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Linkages between Pro-Poor Growth, Social Programmes and Labour Market: The Recent Brazilian Experience

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ABSTRACT

This paper analyzes the relationship between growth patterns, poverty and inequality in Brazil during its globalization process, focusing on the role played by the labour market and social programs. From a methodological point of view, the paper makes two contributions to the literature. One contribution is the proposal of a new measure of pro-poor growth, which links growth rates in mean income and in income inequality. The other contribution is a decomposition methodology that explores linkages between three dimensions: growth patterns, labor market performances, and social policies. The proposed methodologies are then applied to the Brazilian National Household Survey (PNAD) covering the period 1995-2004. The analysis based on Brazilian experience demonstrates that government social policies can play an important role in protecting the poor from external shocks, which occur more frequently in the era of globalization.

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1. INTRODUCTION

Globalization bears both optimistic and pessimistic views about its effects on economy. According to a trade model in economics, lower tariffs and transportation costs should push each country to specialize in producing the goods that the country has a comparative advantage. In principle, globalization should hence lead to an increase in the relative demand for skilled labour in rich industrialized countries, and an increase in the demand for the unskilled labour in poor developing countries. In contrast, a pessimistic view about the effects of globalization stems from that it could be a source of increased inequality. While integration with world markets can make a significant contribution to the productivity increase and thus economic growth, it may be detrimental to equity. Low wages and restricted workers' rights could be important factors to attract foreign investment and gain greater access to world market, which overall tend to benefit capital owners. At the same time, globalization could engender more inequality among workers. This can occur if only a small proportion of the people who have skills benefit from increased economic integration and the rest are left behind.

From empirical perspectives on the effects of globalization, the available evidence is mixed. The Asian experience over the past two decades suggests that globalization has a positive and dramatic impact on both growth and poverty reduction. Yet there has been an increase in inequality as observed in China and India. Moreover, several studies also suggest that Latin American countries have experienced an increase in wage inequality after their economic liberalization. This warrants a closer look at the merits of the relationship between globalization, growth, poverty and inequality. This study focuses particularly on the analysis of the association between growth patterns, poverty and inequality during the globalization process, focusing on the role played by the labor market and social programs. This relationship is empirically examined in the context of Brazil.

This paper analyzes the relationship between growth patterns, poverty and inequality in Brazil during its globalization process, focusing on the role played by the labor market and social programs. From a methodological point of view, the paper makes two contributions to the literature. One contribution is the proposal of a new measure of pro-poor growth, which links growth rates in mean income and in income inequality. The other contribution is a decomposition methodology that explores linkages between three dimensions: growth patterns, labor market performances, and social policies. The proposed methodologies are

then applied to the Brazilian National Household Survey (PNAD) covering the period 1995-2004.

2. PRO-POOR GROWTH RATE

Suppose x is the real income of an individual, which is a random variable with density function $f(x)$, then the real mean income of the population is defined as[iii]

$$\mu = \int_0^\infty xf(x)dx \tag{1}$$

A county's performance in average standard of living can be measured by the growth rate γ given by

$$\gamma = \Delta Ln(\mu) \tag{2}$$

Economic growth has an impact on each individual in a different manner. Following Kakwani and Pernia (2000), growth is defined as pro-poor (or anti-poor) if the poor benefit proportionally more (or less) than the non-poor, i.e., growth results in a redistribution of income in favour of the poor. When there is a negative growth rate, growth is defined as pro-poor (anti-poor) if the loss from growth is proportionally less (more) for the poor than for the non-poor. This is a relative concept of pro-poor (anti-poor) growth because growth leads to a reduction (or increase) in relative inequality.[iii]

The pattern of growth can be described by two factors: (i) the growth rate in mean income defined by γ and (ii) how inequality changes over time. To measure the pattern of growth, we need to specify a social welfare function, which gives a greater weight to utility enjoyed by the poor compared to utility enjoyed by the non-poor.[iv] Suppose $u(x)$ is the utility function, which is increasing in x and concave, then we can define a general class of social welfare function as

$$W = \int_0^\infty u(x)w(x)f(x)dx \tag{3}$$

where $w(x)$ is the weight given to the utility of the individual with income x. The main problem with this social welfare functionon is that it is not invariant to the positive linear transformation of the utility function. Following Atkinson's (1970) idea of equally distributed equivalent level of income, we can get a money-metric social welfare function denoted by x^* from (3) as

$$W = u(x^*) = \int_0^\infty u(x)w(x)f(x)dx \quad (4)$$

where x^* is the equally distributed equivalent level of income which, if given to every individual in the society, results in the same social welfare level as the actual distribution of income. Note that if $w(x) = 1$ for all x, then x^* in (4) is identical to the money-metric social welfare proposed by Atkinson (1970).

To make pro-poor growth operational, we need to specify $u(x)$ and $w(x)$. The most popular form of the utility function is the logarithmic utility function which, given by $u(x) = log(x)$, is increasing and concave in x. In this study, we adopt the logarithmic utility function not only because of its popularity, but also because of its attractive features such as the decomposability of growth rate in terms of some labor force characteristics (see next section). Atkinson (1970) specified *u(x)* by an entire class of homothetic functions, which provide flexibility to choose any value of inequality aversion parameter. By choosing logarithmic function, we have chosen inequality aversion parameter to be equal to 1.

The inequality aversion parameter determines how much weight should be given to the poor relative to the non-poor; the higher the inequality aversion parameter, the greater is the weight given to the poor relative to the non-poor. Since Brazil has persistently suffered high degree of inequality, it is our opinion that we should choose inequality aversion parameter to be higher than what is implied by the logarithmic utility function. We can achieve this objective by choosing *w(x)*, which is a decreasing function of x so that the total weight given to all individuals add up to unity, which implies

$$\int_0^\infty w(x)f(x)dx = 1 \quad (5)$$

According to Sen (1974), the weighting function *w(x)* can capture the relative deprivation suffered by the poor relative to the non-poor in society. Following him, a simple way to capture relative deprivation is to assume that an individual's deprivation depends on the number of persons who are better off than him/her in society. Such a weighting scheme is given by

$$w(x) = 2[1 - F(x)] \quad (6)$$

where $F(x)$ is the distribution function. This function implies that the relative deprivation suffered by an individual with income x is proportional to the proportion of individuals who

are richer than this individual. It can be verified that $w(x)$ in (6) is a decreasing function of x and satisfies equation (5).[v]

Substituting $u(x) = log(x)$ and $w(x)$ from (6) in (4) gives the social welfare function:

$$log(x^*) = 2\int_0^\infty [1 - F(x)] log(x) f(x) dx \tag{7}$$

which provides the basis for the empirical analysis presented in this paper? If we substitute $u(x)=x$ in (7), we would obtain a social welfare function developed by Sen (1974):

$$W = \mu(1 - G) \tag{8}$$

where G is the Gini index. This social welfare function has been criticized on the ground that it is not strictly quasi-concave.[vi] It can be demonstrated that our proposed social welfare function in (7) is indeed strictly quasi-concave. This is not the only reason for using the proposed social welfare function. Sen's social welfare function can not be used to directly link the growth pattern with the changes in labor force characteristics, which is an important contribution of this paper.

It will be useful to write (7) as

$$log(x^*) = log(\mu) - log(I) \tag{9}$$

where

$$\log(I) = 2\int_0^\infty [1 - F(x)][\log(\mu) - \log(x)] f(x) dx \tag{10}$$

where I is a new measure of inequality. Taking the difference in (9) gives

$$\gamma^* = \gamma - g \tag{11}$$

where $\gamma^* = \Delta log(x^*)$ is the growth rate of money-metric social welfare x^*, $\gamma = \Delta \log(\mu)$ is the growth rate of mean income μ and $g = \Delta \log(I)$ is the growth rate of inequality as measured by I. This equation describes a growth pattern which provides the linkage between growth rates in the mean income and income inequality.

γ^* is the proposed measure of the pro-poor growth rate. If g is positive, then growth is accompanied by an increase in inequality. In this case, we have $\gamma^* < \gamma$ and thus, there is a loss of growth rate due to the increase in inequality. If g is negative, this implies that growth is accompanied by a decrease in inequality, in which case, $\gamma^* > \gamma$, which suggests that there is a gain in growth rate due to the decrease in inequality. Growth is defined as pro-poor (or anti-

poor) if there is a gain (or loss) in growth rate. Thus, a change in inequality is captured by the gain and loss in growth rate.

3. CALCULATING PRO-POOR GROWTH RATE FROM HOUSEHOLD SURVEYS

This study utilizes the *Pesquisa Nacional por Amostra de Domicílios* (PNAD, the Brazilian Annual National Household Survey) from 1995 to 2004. Each household survey contains a variable called the weighting coefficient (WTA), which is the number of population households represented by each sample household. The sum of the WTAs for all sample households provides the total number of households in the country. A population weight variable (POP) can be constructed by multiplying the weighting coefficient (WTA) by the household size. The sum total of the (POP) variable for all sample households provides an estimate of the total population in the country. The total population estimate for Brazil was calculated as equal to 148.11 million for 1995, which increased to 173.71 million in 2004.

Using the (POP) variable, one can easily calculate the relative frequency that is associated with every sample household. Suppose f_{jt} is the relative frequency associated with the jth household at year *t*. If x_{jt} is the per capita real income of the jth household at year *t*, then the mean income of all individuals in the country at year *t* can be estimated as

$$\mu_t = \sum_{j=1}^{n} f_{jt} x_{jt} \tag{12}$$

which was estimated for every year between 1995 and 2004. We then estimate the growth rate of the mean income at year *t* as

$$\gamma_t = \Delta \log(\mu_t) \tag{13}$$

To compute the social welfare function defined in (7), we need an estimate of the probability distribution function $F(x)$. An unbiased estimate of $F(x)$ for the jth household at year *t* is given by[vii]

$$p_{jt} = \sum_{i=1}^{j} f_{it} - f_{jt} / 2 \tag{14}$$

when households are arranged in ascending order of their per capita real income x_{it}. Substituting (14) into (7) gives a consistent estimate of money-metric social welfare x_t^* as

given by

$$log\left(x_t^*\right)=2\sum_{j=1}^{n} f_{jt}\left(1-p_{jt}\right)log\left(x_{jt}\right) \quad (15)$$

which gives an estimate of the pro-poor growth rate at year *t* as

$$\gamma_t^* = \Delta \log(x_t^*) \quad (16)$$

Growth will be pro-poor (or anti-poor) at year *t* if γ_t^* is greater (or less) than γ_t.

4. LINKING PRO-POOR GROWTH WITH LABOUR FORCE CHARACTERISTICS

The PNAD provides labor force characteristics of individuals. From the individual information, we can calculate the following variables at the household level.

- Per capita real labour income (y_l)
- Per capita non-labour income (y_{nl})
- Per capita employed persons in the household (e)
- Per capita labour force participation rate (ℓ)
- Per capita hours of work in the labour market (h)
- Per capita years of schooling in the household (s)

Using these variables, we calculate the following variables of interest:[viii]

- Employment rate: $e_r = e/\ell$
- Hours worked per employed person: $h_e = h/e$
- Productivity: $\xi = y_l / h$

The linkage between the growth rate of per capita labour income and growth rates of the four labor force characteristics (which include employment, hours of work per employed person, labor force participation rate and productivity) is provided through the following identity:

$$ln\left(y_l\right)=ln\left(e_r\right)+ln\left(h_e\right)+ln\left(\ell\right)+ln\left(\xi\right) \quad (17)$$

Using this definition, it is easy to show that growth rate in per capita labour income is related to growth rates of the four labor force characteristics in an additive fashion:

$$\gamma(y_l) = \gamma(e_r) + \gamma(h_e) + \gamma(\ell) + \gamma(\xi) \tag{18}$$

The first factor is the employment rate. If this factor is positive, this suggests that the employment rate has improved in the economy, contributing positively to economic growth. A similar interpretation can be given to the other factors. The last factor is the contribution of change in productivity to the growth rate of per capita labour income.

Again using the identity (17) in (15), it is easy to show that the pro-poor growth rate of per capita labour income is also related with pro-poor growth rates of the same four labor market characteristics in an additive fashion as[ix]

$$\gamma^*(y_l) = \gamma^*(e_r) + \gamma^*(h_e) + \gamma^*(\ell) + \gamma^*(\xi) \tag{19}$$

Subtracting (18) from (19) gives the decomposition of the growth rate of inequality in total income in terms of four factors as

$$g^*(y_l) = g^*(e_r) + g^*(h_e) + g^*(\ell) + g^*(\xi) \tag{20}$$

The growth rate of labour income is pro-poor (or anti-poor) if $g^*(y_l)$ is greater (or less) than 0. This equation provides the contributions of various labour force characteristics to a gain (or loss) of growth rate due to changes in the pattern of per capita labour income.[x] If, for instance, $g^*(e_r)$ is positive (or negative), it means that employment generated in the economy contributes to a decrease (or increase) in inequality in per capita income. A similar interpretation applies to the other factors.

Schooling is a major factor that has an impact on productivity. It is generally true that the higher the level of schooling an individual possesses, the greater is his/her productivity (or labour earnings per hour). Thus, an increase in years of schooling should lead to an increase in productivity. But the relationship between schooling and productivity is not that simple. Changes in years of schooling are also accompanied by changes in returns from schooling. The returns from schooling also vary from one household to another depending on a host of factors such as age, location, occupation and so on. Growth rates of returns are also not uniform across households.

Productivity of the jth household denoted by ξ^j can be written as

$$\xi^j = y_l^j / h^j \tag{21}$$

where y_l^j is the per capita labour income of the jth household and h^j is the per capita hours of work in the labour market provided by the jth household. Suppose $\bar{r}$ is the average hourly return from per year of schooling of all the working population and $\bar{r}^j$ is the average return (per hour) from per year of schooling of the jth household. Then the productivity of the jth household can be written as

$$\xi^j = s^j \bar{r}\left(\bar{r}^j / \bar{r}\right) \tag{22}$$

where

$$\bar{r}^j = \xi^j / s^j \tag{23}$$

Taking the logarithm in both sides of equation (22), we obtain

$$log\left(\xi^j\right) = log\left(s^j\right) + log(\bar{r}) + log\left(\bar{r}^j / \bar{r}\right) \tag{24}$$

which on utilizing the averages of the variables and taking first differences gives

$$\gamma(\xi) = \gamma(s) + \gamma(\bar{r}) \tag{25}$$

which shows that the growth rate in the mean productivity can be decomposed into two components. The first component is the growth rate of mean years of schooling, and the second component is the growth rate of average returns from per year of schooling.[xi]

Applying the identity (24) in (15), it can be easily shown that the pro-poor growth rate of productivity is related to three factors in an additive fashion as

$$\gamma^*(\xi) = \gamma^*(s) + \gamma^*(\bar{r}) + \gamma^*\left(\bar{r}^j / \bar{r}\right) \tag{26}$$

Subtracting (25) from (26) gives the decomposition of the growth rate of inequality in productivity in terms of three factors:

$$g^*(\xi) = g^*(s) + g^*(\bar{r}) + g^*\left(\bar{r}^j / \bar{r}\right) \tag{27}$$

The first term in the right hand side of (27) relates to how growth in years of schooling is distributed among the poor and the non-poor. The schoolingg will be pro-poor (or anti-poor) if $g^*(s)$ is greater (or less) than zero. The second term in (27) will always be zero, because $\bar{r}$ is the same for all households. The third term measures the impact of the redistribution of the rates of returns among households. If $g^*\left(\bar{r}^j / \bar{r}\right)$ is greater (or less) than 0, changes in the rates of returns from schooling favour poor (or non-poor) households more than non-poor (or poor) households. This decomposition is useful in understanding the impact of schooling on growth

and inequality.

5. TRENDS IN GROWTH, INEQUALITY AND POVERTY

For this study, we have chosen per capita real income as a welfare indicator. Per capita real income is defined as per capita nominal income adjusted for prices, which vary across regions and over time. This is achieved by dividing the per capita nominal income by the per capita poverty line expressed as a percentage. The poverty line used in this paper takes into account regional costs of living (Ferreira et al. 2003, Neri 2001).

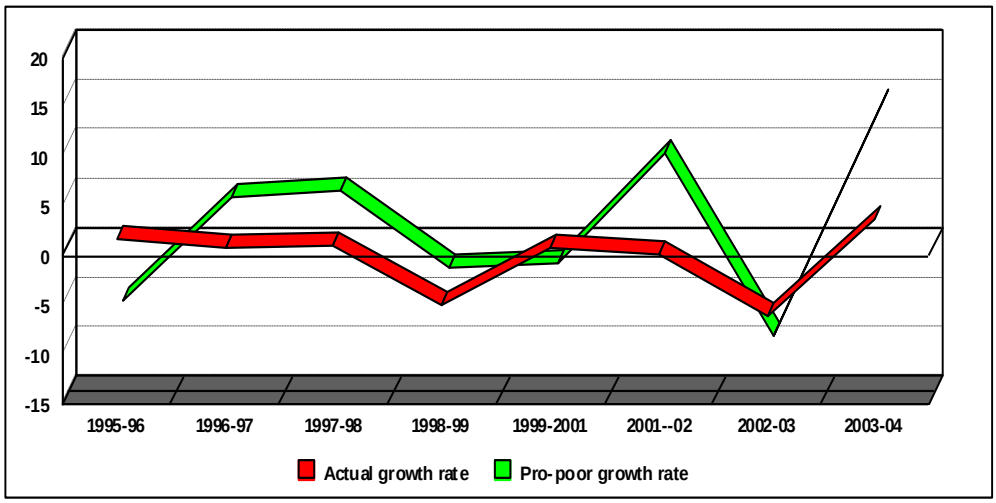
Table 1 presents growth rates of per capita real income and per capita money metric social welfare. The results reveal that the trend in per capita real income has been declining at an annual rate of 0.63 percent over 1995-2004. Hence, the actual growth rate of per capita real income has been almost stagnant. This unimpressive performance in per capita real income worsened even further in the second period 2001-2004, when per capita real income fell at an annual rate of 1.35 percent.

Table 1: Growth rates of per capita real income and social welfare

Period	Actual growth rate	Pro-poor growth rate	Gain(+)/loss(-) of growth
1995-96	1.59	-5.95	-7.54
1996-97	0.65	4.42	3.77
1997-98	0.97	5.07	4.10
1998-99	-5.15	-2.53	2.63
1999-2001	0.76	-2.17	-2.94
2001-2002	0.11	8.98	8.87
2002-2003	-6.12	-9.64	-3.52
2003-2004	3.56	14.11	10.55
1995-2004	**-0.63**	**0.73**	**1.36**
1995-2001	**-0.30**	**0.10**	**0.40**
2001-2004	**-1.35**	**3.07**	**4.42**

Source: authors' calculation based on PNAD.

Figure 1: Growth rates of per capita real income and social welfare



This pessimistic picture, however, tends to disappear if growth is evaluated in terms of social welfare, which makes an adjustment for inequality, (which is called the pro-poor growth rate in the table.) This is a more relevant concept for evaluating a country's performance in relation to its standard of living. In the first period (1995-2001), the trend in the pro-poor growth rate, although positive, was only 0.10 percent, which cannot be regarded as a good performance, but the trend in the growth rate in the second period (2001-2004) increased to 3.07 percent, which is an exceptionally good performance.

The last column of Table 1 is obtained by subtracting the actual growth rate from the pro-poor growth rate. Gains in growth rates imply a decline in inequality, while losses in growth rates imply an increase in inequality. Substantial gains in growth rates are quite noticeable in the second period, 2001-2004. There were gains in growth rates equivalent to 4.42 percent per annum because of falling inequality in the 2000s. By contrast, the gains were merely 0.40 percent per year in the first period, 1995-2001. Thus, in the second period, the poor were able to benefit proportionally much more from growth than in the first period. This growth pattern has led to an unprecedented reduction in inequality in Brazil (which is also evident from Figure1).

Having examined the trends in growth and inequality, it is interesting to analyze the trends in poverty over 1995-2004. Poverty estimates for the headcount ratio, the poverty gap ratio and the severity of poverty are presented in Table 2. The results show a significant reduction in poverty between 1995 and 1998.

Table 2: Poverty estimates

Period	Headcount ratio	Poverty gap ratio	Severity of poverty
1995	29.37	12.80	7.69
1996	29.23	13.31	8.26
1997	29.24	13.00	7.98
1998	27.83	12.28	7.40
1999	28.81	12.58	7.53
2001	28.28	12.75	7.84
2002	27.39	11.78	6.95
2003	28.19	12.32	7.51
2004	26.04	10.87	6.36
Annual growth rates			
1995-2001	-0.68	-0.54	-0.50
2001-2004	-2.20	-4.32	-5.52
1995-2004	-1.00	-1.46	-1.76

Source: authors' calculation based on PNAD.

However, the percentage of poor increased from 27.83 percent in 1998 to 28.81 percent in 1999, which could be due to impact of the Asian crisis upon the Brazilian economy. Since 1999, poverty had been on the decline. Note that the real minimum wage had increased to its highest point during the period 2000-2001, 9.1 percent. It appears that raising the minimum wage is an important measure that reduces poverty in Brazil as a whole. It should be highlighted, however, that the positive impact of a higher minimum wage rate can be reduced with a rising unemployment rate, due to higher costs. In Brazil, the annual growth rate of the minimum wage has been increasing over time and the unemployment rate has been on the rise as well. The unemployment rate recently reached almost 10 percent in 2001 (WDI 2004). This indicates that the positive impact of the increasing minimum wage on poverty reduction could have been mitigated by the rising unemployment rate in the 1990s.

All in all, the Brazilian experience exhibits an interesting pattern between growth in per capita real income and poverty: while per capita real income declined over the period, poverty also fell. This is an interesting case that does not support a *priori* the notion that a positive (or negative) growth leads to a decrease (or increase) in poverty. More importantly, the negative growth during the period, 1995-2004, was pro-poor in the sense that the poor made positive gains in their incomes, despite the fact that average incomes declined. Thus, there was a sharp decline in inequality over the period which offset the adverse effect of the negative growth on poverty.

6. PATTERNS OF PRO-POOR GROWTH

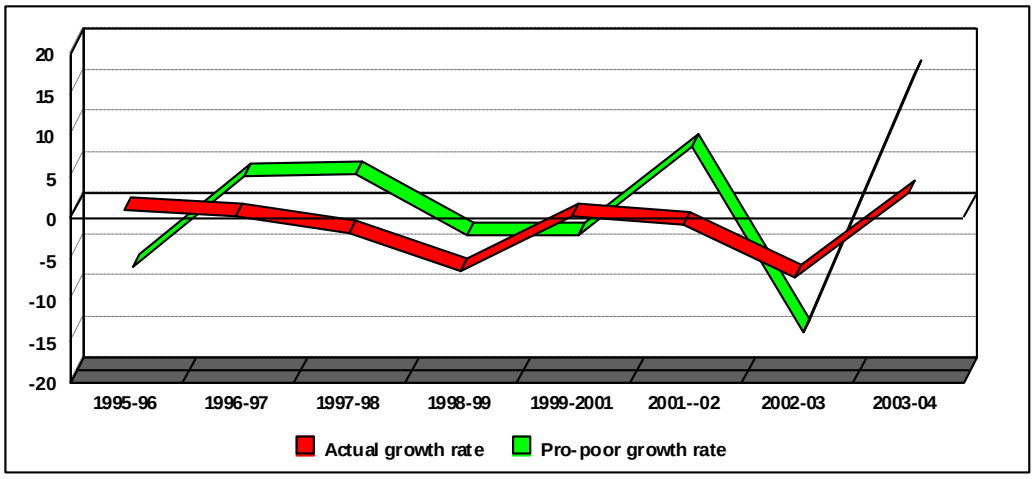
Per capita total income can be derived from both labor and non-labor income sources. Table 3 shows growth rates of per capita labor income during 1995-2004. Consistent with the growth rate in per capita total income, earnings from the labour market did not perform well over the period. Per capita real labour income declined at an annual rate of 1.49 percent between 1995 and 2004. The second period was even worse, when the growth rate in labour income became -2.05 percent per annum. However, the per capita growth rate in social welfare became positive, with an annual rate of 0.97 percent in the second period. Thus, there was gain of 3.02 percent in growth rate, which is attributed to a decline in inequality. This indicates that in the 2000s, the labor market conditions improved for the poor relative to the non-poor. Figure 2 shows that labor income had benefited the poor proportionally more than the non-poor in the latest period, 2003-04, in particular. It will be interesting to find out what factors of the labour market – such as employment and productivity, among others – played a major role in explaining this pro-poor growth pattern in this period. This task is taken in the next section.

Table 3: Growth rates of per capita labour income

Period	Actual growth rate	Pro-poor growth rate	Gain(+)/loss(-) of growth
1995-96	1.16	-7.21	-8.37
1996-97	0.33	3.71	3.38
1997-98	-1.66	3.97	5.63
1998-99	-6.23	-3.38	2.84
1999-2001	0.39	-3.54	-3.93
2001-2002	-0.58	7.24	7.82
2002-2003	-7.15	-15.20	-8.05
2003-2004	3.28	16.24	12.97
1995-2004	**-1.49**	**-0.73**	**0.76**
1995-2001	**-1.30**	**-0.97**	**0.32**
2001-2004	**-2.05**	**0.97**	**3.02**

Source: authors' calculation based on PNAD.

Figure 2: Actual and pro-poor growth rates of per capita labour income



The changes in non-labor income are in sharp contrast with those in labor income. The story of non-labor income can be told with the help of Table 4. Per capita non-labor income grew at an annual rate of 2.64 percent between 1995 and 2004, the growth rate being much slower in the second period.

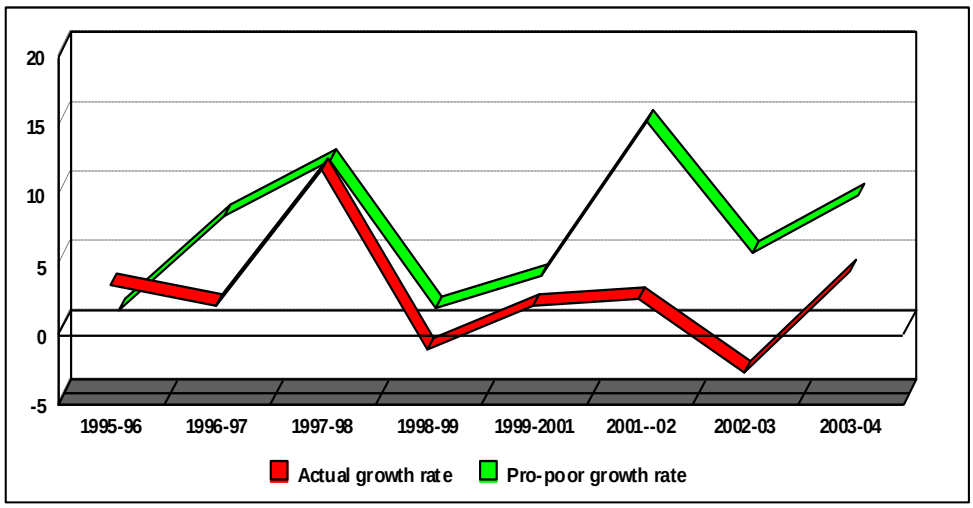
In view of the pro-poor growth, the non-labour income performed even better than the actual growth. Interestingly, when the non-labour income is adjusted for inequality, the growth rate becomes much higher for the second period than for the first period. This is suggested by the fact that the annual pro-poor growth rates are 5.20 and 9.14 percent for 1995-2001 and 2001-2004, respectively. Hence, the growth in non-labour income was much more pro-poor in the period of 2001-2004. More importantly, the high pro-poorness of non-labour income is the factor that underpins the fall in inequality during the second period. It can be seen clearly from Figure 3 that the gap between the pro-poor growth rate and the actual growth rate widened in the second period compared to the first period.

Table 4: Growth rates of per capita non-labour income

Period	Actual growth rate	Pro-poor growth rate	Gain(+)/loss(-) of growth
1995-96	3.56	0.95	-2.61
1996-97	2.10	7.63	5.53
1997-98	11.77	11.66	-0.11
1998-99	-1.13	1.01	2.14
1999-2001	2.09	3.42	1.33
2001-2002	2.51	14.53	12.02
2002-2003	-2.69	5.06	7.76
2003-2004	4.48	9.18	4.71
1995-2004	**2.64**	**6.30**	**3.66**
1995-2001	**3.69**	**5.20**	**1.51**
2001-2004	**1.02**	**9.14**	**8.12**

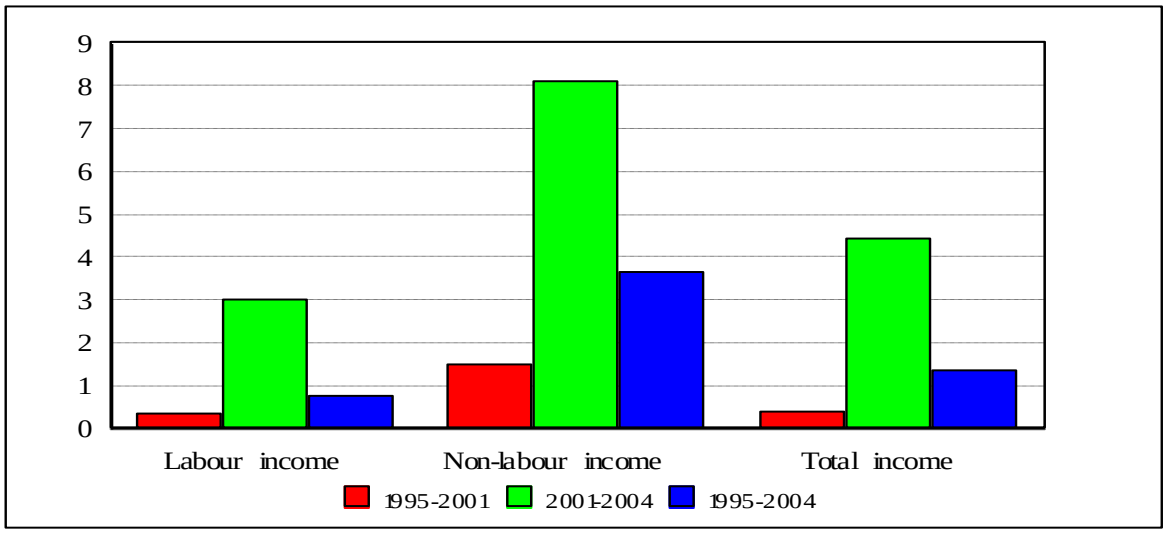
Source: authors' calculation based on PNAD.

Figure 3: Actual and pro-poor growth rates of per capita non-labour income



In summary, growth in total income is much more pro-poor in the second period than in the first period. This is due mainly to the non-labour income that benefited the poor proportionally more than the non-poor. Compared to the non-labour income, the pro-poorness of the labour income was rather small over the period. Figure 4 sums up these findings.

Figure 4: Gains and losses of growth rates



7. LINKAGES BETWEEN LABOUR MARKET AND PRO-POOR GROWTH[xii]

Using a decomposition presented in the paper, this section attempts to explain the pro-poor growth in Brazil in terms of the four labor market characteristics, which include the labor force participation rate, the employment rate, hours of work per employed person, and productivity. The impact of labor productivity is further explained by years of schooling and average and relative rates of returns. The decomposition results are presented in Tables 5-7.

Table 5: Explaining growth rates of per capita real income

Explanatory factors	1995-2004	1995-2001	2001-2004	2003-04
Labour force participation rate	0.73	0.48	1.27	1.06
Employment rate	-0.34	-0.66	0.07	0.79
Hours of work per person employed	-0.25	-0.07	-0.72	-0.43
Productivity	-1.63	-1.05	-2.67	1.86
- Years of schooling	2.99	2.34	4.04	4.49
- Average rate of returns per year of schooling	-4.62	-3.38	-6.71	-2.63
- Relative rate of returns per year of schooling	-0.00	0.00	0.00	-0.00
Total labour income	-1.49	-1.30	-2.05	3.28

Source: authors' calculation based on PNAD

The per capita labour income declined at an annual rate of 1.49 percent in the entire period from 1995 to 2004. The employment rate and hours of work contributed to a decline in growth rate by 0.34 and 0.25 percent, respectively. The decline in productivity was the major factor that contributed to a decline of growth rate of 1.63 percent. Despite the weak labour

market, the labour force participation rate increased at an annual rate of 0.73 percent, which made a positive contribution to growth of the same magnitude.

It is also evident that the work force in Brazil is getting more educated. The years of schooling of the labour force increased at an annual rate of 2.99 percent during the 1995-04 period, which contributed to an increase in productivity at the same rate (2.99 percent). The expansion of education has been accompanied by a decline in the average rates of return from schooling at an annual rate of 4.62 percent. This suggests that the demand in the labour market has been sluggish and that growth in wage rates has not kept up with the supply of workers with more years of schooling.

A similar story emerges when one looks at the sub periods: 1995-01 and 2001-04. However, the story changes one looks at the changes that occurred during 2003-04, when the per capita labor income increased by 3.28 percent. Again, productivity was the major factor contributing to the growth, but in this case, it contributed a positive rate of 1.86 percent. The labour force participation rate increased by 1.06 percent, while the employment rate increased by 0.79 percent. This implies that the per capita employment rate (i.e. the sum of the labour force participation rate and the employment rate) increased by 1.85 percent. These observations show that the labor market turned around very strongly in the 2003-04 period. The rate of return from schooling declined at a much slower rate of only 2.63 percent, despite the fact that the years of schooling of the work force increased at a faster rate of 4.49 percent.

Table 6: Explaining pro-poor growth rate of money-metric social welfare

Explanatory factors	1995-2004	1995-2001	2001-2004	2003-04
Labour force participation rate	0.41	0.19	1.24	2.69
Employment rate	-0.68	-1.14	0.17	2.35
Hours of work per person employed	-0.41	-0.21	-1.01	0.44
Productivity	-0.05	0.18	0.56	10.76
- Years of schooling	3.95	2.80	6.47	7.54
- Average rate of returns per year of schooling	-4.62	-3.38	-6.71	-2.63
- Relative rate of returns per year of schooling	0.61	0.77	0.81	5.85
Total labour income	-0.73	-0.97	0.97	16.24

Source: authors' calculation based on PNAD

Table 6 presents the growth rates of money metric social welfare. The growth rate of per capita social welfare was -0.97 percent in the first period (1995-01), but increased to 0.97 in the second period (2001-02). The factors that were contributing positively to growth in the second period are labour force participation rate, employment rate and productivity. The productivity growth rate of 0.56 percent is further decomposed into three factors: (i) years of schooling, which contributed to an increase in the growth rate of productivity by 6.47 percentage points; (ii) average rate of return, which contributed to a decline in productivity by 6.71 percentage points; and (iii) relative rate of return, which contributed to an increase in the growth rate of productivity by 0.81 percentage points.

Different households enjoy different rates of return from per year of schooling. These differences may be caused by a host of variables including age and gender of earners in the household, number of earners in the household, sectors of employment by workers in the household, educational levels of working members, and so on. Thus, relative rates of returns will also change due to a multitude of factors. The changes in relative rates of return will not affect the growth rate of the mean labour income, but they will affect the social welfare, which is sensitive to changes in relative distribution. The empirical results show that the changes in relative rates of return have contributed to the increase in the growth rate of social welfare by 0.81 percentage points. This is a small contribution compared to the decline in welfare that is caused by the average rate of return from schooling.

Table 7 presents gains (and losses) of growth rates due to pro-poor (and anti-poor) growth. The labour income became highly pro-poor in the 2001-04 period, contributing to gains in the growth rate of 3.02 percent. In 2003-04, the gain in growth rate increased to 12.97 percent, which indicates a large reduction in inequality. Thus, the Brazilian labour market became highly pro-poor in 2003-04. Productivity was the most important factor contributing to gains in the growth rate of 8.9 percent. Schooling contributed to gains in the growth rate of about 3 percent points. The relative rates of returns from schooling became highly favourable to the poor, contributing to gains in the growth rate of 5.85 percent points.

Table 7: Explaining gains and losses in growth rates

Explanatory factors	1995-2004	1995-2001	2001-2004	2003-04
Labour force participation rate	-0.32	-0.29	-0.03	1.63
Employment rate	-0.34	-0.48	0.11	1.56
Hours of work per person employed	-0.17	-0.14	-0.29	0.87
Productivity	1.58	1.23	3.23	8.90
- Years of schooling	0.97	0.46	2.43	3.05
- Average rate of returns per year of schooling	0.00	0.00	0.00	0.00
- Relative rate of returns per year of schooling	0.61	0.77	0.81	5.85
Labour income	0.76	0.32	3.02	12.97

Source: authors' calculation based on PNAD

Apart from productivity, the other labour market characteristics such as the labour force participation rate, the employment rate, and work hours per employed person also contributed to a large reduction in inequality during 2001-04.

8. CONTRIBUTION OF LABOUR AND NON-LABOUR INCOMES TO PRO-POOR GROWTH

The previous section explained the growth rate in labor income in terms of labor market characteristics. This section attempts to explain the contributions of both labor and non-labor incomes to the pro-poor growth rate of per capita income. As pointed out earlier, for the 1995-2004 period, the average growth rate of the total income was -0.63 percent per annum, while labor income grew at an average rate of -1.49 percent, and non-labor income grew at an average rate of 2.64 per annum. However, in order to see the contribution of different income sources to total income - as we have done for the labour market components - it is not sufficient to gauge the growth rates of different component ratios; it is also necessary to take into account the relative weights of each income source in total income. This point also applies to pro-poor growth and to the inequality aspects of social welfare. The interaction between the high non-linearity of these last two concepts and the additive nature of income sources create some difficulties. As a result, Shapley decomposition was used to obtain each income source contribution to pro-poor growth. In general, the contribution of a given source to the total growth of a particular social welfare concept is positively related to its initial weight and to its relative rate of growth in the same period. In Table 8 presents the rates of growth and the contributions of the labor and non-labor income components to the growth rate of total income.

In 1995, labour income amounted to 82.1 percent of total income, while the remaining 17.9 percent referred to non-labour. However, the main sources of growth, and in particular pro-poor growth sources, relied on the latter. As shown in Table 8, the fall of total income of -0.63 percent per year in the overall 1995-2004 period can be decomposed into the adverse labor income contribution of -1.17 percent per year and the contribution of non-labor income of 0.54 percent per year.

Table 8: Growth rates and contributions to growth rates by income components

Period	Growth rates			Contributions to growth rates		
	Labour income	Non-labour income	Total income	Labour Income	Non-labour income	Total income
Actual growth						
1995-2004	-1.49	2.64	-0.63	-1.17	0.54	-0.63
1995-2001	-1.30	3.69	-0.30	-1.02	0.72	-0.30
2001-2004	-2.05	1.02	-1.35	-1.59	0.24	-1.35
Pro-poor growth						
1995-2004	-0.73	6.30	0.73	-0.60	1.33	0.73
1995-2001	-0.97	5.20	0.10	-0.74	0.84	0.10
2001-2004	0.97	9.14	3.07	0.61	2.46	3.07
Inequality						
1995-2004	0.76	3.66	1.36	0.57	0.79	1.36
1995-2001	0.32	1.51	0.40	0.28	0.12	0.40
2001-2004	3.02	8.12	4.42	2.20	2.22	4.42

Source: authors' calculation based on PNAD

In turn, differences in pro-poor average annual growth rates are somewhat smaller as can be seen from Table 8: total social welfare increased 0.73 percent; labor income declined by 0.73 percent and non-labor income increased by 6.30 percent. The weight of labour income in social welfare in the initial period 1995 was 83.9 percent, which is even higher than in the case of average total incomes. Its contribution to total social welfare growth in the whole period was -0.60 percent per annum, i.e. about half of its contribution to average income growth. Conversely, non-labour income's share of the social welfare growth was 1.33 percent per year, making it an important factor in determining the positive social welfare trend assumed in the 1995-2004 period.

Focusing on individual periods, the contribution of labour income to average annual growth changed from -1.02 percent in 1995-2001 to -1.59 percent in 2001-04. The track record of

labour income's contribution to pro-poor growth is better than its contribution to growth per se: -0.74 percent in 1995-2001 and 0.61 percent in 2001-04. Likewise, non-labour's income share of pro-poor growth also surpasses its effects on average income growth in both periods. Note that from 1995 to 2001, non-labour's income impact on pro-poor growth rose from 0.84 percent per year to 2.46 percent per year in the 2001-2004 period.

Both labour and non-labour incomes have contributed to a decline in total inequality. During the 1995-2001 period, it was the labour income that had a higher contribution to the inequality reduction: 0.28 and 0.12 percent due to the labour and non-labour income, respectively. In total, the reduction in inequality amounts to a gain in growth rate by only 0.40 percent. In the second period (2001-04), the gain in growth rate due to a fall in inequality was 4.42 percent, which is substantially greater than the corresponding figure for the first period (1995-2001). Of the gain of 4.42 percent, 2.20 percent was contributed by the labour income and 2.22 percent by the non-labour income. Thus, the contribution of non-labour income to the inequality reduction was slightly higher than that of labour income, despite the fact that the share of labour in total income was much higher than that of non-labour income. This suggests that the non-labour income has been more pro-poor than the labour income in the second period.

9. DECOMPOSING THE CONTRIBUTION OF NON-LABOUR INCOMES

This section aims to assess the contribution of different types of non-labour income sources to the total growth of different welfare concepts, through a decomposition scheme of these income sources impacts.

Special attention is paid to incomes mostly directly affected by social policies, such as social security benefits and other non-labour income sources that include cash transfers from social programs and capital income - which turns out to be underestimated in PNAD data. The remaining sources of non-labour income such as rents and private transfers (remittances, donations, child maintenance support, etc) are part of what is called non-social income.

Table 9: Growth rates by non-labour components

Period	Labour income	Non-labour income			Total income
		Social security	Other non-labour	Non-social income	
Actual growth					
1995-2004	-1.49	3.25	5.77	-2.43	-0.63
1995-2001	-1.30	4.69	0.73	-1.23	-0.30
2001-2004	-2.05	0.86	13.26	-3.69	-1.35
Pro-poor growth					
1995-2004	-0.73	3.12	29.94	1.43	0.73
1995-2001	-0.97	2.56	25.50	4.41	0.10
2001-2004	0.97	3.90	35.21	-1.97	3.07
Inequality					
1995-2004	0.76	-0.13	24.17	3.86	1.36
1995-2001	0.32	-2.13	24.77	5.64	0.40
2001-2004	3.02	3.04	21.94	1.72	4.42

Source: authors' calculation based on PNAD

Table 9 presents trends in growth rates by non-labor income components. The results reveal that while social security has contributed to a rise in inequality during the 1995-2004 period, the others – including other non-labour income and non-social income – have been attributed to a fall in inequality during the same period. Interestingly, in the 2001-04 period, all three non-labour income components made a positive contribution to the reduction in inequality.

Table 10 explains the net contributions of each non-labour income component to growth patterns and inequality reduction. The results are obtained from the Shapley decomposition method. According to the table, other non-labour income has been the dominant net contributor to a reduction in inequality over the decade 1995-2004. Its net contribution is particularly high in the latter period 2001-04. While non-social income appears to play a smaller role in reducing inequality, the net impact of social security has been quite important. During the first period (1995-2001), the net effect of social security resulted in an increase in inequality. Its net contribution on inequality was greater than the net contributions by the other two components. Nevertheless, the sum of the net contributions by the other two sources had offset the net contribution by social security. As a result, inequality of the non-labour income in the first period showed a slight fall of 0.12 percent.

Table 10: Explaining contributions of growth rates by non-labour income components (based on Shapely decomposition)

Period	Labour income	Non-labour income			Total income
		Social security	Other non-labour	Non-social income	
Actual growth					
1995-2004	-1.17	0.54	0.06	-0.07	-0.63
1995-2001	-1.02	0.75	0.01	-0.04	-0.30
2001-2004	-1.59	0.17	0.16	-0.10	-1.35
Pro-poor growth					
1995-2004	-0.60	0.40	0.88	0.04	0.73
1995-2001	-0.74	0.34	0.38	0.12	0.10
2001-2004	0.61	0.48	2.00	-0.03	3.07
Inequality					
1995-2004	0.57	-0.14	0.82	0.11	1.36
1995-2001	0.28	-0.41	0.37	0.16	0.40
2001-2004	2.20	0.31	1.84	0.07	4.42

Source: authors' calculation based on PNAD

9.1 Non-Social Income

Non-social income fell at an average rate of -2.43 percent per year in the 1995-2004 period, but it had a sharper decrease in the second period (-3.69 percent) than the rate of -1.23 percent per year observed in the first period (Table 14). In spite of the negative growth, non-social income contributed to a fall in inequality over the decade. Its effect on the inequality reduction had been much greater in the first period as compared to the second period; 5.64 percent (in 1995-2001) against 1.72 percent (in 2001-04).

Nevertheless, the net contribution of non-social income to overall growth performance was rather small given its growth rates. As shown in Table 10, the net effect of non-social income on inequality reduction was just 0.11 percent between 1995-2004; its magnitude fell to 0.07 percent in the 2001-04 periods from 0.16 percent in the 1995-2001 periods.

9.2 Social Security Benefits

Social security is the main component of social income in Brazil, second only to labour earnings among all income sources collected by PNAD. In 2004, it amounted to 19.55 percent of all income sources and 92.5 percent of social income. Social security benefits information includes a contributory Pay-as-You-Go system and non-contributory benefits, both of which are subject to discretionary income policies from the government. The average growth rate of per capita social security benefits was 3.25 percent per year from 1995 to 2004 (Table 14). The average growth rate of social security in the first period was much higher than in the second period, 4.69 percent against 0.86 percent. However, rapid growth in social security has resulted in an increase in inequality in Brazil over the 1995-2004 period. Its adverse impact amounted to an increase of inequality of 2.13 percent in the first period. Yet the impact of social security income on inequality was reversed when its growth slowed down: it led to a reduction in inequality of 3.04 percent in the second period. A similar story emerges from the results reported in Table 10.

Given the dominance of the public transfer aspect in this income aggregate, it is useful to observe the ratio of pro-poor growth to total growth contribution. This can be interpreted as an elasticity that shows how many public resources (measured by their share of total income) are translated into social welfare, a type of cost-benefit analysis. The corresponding elasticity of pro-poor growth with respect to total growth (i.e. its fiscal cost), both explained by social security, rose from 0.45 in the 1995-2001 period to 2.82 in 2001-2004, demonstrating a marked improvement in the ability of social security benefits in targeting the poorest segments of Brazilian society.[xiii] After 1998, the government adopted the new policy of setting higher adjustment rates to lower social security benefits. In the entire 1995-2004 period, this elasticity amounted to 0.74. This elasticity allows comparing to what extent different types of public transfers reach the poor.

9.3 Other Non-labour Income

Other non-labour income sources include very different types of incomes, ranging from cash transfer programs such as the *Bolsa-Família* to capital income such as flows derived from interest rates paid on government debt. The pro-poorness aspects of these items are expected

to be very different, despite the fact that both are not only subject to public policy choices but are mostly mediated by the State[xiv] as well. Interest income is largely underestimated by PNAD data, hence this income concept is largely explained by public cash transfer programmes such as *Bolsa-Família*.

According to Table 9, the other sources of non-labour income aggregate have grown at an annual rate of 5.77 percent in the whole period from 1995 to 2004, presenting very diverse patterns across sub-periods. They increased, on average, 0.73 percent in the first period 1995-2001, but this growth accelerated considerably in the 2001-2004 period to 13.26 percent, reflecting the expansion of the conditional cash transfer programmes.

Table 9 also assesses the impact of other non-labour income source on inequality reduction. This income source has attributed to gain in growth rate of 24.17 percent per year in the 1995-2004 period. This is due to a huge reduction in inequality, which can be explained by the fact that cash transfers were targeted to the poorest sectors of the population. The magnitude of inequality reduction of this income component reduced to some extent in the subsequent period as is indicated by falling the magnitude of gain in growth rate from 24.77 percent in the 1995-2001 period to 21.95 percent in the 2001-2004 period. This suggests that the impact of cash transfers became slightly less pro-poor in the second period.
As we have seen, to measure the contribution of the expansion of cash transfer programmes from 2001 onwards, it is not sufficient to gauge its relatively high growth rates. Instead, its relative weight among different non-labour income sources must also be considered. In Table 10, the net contribution of other non-labour income to total growth per year during the 1995-2004, 1995-2001, and 2001-2004 periods was 0.06, 0.01, and 0.16, respectively. This means that the role of cash transfers to explain income growth is quite small. But by the same token, the impacts of other income sources on the fiscal budget deficit were also relatively mild.

According to Table 10, the net contribution of other non-labour income source to inequality reduction outweighs the contributions made by the other two income components. In the overall 1995-2004 period, it was responsible for 0.82 percent of the fall in inequality. Similarly, its net contribution was 0.37 percent of the fall in inequality in the 1995-2001 period, and then increased to 1.84 percent of the inequality fall. This indicates that other non-labour income sources constitute a key determinant of the reduction in inequality in Brazil over the period.

The elasticity of the contribution to pro-poor growth of a particular income transfer with respect to its contribution to total growth is useful to guide policies aimed at the poorest groups in the Brazilian society. The corresponding other non-labour income sources elasticity was 14.66 during the 1995-2004 period, which is much higher than the one found for social security benefits. Each percentage point in the share of government transfers in this item bought 19.8 times more pro poor growth in other non-labour income than in social security benefits, this result is consistent with the evaluation of conditional cash transfers done in Brazil and elsewhere (Lindert et al. 2005, Barros 2005, Hoffman 2005, Soares 2006, Bourguignon et al. 2003, Skoufias et al. 2001, Coady et al. 2004, Suplicy 2002).[xv]

In sum, other non-labour income sources have played a dominant role in achieving the pro-poor pattern of growth in Brazil, while having a minor contribution to total growth and to the Brazilian fiscal accounts. It seems that government cash transfers programmes are so well targeted that even with relatively small costs they had a large impact on the poor people's living conditions.

10. CONCLUSIONS

This paper makes two important contributions to the literature. One contribution is its proposal for a new measure of pro-poor growth. This new measure provides the linkage between growth rates in the mean income and income inequality. In this sense, growth is defined as pro-poor (or anti-poor) if there is a gain (or loss) in growth rate due to a decrease (or increase) in inequality. The other contribution is to develop a decomposition methodology exploring linkages between three dimensions; growth patterns, labour market performances, and social policies. Through this decomposition, the growth in per capita labour income is explained in terms of four components: the employment rate, hours of work in the labour market, the labour force participation rate, and productivity. Using a Shapely decomposition methodology, the paper first assesses the relative contributions of labour and non-labour incomes to pro-poor pattern of growth in per capita income. The non-labour income consists of social and non-social incomes so the paper demonstrates how the Shapely decomposition can be utilized to capture the contributions of social security income and governments

targeted cash transfers on the pro-poor patterns of growth.

For empirical analysis, the study has used the Brazilian National Household Survey (PNAD) from 1995 to 2004. The paper has analyzed the evolution of Brazilian social indicators based on per capita income exploring links with adverse labour market performance and social policy changes, in particular the expansion of targeted cash transfers and devising more pro-poor social security benefits. The description of these social indicators depends on two main dimensions: i) who was affected by shocks perceived in the labour market and changes observed in social policies? In particular, to what extent did these innovations affect the poorest segments of the Brazilian society more?; and ii) to what extent did the crisis affect labour income vs. other income sources such as official cash transfers, social security benefits or private incomes?

The general answer to these questions is that the labour earnings of the upper segments of Brazilian society were the epicentre of the economic crisis. Although per capita income fell during the 1995-2004 period, it cannot be referred to as a 'poverty crisis'. While labour markets were quite adversely affected, incomes derived from social security and other government transfers played a crucial role in cushioning the consequences of macro shocks observed, specifically among the poorest segments of Brazilian society.

While globalization can make a significant contribution to productivity increase and hence economic growth, but it also makes economies more vulnerable to external shocks. The Brazilian experience presented in the paper shows that government social policies can play an important role in protecting the poor from external shocks which otherwise can have a devastating impact on the living conditions of the poor.

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Appendix 1: Alternative Methodology to Decompose Productivity

Schooling is a major factor that has an impact on productivity. It is generally true that the higher the level of schooling an individual possesses, the greater is his/her productivity (or labour earnings per hour). The relationship between productivity and schooling is not exact. There can be many unexplained factors that have an impact on productivity. A household consists of working and non-working members. Schooling of non-working members may not be relevant to explaining labour productivity in the household. Hence we account for per capita years of schooling of only working members within household. Suppose s^* is the per capita years of schooling of the working members in household. Using this variable, we fit the following regression model that explains productivity:

$$log(\xi) = \alpha + \beta_1 log(s^*) + \beta_2 log(s^*)^2 + log(u) \quad \text{(A1)}$$

where u is the error term which represents the aggregate impact of omitted variables from the model. Note that this regression equation can be estimated at household level using the weighted least squares method with weights being equal to population households represented by each sample household in the survey. Suppose $\hat{\alpha}$, $\hat{\beta}_1$ and $\hat{\beta}_2$ are the estimates of the model, which on substituting in (A1) gives

$$log(\xi) = log(\hat{\xi}_s) + log(\hat{u}) \quad \text{(A2)}$$

where

$$log(\hat{\xi}_s) = \hat{\alpha} + \hat{\beta}_1 log(s^*) + \hat{\beta}_2 log(s^*)^2 \text{ and } log(\hat{u}) = log(\xi) - log(\hat{\xi}_s).$$

Using (A2), we can write the growth rates and the pro-poor growth rates in productivity in an additive fashion as

$$\gamma(\xi) = \gamma(\hat{\xi}_s) + \gamma(\hat{u}) \quad \text{(A3)}$$

and

$$\gamma^*(\xi) = \gamma^*(\hat{\xi}_s) + \gamma^*(\hat{u}) \quad \text{(A4)}$$

which show that growth rates in productivity can be decomposed as the sum of two components: the first component is the impact of schooling and the second component is the

aggregate effect of all the unexplained factors.

Subtracting (A3) from (A4) gives

$$g^*(\xi) = g^*(\hat{\xi}_s) + g^*(\hat{u}) \qquad \text{(A5)}$$

This equation provides the contributions of schooling and other unexplained variables to the growth rate of inequality in productivity. If, for instance, $g^*(\xi_s)$ is positive (or negative), this means that changes in schooling contribute to a decrease (or increase) in inequality in per capita income. Schooling can impact inequality in productivity through two factors. The first factor is the change in inequality of years of schooling and the second factor relates to returns from education. The first component in (A6) is the total effects of both factors.

There could be various factors that have impacts on productivity. These factors might include years of schooling, returns to schooling, gender, experience, and so forth. In this study, we particularly look into years of schooling and returns to schooling. According to our regression analysis, the years of schooling are able to explain per capita productivity by almost 93-95 percent: R-square of the regression model varies between 0.93 and 0.95. This suggests that the years of schooling could be a prime factor that explains per capita productivity.

Table A1 examines growth rates of years of schooling over the period with which we are concerned. Note that the number of years of schooling differ from one household to another as they are adjusted for household size. In the table per capita years of schooling are presented for both all members and only working members within household. From the results we find an overall increase in years of schooling but a higher increase for the poor. As a result, more years of schooling have contributed to a fall in inequality of years of schooling over the period, which is sharper in the second period, 2001-04. The pro-poorness of schooling is far greater in the second period compared to the first period. In addition, the results highlight that the degree of pro-poorness of schooling of working members is higher than that of all members within household.

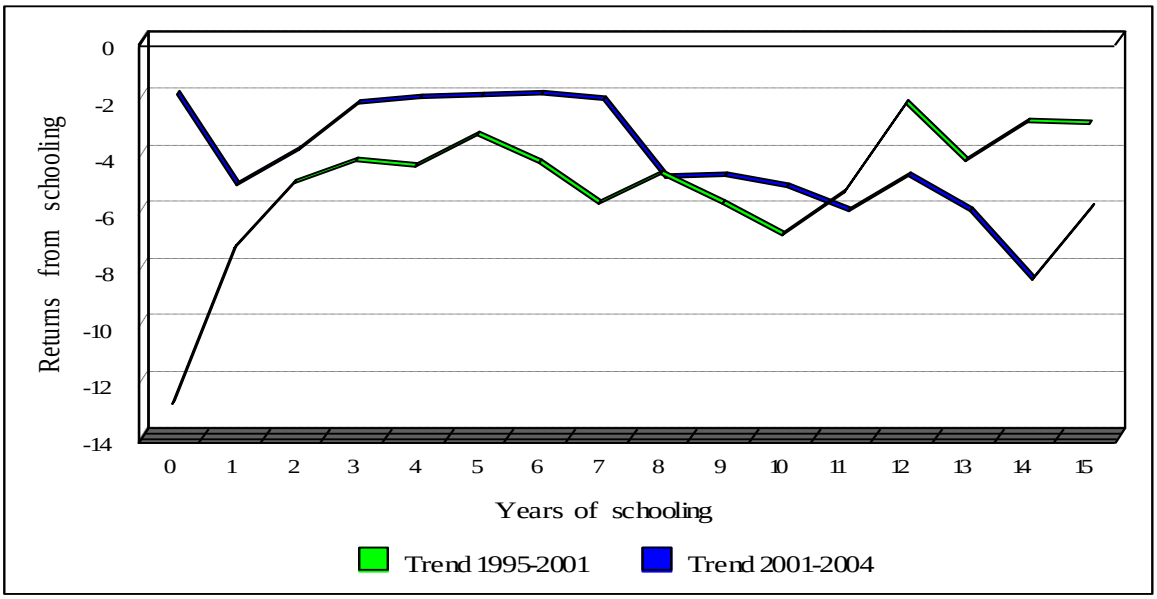
Table A1: Growth rates of per capita years of schooling

	All members			Working members		
Period	Actual growth rate	Pro-poor growth rate	Gain(+)/loss(-) of growth	Actual growth rate	Pro-poor growth rate	Gain(+)/loss(-) of growth
1995-96	5.28	7.97	2.68	1.09	-1.30	-2.38
1996-97	1.73	1.53	-0.20	2.03	2.52	0.49
1997-98	3.80	5.15	1.35	2.26	4.49	2.24
1998-99	2.93	5.57	2.63	2.53	4.68	2.15
1999-2001	2.55	3.67	1.12	2.96	2.03	-0.93
2001-2002	3.71	5.48	1.77	5.25	8.75	3.50
2002-2003	3.24	8.13	4.89	2.81	3.96	1.16
2003-2004	2.54	0.65	-1.89	4.49	7.54	3.05
1995-2004	**3.05**	**4.66**	**1.61**	**2.99**	**3.95**	**0.97**
1995-2001	**3.05**	**4.46**	**1.41**	**2.34**	**2.80**	**0.46**
2001-2004	**3.17**	**5.09**	**1.92**	**4.04**	**6.47**	**2.43**

Source: authors' calculation

The impact of schooling on changes in inequality can be explained by two factors. One is changes in inequality of years of schooling and the other is changes in returns from schooling. As we have observed earlier, schooling has become more equal across the population in Brazil. This in turn has contributed to a reduction in inequality: the higher level of education, the greater earnings per hour. However, rates of return from education also change over time. In this context, we look at the returns to each year of schooling in Brazil over 1995-2004. Figure A2 presents the trends in the returns from schooling over two periods, 1995-2001 and 2001-2004. The results show that educational returns have declined at all levels. It is evident that across educational levels, the curve of returns has an upward sloping in the first period but a downward sloping in the second period. This suggests that the gap in educational returns widened in the first period but narrowed in the second period. While the widening gap indicates an increasing inequality, the narrowing gap implies a fall in inequality. Therefore, a sharp decline in inequality over the 2001-04 period is mainly due to the gap in educational returns that has narrowed over the period between higher and lower levels.

Figure A1: Returns from schooling



Appendix 2: Shapely Decomposition to Explain Contributions of Income Components for Pro-Poor Growth

Suppose there are four income components which include:

X_{1t}: Per capita labour income at year t
$X_{2t:}$ Per capita social security income at year t
X_{3t}: Per capita cash transfers at year t
X_{4t}: Per capita non-social income at year t

Total per capita income at year t is thus the sum of the four individual income components. Thus we can write

$$X_t = X_{1t} + X_{2t} + X_{3t} + X_{4t}$$

Suppose $\log(x^*(X_t))$ is the logarithm of social welfare at year t calculated on the basis of total per capita income X_t, which can be calculated from equation (14). Then the growth rate of social welfare at year t is given by

$$\gamma_t^* = \log(x^*(X_t)) - \log(x^*(X_{t-1})) \qquad \text{(A.1)}$$

The Shapely decomposition can be used to calculate the contribution of each income component to the growth rate of social welfare of the total per capita income X_t as

$$\gamma_t^* = \gamma_t^*(C_1) + \gamma_t^*(C_2) + \gamma_t^*(C_3) + \gamma_t^*(C_4) \qquad \text{(A.2)}$$

where , $\gamma_t^*(C_i)$,where *i* varies from 1 to 4, is the contribution of the ith income component to the growth rate of total welfare. Thus (A.1) is the proposed decomposition method which can be used to analyze the net contribution of each income component to the growth rate of welfare. This equation can also be utilized to analyze the contributions of each income component to growth in total inequality. Using the Shapely decomposition, we can write the net contribution of each income component to the growth rate of total welfare as follows:

$$\gamma_t^*(C_1)=\frac{6}{24}\left[\log x^*\left(X_{1t}+X_{2t}+X_{3t}+X_{4t}\right)-\log x^*\left(X_{1t-1}+X_{2t}+X_{3t}+X_{4t}\right)\right]$$
$$+\frac{2}{24}\left[\log x^*\left(X_{1t}+X_{2t-1}+X_{3t}+X_{4t}\right)-\log x^*\left(X_{1t-1}+X_{2t-1}+X_{3t}+X_{4t}\right)\right]$$
$$+\frac{2}{24}\left[\log x^*\left(X_{1t}+X_{2t}+X_{3t-1}+X_{4t}\right)-\log x^*\left(X_{1t-1}+X_{2t}+X_{3t-1}+X_{4t}\right)\right]$$
$$+\frac{2}{24}\left[\log x^*\left(X_{1t}+X_{2t}+X_{3t}+X_{4t-1}\right)-\log x^*\left(X_{1t-1}+X_{2t}+X_{3t}+X_{4t-1}\right)\right]$$
$$+\frac{2}{24}\left[\log x^*\left(X_{1t}+X_{2t-1}+X_{3t-1}+X_{4t}\right)-\log x^*\left(X_{1t-1}+X_{2t-1}+X_{3t-1}+X_{4t}\right)\right]$$
$$+\frac{2}{24}\left[\log x^*\left(X_{1t}+X_{2t-1}+X_{3t}+X_{4t-1}\right)-\log x^*\left(X_{1t-1}+X_{2t-1}+X_{3t}+X_{4t-1}\right)\right]$$
$$+\frac{2}{24}\left[\log x^*\left(X_{1t}+X_{2t}+X_{3t-1}+X_{4t-1}\right)-\log x^*\left(X_{1t-1}+X_{2t}+X_{3t-1}+X_{4t-1}\right)\right]$$
$$+\frac{6}{24}\left[\log x^*\left(X_{1t}+X_{2t-1}+X_{3t-1}+X_{4t-1}\right)-\log x^*\left(X_{1t-1}+X_{2t-1}+X_{3t-1}+X_{4t-1}\right)\right]$$

$$\gamma_t^*(C_2)=\frac{6}{24}\left[\log x^*\left(X_{1t}+X_{2t}+X_{3t}+X_{4t}\right)-\log x^*\left(X_{1t}+X_{2t-1}+X_{3t}+X_{4t}\right)\right]$$
$$+\frac{2}{24}\left[\log x^*\left(X_{1t-1}+X_{2t}+X_{3t}+X_{4t}\right)-\log x^*\left(X_{1t-1}+X_{2t-1}+X_{3t}+X_{4t}\right)\right]$$
$$+\frac{2}{24}\left[\log x^*\left(X_{1t}+X_{2t}+X_{3t-1}+X_{4t}\right)-\log x^*\left(X_{1t}+X_{2t-1}+X_{3t-1}+X_{4t}\right)\right]$$
$$+\frac{2}{24}\left[\log x^*\left(X_{1t}+X_{2t}+X_{3t}+X_{4t-1}\right)-\log x^*\left(X_{1t}+X_{2t-1}+X_{3t}+X_{4t-1}\right)\right]$$
$$+\frac{2}{24}\left[\log x^*\left(X_{1t}+X_{2t}+X_{3t-1}+X_{4t-1}\right)-\log x^*\left(X_{1t}+X_{2t-1}+X_{3t-1}+X_{4t-1}\right)\right]$$
$$+\frac{2}{24}\left[\log x^*\left(X_{1t-1}+X_{2t}+X_{3t}+X_{4t-1}\right)-\log x^*\left(X_{1t-1}+X_{2t-1}+X_{3t}+X_{4t-1}\right)\right]$$
$$+\frac{2}{24}\left[\log x^*\left(X_{1t-1}+X_{2t-1}+X_{3t}+X_{4t}\right)-\log x^*\left(X_{1t-1}+X_{2t-1}+X_{3t-1}+X_{4t}\right)\right]$$
$$+\frac{6}{24}\left[\log x^*\left(X_{1t-1}+X_{2t}+X_{3t-1}+X_{4t-1}\right)-\log x^*\left(X_{1t-1}+X_{2t-1}+X_{3t-1}+X_{4t-1}\right)\right]$$

$$\gamma_t^*(C_3)=\frac{6}{24}\left[\log x^*\left(X_{1t}+X_{2t}+X_{3t}+X_{4t}\right)-\log x^*\left(X_{1t}+X_{2t}+X_{3t-1}+X_{4t}\right)\right]$$
$$+\frac{2}{24}\left[\log x^*\left(X_{1t-1}+X_{2t}+X_{3t}+X_{4t}\right)-\log x^*\left(X_{1t-1}+X_{2t}+X_{3t-1}+X_{4t}\right)\right]$$
$$+\frac{2}{24}\left[\log x^*\left(X_{1t}+X_{2t-1}+X_{3t}+X_{4t}\right)-\log x^*\left(X_{1t}+X_{2t-1}+X_{3t-1}+X_{4t}\right)\right]$$
$$+\frac{2}{24}\left[\log x^*\left(X_{1t}+X_{2t}+X_{3t}+X_{4t-1}\right)-\log x^*\left(X_{1t}+X_{2t}+X_{3t-1}+X_{4t-1}\right)\right]$$

$$+\frac{2}{24}\left[\log x^*\left(X_{1t-1}+X_{2t-1}+X_{3t}+X_{4t}\right)-\log x^*\left(X_{1t-1}+X_{2t-1}+X_{3t-1}+X_{4t}\right)\right]$$
$$+\frac{2}{24}\left[\log x^*\left(X_{1t-1}+X_{2t}+X_{3t}+X_{4t-1}\right)-\log x^*\left(X_{1t-1}+X_{2t}+X_{3t-1}+X_{4t-1}\right)\right]$$
$$+\frac{2}{24}\left[\log x^*\left(X_{1t}+X_{2t-1}+X_{3t}+X_{4t-1}\right)-\log x^*\left(X_{1t}+X_{2t-1}+X_{3t-1}+X_{4t-1}\right)\right]$$
$$+\frac{6}{24}\left[\log x^*\left(X_{1t-1}+X_{2t-1}+X_{3t}+X_{4t-1}\right)-\log x^*\left(X_{1t-1}+X_{2t-1}+X_{3t-1}+X_{4t-1}\right)\right]$$

$$\gamma_t^*(C_4)=\frac{6}{24}\left[\log x^*\left(X_{1t}+X_{2t}+X_{3t}+X_{4t}\right)-\log x^*\left(X_{1t}+X_{2t}+X_{3t}+X_{4t-1}\right)\right]$$
$$+\frac{2}{24}\left[\log x^*\left(X_{1t-1}+X_{2t}+X_{3t}+X_{4t}\right)-\log x^*\left(X_{1t-1}+X_{2t}+X_{3t}+X_{4t-1}\right)\right]$$
$$+\frac{2}{24}\left[\log x^*\left(X_{1t}+X_{2t-1}+X_{3t}+X_{4t}\right)-\log x^*\left(X_{1t}+X_{2t-1}+X_{3t}+X_{4t-1}\right)\right]$$
$$+\frac{2}{24}\left[\log x^*\left(X_{1t}+X_{2t}+X_{3t-1}+X_{4t}\right)-\log x^*\left(X_{1t}+X_{2t}+X_{3t-1}+X_{4t-1}\right)\right]$$
$$+\frac{2}{24}\left[\log x^*\left(X_{1t-1}+X_{2t-1}+X_{3t}+X_{4t}\right)-\log x^*\left(X_{1t-1}+X_{2t-1}+X_{3t}+X_{4t-1}\right)\right]$$
$$+\frac{2}{24}\left[\log x^*\left(X_{1t-1}+X_{2t}+X_{3t-1}+X_{4t}\right)-\log x^*\left(X_{1t-1}+X_{2t}+X_{3t-1}+X_{4t-1}\right)\right]$$
$$+\frac{2}{24}\left[\log x^*\left(X_{1t}+X_{2t-1}+X_{3t-1}+X_{4t}\right)-\log x^*\left(X_{1t}+X_{2t-1}+X_{3t-1}+X_{4t-1}\right)\right]$$
$$+\frac{6}{24}\left[\log x^*\left(X_{1t-1}+X_{2t-1}+X_{3t-1}+X_{4t}\right)-\log x^*\left(X_{1t-1}+X_{2t-1}+X_{3t-1}+X_{4t-1}\right)\right]$$

Similarly, we can calculate the contribution of each income component to the growth rate of total per capita income:

$$\gamma_t=\gamma_t(C_1)+\gamma_t(C_2)+\gamma_t(C_3)+\gamma_t(C_4) \tag{A.3}$$

Subtracting (A.3) from (A.2) gives the contribution of each income component to the inequality of total per capita income.

$$g_t^*=g_t^*(C_1)+g_t^*(C_2)+g_t^*(C_3)+g_t^*(C_4) \tag{A.4}$$

ENDNOTES

[i]

[ii]. The real income is the nominal income adjusted for prices. The prices can vary across regions and over time. The determination of real income will depend on both regional price indices and consumer prices indices, which vary over time.

[iii] Pro-poor growth can also be defined in a stronger absolute sense: growth is pro-poor if the poor enjoy greater absolute benefits than the non-poor. When growth is negative, growth is absolute pro-poor if the absolute loss from growth is less for the poor than for the non-poor. Absolute pro-poor (anti-poor) growth reduces (increases) absolute inequality. See Grosse, Harttgen and Klasen (2008) and Kakwani and Son (2008) for a detailed discussion of absolute pro-poor growth, see. In this paper, our focus will be on relative pro-poor growth.

[iv] One can also measure the pattern of growth by means of poverty measures instead of a social welfare function. Kakwani and Son (2008) have used the entire class of additive decomposable poverty measures to describe the pattern of growth. Ravallion and Chen (2003) focused on a particular member of this class, i.e. the Watts poverty measure. Thus, the proposed measure of pro-poor growth does not require a poverty line; it is a distribution-weighted growth measure where increases (decreases) in inequality involve loss (gain) in growth rate.

[v]. Note that this weighting scheme is also implicit in the Gini index, which is the most popular measure of inequality.

[vi] See Dasgupta, Sen and Starrett (1973) and Rothschild and Stiglitz (1973).

[vii]. This equation makes a continuity correction, which is estimated by obtaining an unbiased estimate of F(x).

[viii]. Productivity is defined here as labor earning per hour of work. This is a restricted definition and is valid only under the assumption that workers are always and every where paid their marginal product. Although this assumption is not strictly valid, the workers with higher productivity tend to be higher hourly wage rates. Thus, the hourly earnings can be used as proxy for productivity. Moreover, since our purpose is to evaluate the standards of living of households, this restricted definition is more relevant because it is directly related to households' standard of living.

[ix]. Note that the pro-poorness of labor income is measured with respect to the total per capita income.

[x]. A gain in growth rate implies a decrease in inequality and a loss in growth rate indicates an increase in inequality.

[xi]. Changes in relative rates of returns from schooling do not affect the growth rate of productivity but will have an impact on the pro-poor growth rate of productivity through changes in the distribution.

[xii]. Barros and Camargo (1992) and Barros et al. (2004) develop an alternative decomposition methodology also applied to Brazilian data. Amadeo et al. (1993) and Amadeo and Camargo (1997) discuss the characteristics of Brazilian labor markets.

[xiii]. One possibility is to divide the information on social security benefits in two regimes: one with benefits equal to one minimum wage, the constitutional floor, and the rest. Neri (1998, 2001) followed this approach and showed that around 60% of social security benefits amounted to one minimum wage, while 80% of social security income accrued to benefits above this level. Each additional real spent adjusting the social security benefits floor resulted in 4.5 times more poverty reduction than a uniform adjustment for all benefits.

[xiv]. The public debt is the main source of interest gains earned by Brazilian households.

[xv]. The cash transfer elasticity of pro poor growth decreased from 38 in the 1995-2001 period to 12.5 percent in 2001-2004, showing a loss in the pro-poorness of cash transfers but in the last period it is still 4.43 higher than the value the elasticity found for social security benefits.