.5
Goiás	90.6	45.3	91.8	0.43	0.466	1,328.95	41.9	24.9	62.1
Distrito Federal	65.3	23.6	109.5	1.13	0.570	6,078.81	96.0	68.1	81.0

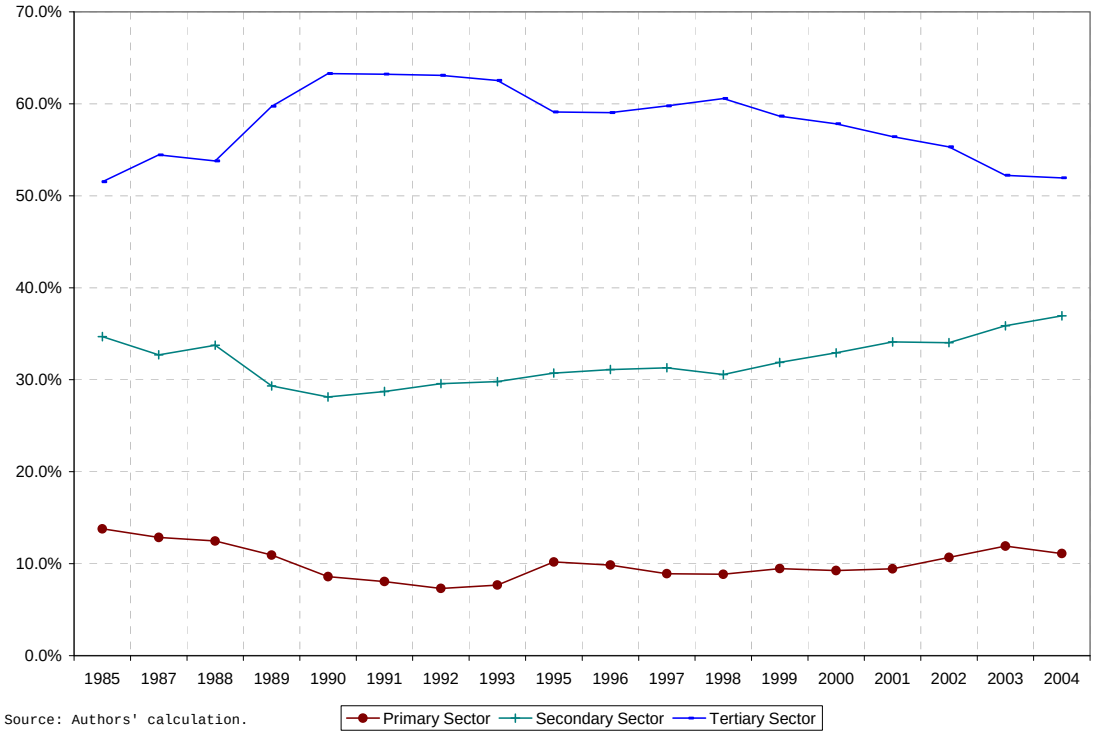
Source: CENSUS 1970; IBGE; Fundação João Pinheiro; IPEA

Figure 1: Evolution of Federal expenditure in social security and assistance



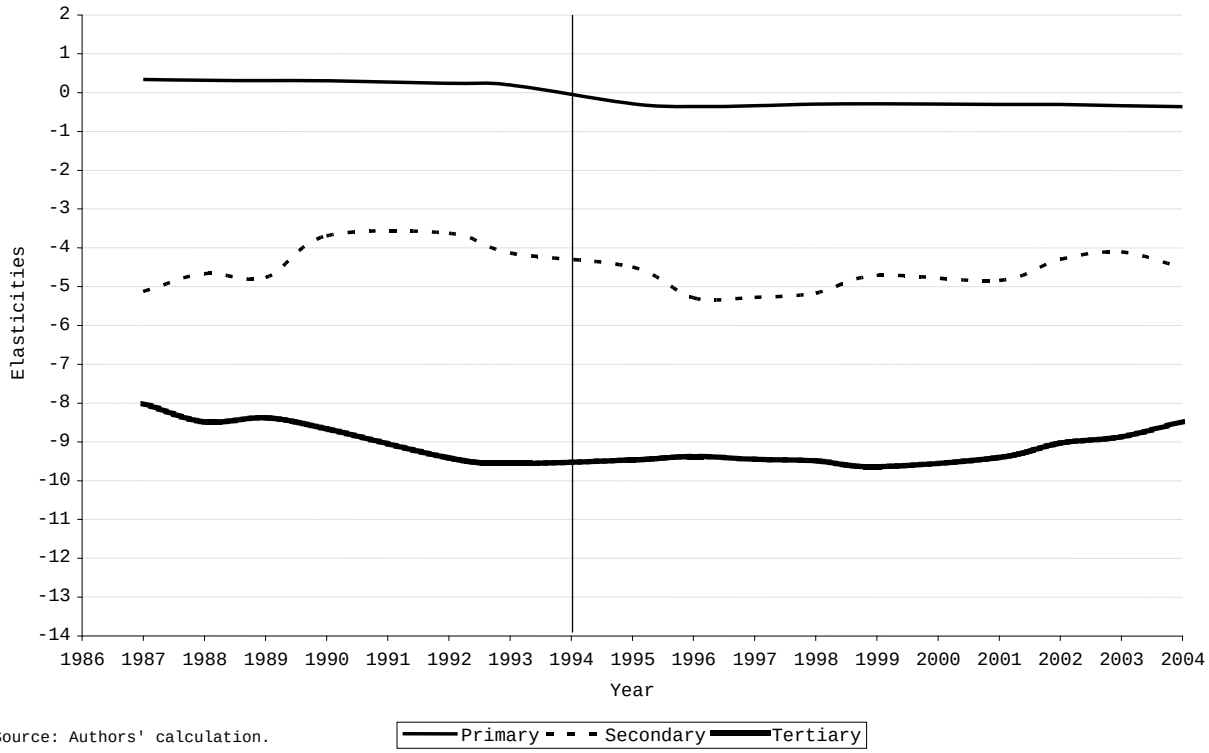
Source: Authors' calculation.

Figure 2: Sectoral shares of GDP



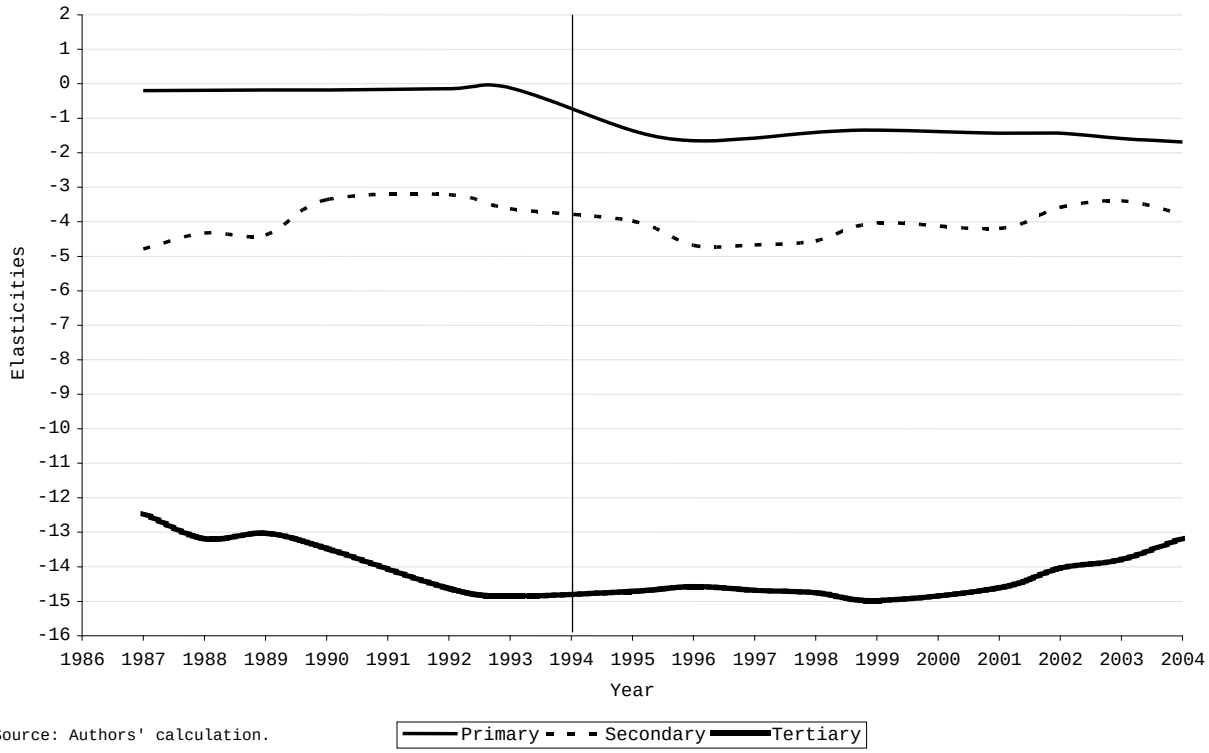
Source: Authors' calculation.

Figure 3a: Weighted average of sectoral growth elasticity for headcount index



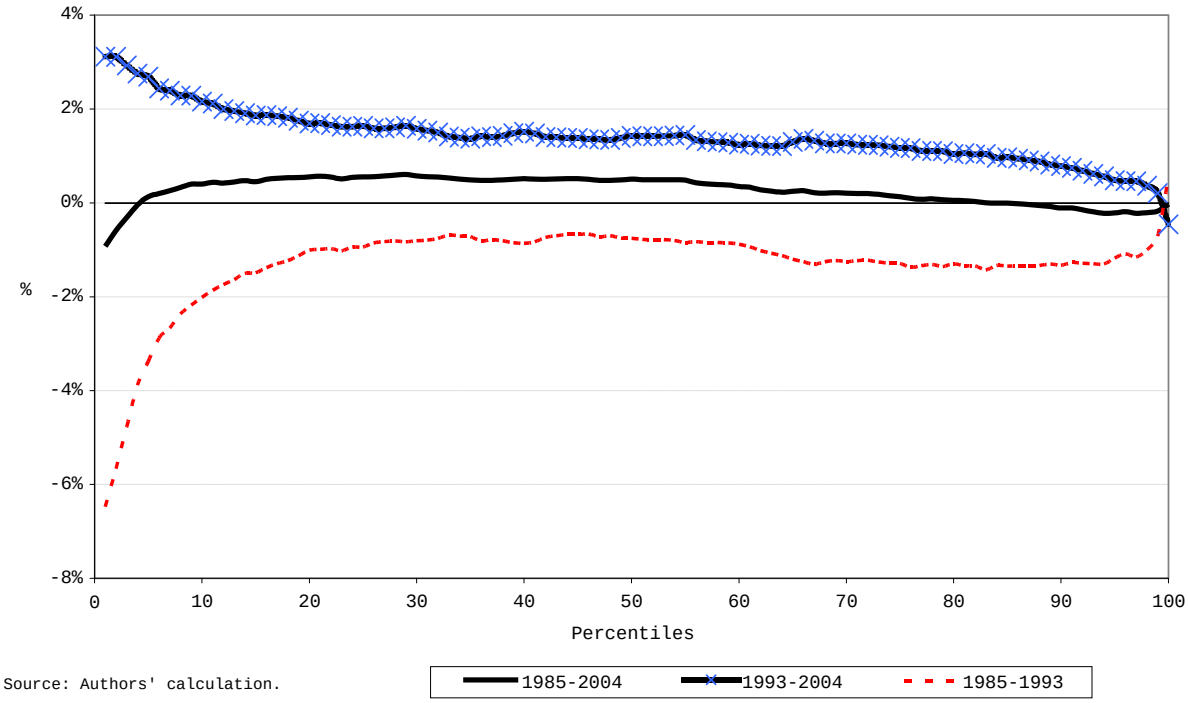
Source: Authors' calculation.

Figure 3b: Weighted average of sectoral elasticity for poverty gap index



Source: Authors' calculation.

Figure 4: Growth incidence curves for Brazil



Source: Authors' calculation.

Figure 5: Poverty measures with and without growth effects

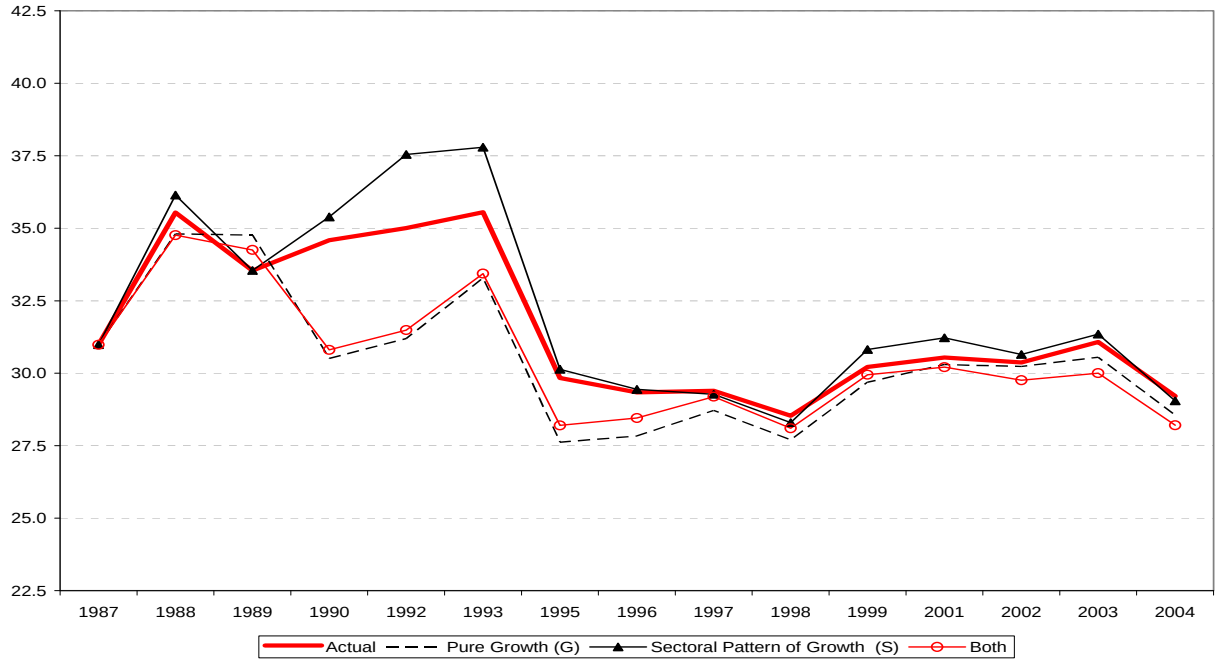


Figure 6: Poverty measures with and without the changes in social assistance spending, state-level public spending and inflation