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FLUCTUATIONS AND PERSISTENCE IN POVERTY: A TRANSIENT-CHRONIC DECOMPOSITION MODEL FOR PSEUDO-PANEL DATA[*]

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ABSTRACT

Although many studies addressed poverty issues, very few of then did analyze the transient or persistent nature of this phenomenon. Encouraged by this lack of dynamic poverty analyses, the objective of this paper is to evaluate which features determine the relative position and the dynamics of the destitution state of the individual. Due to the scarcity of panel surveys in Brazil, it was used a pseudo-panel obtained from the *Pesquisa Nacional por Amostra de Domicílios* (PNAD/IBGE) database in this study. With these data, the state permanence and the state transience probabilities were estimated in a Markov matrix with the application of a bivariate probit model with endogenous switching for grouped data. It was chosen as the welfare indicator the per capita household income, which was analyzed in relation to a relative poverty line. Moreover, in order to verify the sensibility of the parameters estimated in the econometric analysis, distinct poverty lines were used and also different assumptions of household scale economies and of intrahousehold relative costs were made. The transient-chronic analysis is based on the distinction between stationary and transient components of intertemporal propensity to poverty. The results enabled to identify which groups in the population were especially sensitive to the chronic and to the transient types of poverty.

Key Words: Chronic Poverty and Transient Poverty; State Persistence and State Transition; Endogenous Switching Probit Model; Pseudo-panel; Brazil.

JEL Classification: C35, C51, I32

1. INTRODUCTION

Studies on poverty in Latin America have revealed that some specific groups in the population are most likely to be poor, such as: people of African descent, indigenous groups, individuals with low schooling, undocumented workers (specially children and teenagers), families with larger numbers of dependents and headed by individuals with little or no formal education, etc. (IADB, 1998; WORLD BANK, 2003).

As far as Brazil is concerned, poverty is not homogeneously spread throughout its many regions. Independently of the used indicator, the occurrence of poverty is much higher in the North and Northeast regions of the country. Over the past thirty years, also due to rural/urban migration, poverty has increasely become an urban and metropolitan phenomenon, even though it continues to be higher in rural areas. According to Rocha (2003), by the late 1990's, urban poor accounted for 78% of the total in Brazil.

Studies, such as the ones developed by Rocha (2003) and Ferreira *et al.* (2000), which analyzed the poverty profile in Brazil through a static analysis of the family, presented results similar to these mentioned above. Nevertheless, if poverty is also seen as a dynamic phenomenon, this type of analyses provides an incomplete record of its actual incidence in the population. Taking into account that about 35% of the population is currently poor (ROCHA, 2003), we can inquire about for which populational groups poverty is a persistent phenomenon or simply a temporary episode.

The Chronic Poverty Report 2004-05 (CPRC, 2004) indicates that the chronic poor in Brazil, most of which are situated in rural Northeast Region and in shanty towns of large metropolitan areas, tend to be from specific groups in the population, as pointed out above. However, the report also shows that there is not much available information regarding the relationship between chronic poverty and incapabilities.

Encouraged by this lack of studies, the main objective of this article is to identify which are the individual and family aspects that determine the static and the dynamic states of poverty. We intend, thus, to distinguish groups that are characterized by the frequent transition to poverty from those which are persistently or chronically poor. In order to do this, we estimated probabilities of state transition or permanence with the use of a bivariate probit model with endogenous selection.

At a first glance, such an estimative would require panel data. Due to the scarcity of longitudinal data in Brazil[1], we have opted for a pseudo-panel analysis. Even though the *Pesquisa Nacional por Amostra de Domicílios* (PNAD/IBGE) does not enable an individual dynamic analysis, it is possible to construct homogenous social groups and to analyze their behavior throughout time. Consequently, we have used this database from different years: 1993, 1995, 1997, 1999, 2001 and 2003.

In addition to this brief introduction, the article is divided in five other sections. The second one presents a review of the literature that addresses the distinction between chronic and transient poverty. Subsequently, the measures of a minimum standard of well-being that were used in the study are defined. The model specifications are presented in the fourth part, which includes the description

[1] An example of survey done in panel format in Brazil is the *Pesquisa Mensal de Emprego* (PME). However, it covers only a short period of time, thus is not designed to analyze long-term dynamics. Moreover, it is limited to specific individual groups, such as the unemployed.

of the theoretical framework, the empirical method of analysis and the source and treatment of the utilized information. The empirical results are presented in the fifth part. Finally, some final considerations are discussed in the sixth section.

2. CHRONIC AND TRANSIENT POVERTY

In a standard definition, chronic poverty can be specified as an individual experience of deprivation that lasts for a long period of time, characterizing by the permanent feature (HULME & SHEPHERD, 2003). According to Barrientos *et al*. (2005), there are three main definitions in the literature to identify chronic poverty. The first approach emphasizes that the duration of poverty, identifying the chronic poor as those with per capita income (or consumption) levels persistently below the poverty line during a long period of time, while transient poverty is associated with a fluctuation of income observed about a poverty line (GAIHA & DEOLALIKAR, 1993). The second definition, called the "components approach", assumes the hypothesis of permanent income, it distinguishes the constant component of income/consumption (the determinant of chronic poverty) from the fluctuation component (the determinant of transient poverty) (JALAN & RAVALLION, 1998 and 2000). Finally, the third approach considers the current income and its variability among individual groups or families in order to estimate the probability of future deficiency (PRITCHETT *et al.*, 2000; BOURGUIGNON *et al.*, 2004).

Chronic poverty can still be analyzed in terms of absolute and/or relative deprivation. Although most studies in the literature are based on absolute chronic poverty, Yaqub (2003) argues that, regarding the individual who is always around the same quantile of the income distribution, relative chronic poverty would be as difficult, if not harder, to escape than the absolute case. Following this principle, Sen (1981) argues that a relative deprivation in terms of property, income or resources is related to absolute deprivation in terms of individual's capabilities.

According to McKay and Lawson (2002), the characteristics most commonly associated to chronic poverty include, among others[2]: being in a disadvantageous position regarding human capital, factors related to the household demographic composition, regional residence location, ownership or not of physical assets and low paid labor market occupation. In relation to transient poverty, due to its temporary nature, we can expect the associate factors to be different from the previous ones. However, some factors such as human capital are important for both types of poverty. Among the factors which determine the transient component of poverty, can be considered the family size, government transfers, seasonality of economic activities, physical assets scarcity, migration, and life cycle events. Empirical evidence strongly indicates that transient poverty is associated with the inability of families to maintain their consumption level when facing fluctuations or shocks which affect their incomes or individual circumstances (JALAN & RAVALLION, 1998).

[2] The CPRC researchers have identified a group of categories of individuals, families and social groups which are particularly more prone to be chronically poor. Included in these categories are: cases in which deprivation is due to life cycle stages (BARRIENTOS *et al.*, 2003; HARPER *et al.*, 2003); cases that involve those who are discriminated against due to their social position in local, regional or national levels, such as castes, ethnic groups, races, marginalized religious groups, fugitives, nomads and migrants (MEHTA & SHAH, 2003; SEN, 2003); members discriminated against within the household, such as girls, children living among many others, stepchildren, etc; those with long-term or health problems (YEO & MOORE, 2003; LWANGA NTALE *et al.*, 2002); people living in remote rural areas, urban ghettos and violent and unsafe regions (AMIS, 2002; BIRD & SHEPHERD, 2003; GOODHAND, 2003).

Besides the cited individual and household characteristics that enhance the deprivation probability, poverty can also be caused by state dependence. According to Giraldo *et al.* (2002), two distinct processes generate the persistence of poverty. The first, as pointed out above, is the heterogeneity among individuals, since each person presents a different group of characteristics. The second process is linked to the fact that the previous experience of deprivation over a specific period of time makes individuals more prone to poverty over successive periods. Since Heckman's work (1978), this second process acquired the labels True State Dependence (TSD) or Genuine State Dependence (GSD), as indicated by Arulampalam *et al*. (2000) and Cappellari and Jenkins (2002a).

The distinction between chronic and transient poverty and their determinants implies the implementation of distinct public policies; each one specific and more appropriate to each case (GAIHA & DEOLALIKAR, 1993; BARRIENTOS *et al*., 2005). Consequently, analysis of fluctuations in the state of deprivation is important in order to formulate social policies against poverty that are more effective. Regarding this aspect, Hulme and Shepherd (2003) argue that policies based on short-term interventions, whose emphasis is the creation of opportunities for those who are able to escape the precarious condition and keep themselves above the poverty line, are not effective against chronic poverty. Besides this, due to the heterogeneity of chronic poverty experiences and the diverse factors that explain specific events in distinct contexts, policies may have to be implemented in a context based analyses.

3. EQUIVALENT INCOME AND POVERTY LINE

Aspects that define poverty can be expressed through a monetary parameter - income and consumption expenditure - or with the use of non-monetary factors - education, anthropometry and mortality -, although the indicators may have one or more dimensions (SAHN & STIFFEL, 2000; BAULCH & MASSET, 2003). This article focuses on the monetary changes that occur in the short and middle term deprivations, which might or not persist over the long term.

When a monetary indicators is used as a measure of well-being, two index are normally utilized, the consumption expenditure and the available income (MENG *et al*., 2005). Due to different behavior regarding individuals' savings, the correlation between both indicators is not perfect. Although consumption expenses more directly capture the current level of well-being in the household, in many cases, such as in most surveys in Brazil, there is a scarcity of information regarding the access/consumption of properties and services. Consequently, it is usual to consider income as the well-being indicator. Thus, the indicator used in this study is the total household income. This indicator was modified with the use of scale parameters for each household, that is, the so-called "equivalent household income" or simply "equivalent income" in order to be used as an individual index.

Initially, this article considers the per capita household income, which is a unitary scale, that is, all members in the household have the same weight. Other income unit scale used in this work as a means of comparison is the square root one, which attributes to each member of the family an equivalent income dividing the total household income by the square root of the number of its members (similar to the idea in BUHMANN *et al.*, 1988). The comparison of these two scales is

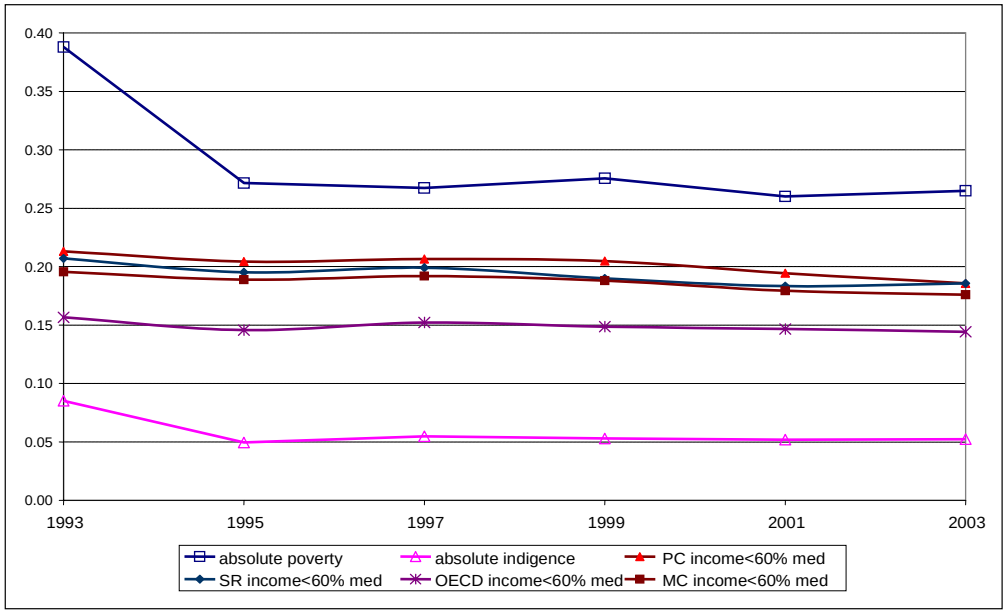
included in order to moderate the assumptions related to scale economies in the family. Besides this, other analyses were made, deflating the monetary indicator for each family according to its composition (MUELLBAUER, 1977). The OECD scale and the McClements' scale are also used in order to consider the relative expense of each household member according to his or her age group.

Once established the well-being index, the poor are those individuals that have an equivalent income below a specific poverty line. On the other hand, we classify as non-poor those individuals with income equal to or above this line. In the definition of this reference line, one of the aspects to be considered is the relation between absolute or relative deprivation (FOSTER, 1998). In this article, a line based on the relative poverty concept has been used that is similar to the one used by Nicoletti (2003), Cappellari and Jenkins (2002a, 2002b) and Galloway (2004). It was defined as a percentage of the median of the equivalent household income distribution for each year and for each scale cited above. With the objective of verifying the sensibility of the estimated parameters, we intend to consider different percentages of this same median, as is shown in this same table. In order to make a comparison between these relative lines and absolute ones, such as the absolute poverty and indigence lines drawn by Rocha (2003), these last two lines were also included in the analyses.

Graph 1 illustrates the evolution of the poverty headcount in Brazil according to different poverty lines from 1993 to 2003. We can observe that the data presents a constant pattern when measures of relative deprivation are used. When we analyze the absolute deprivation, we can observe that the proportion of the poor declines in the period 1993-1995, after "*Plano Real*" [3], and is kept practically constant afterwards.

GRAPH 1

Poverty headcount evolution in Brazilian urban areas based on different poverty measures from 1993 to 2003



Note: absolute lines from Rocha (2003), PC = per capita, SR = square root and MC = McClements
Source: own elaboration based on PNAD data and Rocha (2003).

[3] Money currency change in Brazil in 1994.

According to Rocha (2003), the macroeconomic stabilization in 1994 was a threshold between two distinct levels of incidence of absolute deprivation[4]. She claims that this stabilization from 1996 onwards has been closely connected to the macroeconomic aspects which resulted in a low per capita income increase. Regarding relative deprivation, the works by Ferreira and Litchfield (2000), Ramos and Vieira (2000) and Barros *et al*. (2000) have shown that the distribution of income in Brazil is characterized by the persistence of high inequality, with a slight non-monotonic tendency to rise in the last two decades. Therefore, relative poverty in Brazil has a higher persistence degree than absolute poverty. This aspect reinforces our choice to use measures of relative deprivation in order to define the poor population.

The evaluation of poverty with the square root scale tends to underestimate the degree of poverty when compared to the unitary scale income since the largest families normally have the lowest per capita incomes. Regarding the scales that differentiate the intrahousehold costs, OECD and McClements, they give a poverty estimate that is in even smaller than the other scales since the families with low per capita income have a larger number of children (as is shown by Ferreira *et al*., 2000). However, the changes that occurred in the composition of the Brazilian household over the past two decades tend to approximate the results obtained with the use of these different scales.

4. MODEL SPECIFICATION AND DATA SOURCE

The transient-chronic analysis (henceforth T-C), based on the components approach, is made by considering the distinction between the component of persistence and the component of transition to poverty during a period of time. Nevertheless, and contrary to the empirical analysis proposed by Ravallion (1998) and Jalan and Ravallion (1998, 2000), in this study these two components are not identified in the evaluation of poverty with the use of a base index of well-being (income or consumption). Rather, the propensity to poverty is identified by the estimated duration in each state (poverty and non-poverty), conditioned to the inherited characteristics of the individuals and their state dependence.

4.1. Theoretical Framework

Based on the model developed by Ravallion (1988), the well-being of the individual *j* in time *d* is given by:

$$y_j = \vartheta(x_j, \eta_d), \quad \vartheta_x > 0 \text{ and } \vartheta_\eta > 0, \qquad (1)$$

where the function ϑ is at least two times differentiable and x_j and η_d are the determinants of the equivalent income.

[4] This is justified by three factors derived from stabilization, which are: the moderate behavior of the food prices; the rise in the non-tradable prices, which raised the workers' profit in commerce as well as in the services; and the 42%-rise of the minimum wage in May 1995, combined with influence on the social welfare benefits (ROCHA, 2003).

The function ϑ can be interpreted as an indirect utility function in x_j and η_d. The well-being depends on the factor x_j which, despite varying among individuals, is time constant. It represents the determinants of the permanent income of each *j*-person. Furthermore, the random variable, η_d, common to all individuals, has different values for each interval of time, and determines the permanent income deviations due to time.

Moreover, the permanent income can be also a function of its previous value, y_{jd-1}, because of adjustments in expectations. Thus, (1) can be rewritten as:

$$y_{jd} = \varphi\left(x_j, y_{jd-1}\right) + v_j\left(\eta_d\right), \qquad (2)$$

where φ is a real non-negative function of x_j and y_{jd-1}, $\varphi : x_j, y_{jd-1} \to \Re_+$, and v_j is an increasing function with zero average.

Based on this equation, the poverty observed in *d* can be evaluated as a function P_{jd} in y_{jd}, such as:

$$P_{jd} = p\left(y_{jd}\right) = p\left(\varphi\left(x_j, y_{jd-1}\right) + v_j\left(\eta_d\right)\right), \qquad (3)$$

where $p(.)$ is a poverty function in a specific date.

The chronic poverty measure is defined by the C_{jd} component of P_{jd}, which is only a function of the permanent income, $\bar{y}_{jd} = \varphi\left(x_j, y_{jd-1}\right)$, as follows:

$$C_{jd} = p\left(\bar{y}_{jd}\right) = p\left(\varphi\left(x_j, y_{j0}, \eta_1, ..., \eta_{d-1}\right)\right), \qquad (4)$$

where y_{j0} is the initial income of *j* and $\left(\eta_1, ..., \eta_{d-1}\right)$ represents the random deviations in past periods. Contrary to the Jalan and Ravallion's (1998, 2000) measure, this set of past realizations establishes to the chronic component of poverty a state dependence aspect.

Without shocks in the income in time *d*, that is, $y_{jd} = \bar{y}_{jd}$ and $v_j\left(\eta_d\right) = 0$, the observed poverty must be equal to the chronic poverty measure. Otherwise, a residual component in the difference between P_{jd} and C_{jd} is found. This component is defined as the transient poverty measure,

$$T_{jd} = P_{jd} - C_{jd} = p\left(\varphi\left(x_j, y_{jd-1}\right) + v_j\left(\eta_d\right)\right) - p\left(\varphi\left(x_j, y_{jd-1}\right)\right). \qquad (5)$$

An assumption needed for these measures is that poverty in different periods is intertemporally addictives. Therefore, over the time, the poverty measure expressed in (3) can be written in the following form:

$$P_j = \frac{1}{D}\sum_{d=1}^{D} p(y_{jd}) = E\left[p(y_{jd})\right], \qquad (6)$$

where $p(y_{jd})$ is the poverty function for a given person in a specific data.

In the same way, the measures (4) and (5) are intertemporally represented as:

$$C_j = \frac{1}{D}\sum_{d=1}^{D} p(\bar{y}_{jd}) = E\left[p\left(E_d\left[y_{jd}\right]\right)\right] \qquad (7)$$

and

$$T_j = E\left[p(y_{jd})\right] - E\left[p\left(E_d\left[y_{jd}\right]\right)\right] = E\left[p(y_{jd}) - p\left(E_d\left[y_{jd}\right]\right)\right]. \qquad (8)$$

Therefore, chronic poverty is assessed as a stationary propensity to poverty with the individual's income kept constant in relation to its expectations. The transient poverty is the residual component derived from the difference between the intertemporal observed poverty and its expected value. According to Cruces (2005), this idea of intertemporal assessment is in accordance with the literature on risk aversion, which states that it is preferable for individuals to be in a stable income state rather than fluctuating around the same average income. The connection between the transitions from/to poverty and the family's risk is straightforward, as the latter is exact the origin of income fluctuation. If there are no risks, the distribution of y_{jd} will be a fixed value during all the period.

Similar to the risk aversion theory, the function P_j can be seen as an expected utility of the *j*-person, while $p(.)$ is analogous to a Bernoulli's utility function. In this case, in accordance to Jensen's inequality, if $E\left[p(y_{jd})\right] > p\left(E\left[y_{jd}\right]\right)$, that is $T_j > 0$, the *j*-person has a loss of well-being due to fluctuation. However, using a Foster-Greer-Thorbecke's (FGT)[5] index to assess intertemporal poverty in relation to a y_{jd} distribution, $p(.)$ assumes a functional form where the aversion degree to fluctuation is arbitrary[6].

The evaluation of $p(.)$, considering the probability model described above, relaxes this arbitrariness, allowing the occurrence of three situations:

1. $T_j > 0$, if there is an aversion to state fluctuation;
2. $T_j = 0$, if there are no losses due to state transitions;
3. $T_j < 0$, if there are transient gains for the individual well-being due to fluctuations.

[5] See Foster *et al.* (1984).

[6] Arrow-Pratt's coefficient of absolute risk aversion to the FGT index is defined as $r(y_i) = \frac{\alpha - 1}{z - y_i}$, where *z* is a poverty line and α is the parameter of arbitrary choice. The larger the parameter α the higher is the aversion to income fluctuations.

Given that $y_{jd-1} = p^{-1}\left(P_{jd-1}\right)$ the poverty and its components can be function of last period poverty. Hence the probability function of poverty can be written as:

$$P_{jd} = s_{jd} P_{jd-1} + e_{jd}\left(1 - P_{jd-1}\right). \qquad (9)$$

where s_{jd} is the probability of persistency in poverty and e_{jd} is the probability of transition to the poverty.

As can be seen in Appendix I, in a stationary environment, the poverty propensity which represents a chronic poverty status is defined by:

$$C_{jd} \equiv \frac{e_{jd}}{1 - s_{jd} + e_{jd}}. \qquad (10)$$

Given that $P_{jd} = C_{jd} + T_{jd}$, the transient component of poverty in period *d* is defined as:

$$T_{jd} \equiv p\left(y_{jd}\right) - \frac{e_{jd}}{1 - s_{jd} + e_{jd}}. \qquad (11)$$

This T-C decomposition is similar to the one presented in Suryahadi and Sumarto (2001). In these authors' work, chronic poverty is treated as an estimated value and the transient poverty derives from the residual of the observed values in a cross-sectional analysis.

4.2. Persistency and transition probabilities empirical model

The empirical model used in the analyses of the T-C decomposition discussed above consists of a Markov matrix of state transitions between two periods. Nevertheless, some assumptions are implied: (i) the probabilities of transition are independent of the time spent in each state; (ii) the probabilities of transition are independent of the states previous to $d-1$; (iii) *d* is discrete; and (iv) only one movement can occur per unit of time.

In the model, similar to the one proposed by Cappellari and Jenkins (2002a, 2002b), poverty transition and permanence between two consecutive periods ($d-1$ and *d*) is analyzed by a bivariate model with three steps to be estimated: (i) the determination of the poverty status in period $d-1$ (initial condition problem); (ii) the determination of the poverty status in period *d*; (iii) the correlation between non-observable effects affecting these processes. The combination of these three components characterizes the determinants of the persistency and the entrance rates into poverty.

In $d-1$ it can be assumed that the *j*-person is characterized by the latent propensity to poverty P^{*}_{jd-1} in the form:

$$P^{*}_{jd-1} = z'_j \beta + v_{d-1} + \mu_j + \xi_{jd-1} \qquad (12)$$

where z_j is a vector of explanatory variables which describe the *j*-person, β is a vector of parameters, v_{d-1} is the conjunctural effect's coefficient, and the term of error u_{jd-1} is the sum of an individual specific effect, μ_j, with an orthogonal white noise, ξ_{jd-1}, which follows a normal distribution with average zero. In this model, the observed poverty of *j* in $d-1$, P_{jd-1}, is expressed assuming values 0 or 1, such as:

$$P_{jd-1} = \begin{cases} 0 & \text{if } P^{*}_{jd-1} \leq 0 \\ 1 & \text{if } P^{*}_{jd-1} > 0 \end{cases}.$$

The function of latent propensity to poverty P^{*}_{jd}, that is, the status of poverty in the period *d*, conditioned to poverty in $d-1$, can be separated in two components, characterizing a switching model, as follows:

$$P^{*}_{jd} = \begin{cases} x'_j \gamma_1 + \omega_{1,d-1} + \tau_{1j} + \zeta_{1jd} & \text{if } P^{*}_{jd-1} > 0 \\ x'_j \gamma_2 + \omega_{2,d-1} + \tau_{2j} + \zeta_{2jd} & \text{if } P^{*}_{jd-1} \leq 0 \end{cases}, \qquad (13)$$

where γ_1, γ_2, $\omega_{1,d-1}$, $\omega_{2,d-1}$ and x_j are vectors and the error term, ε_{jd} is the sum of a specific effect, $\tau_j = \tau_{1j} + \tau_{2j}$, and a orthogonal white noise, $\zeta_{jd} = \zeta_{1jd} + \zeta_{2jd}$, that follows a normal distribution with an expectation equal to zero. The poverty observed in period *d*, P_{jd}, is defined in a similar way as P_{jd-1}:

$$P_{jd} = \begin{cases} 0 & \text{if } P^{*}_{jd} \leq 0 \\ 1 & \text{if } P^{*}_{jd} > 0 \end{cases}.$$

As long as equation (13) refers to the poverty status conditioned to a lagged poverty, the error term in this equation can be correlated to the error in expression (12) for the unconditional poverty status in the previous period. According to Maddala (1983), it is assumed that the joint distribution of error terms, u_{jd-1} and ε_{jd}, is a bivariate normal and is characterized by an estimable correlation. Taking such assumptions into account, this correlation is described in the following form: $\rho \equiv \text{corr}\left(u_{jd-1}, \varepsilon_{jd}\right)$.

Therefore, the distribution of non-observed heterogeneity is parameterized (along with the required normalizations) by means of a cross-sectional correlation. The parameter ρ summarizes the association between specific non-observable factors responsible for the poverty status in the base year and the poverty transition. A positive (or negative) sign indicates that a higher poverty propensity in

the subsequent period is among those agents who were more (or less) inclined to the initial poverty. If $\rho = 0$, there is no initial condition problem in the model: the status of poverty in $d-1$ would be treated as exogenous and the poverty transition equations could be estimated using univariate models. In other words, making the assumption of existence or non-existence of correlation between two structural disturbances, the analyses of expression (13) can be given by an endogenous or exogenous switching model.

It is important to emphasize that in the presence of two endogenous variables, that is, with $\rho \neq 0$, there is an identification problem in the model according to the utilization of exogenous variables. In order to avoid this problem, some of the variables, which may affect initial poverty, should have no effect on the transition. Consequently, there should be variables belonging to the vector z_j, which are not included in the vector x_j, the so-called instrumental variables.

In order to estimate the equations in (13), an observed persistent poverty index in *d*, Per_{jd}, is defined as the minimum poverty level between two subsequent periods:

$$Per_{jd} = \min\left(P_{jd-1}, P_{jd}\right).$$

Meanwhile, the transient observed poverty in *d*, $Tran_{jd}$, is characterized by the possibility of occurrence of an increase in poverty from P_{jd-1} to P_{jd}:

$$Tran_{jd} = \max\left(0, P_{jd} - P_{jd-1}\right).$$

Or simply: $Tran_{jd} = P_{jd} - Per_{jd}$.

Therefore, the dynamics between the poverty and non-poverty states is given by the group of expressions that characterize the transitions probabilities, $\alpha_k \in [0,1]$, of four distinct regimes in a Markov matrix:

period	*d*		
	state	poor	not poor
$d-1$	poor	α_1	α_2
	not poor	α_3	α_4

where $\sum_k \alpha_k = 1$. The probabilities of each regime *k* are represented as follows:

$$\begin{aligned}
\alpha_1 &= E\left[Per_{jd} \mid z_j, x_j, d-1\right] = \Phi_2\left(z_j'\beta + v_{d-1}, x_j'\gamma_1 + \omega_{1,d-1}; \rho\right) \\
\alpha_2 &= E\left[P_{jd-1} - Per_{jd} \mid z_j, x_j, d-1\right] = \Phi_2\left(z_j'\beta + v_{d-1}, -x_j'\gamma_1 - \omega_{1,d-1}; -\rho\right) \\
\alpha_3 &= E\left[Tran_{jd} \mid z_j, x_j, d-1\right] = \Phi_2\left(-z_j'\beta - v_{d-1}, x_j'\gamma_2 + \omega_{2,d-1}; -\rho\right) \\
\alpha_4 &= E\left[1 - P_{jd-1} - Tran_{jd} \mid z_j, x_j, d-1\right] = \Phi_2\left(-z_j'\beta - v_{d-1}, -x_j'\gamma_2 - \omega_{2,d-1}; \rho\right).
\end{aligned} \tag{14}$$

Thus, the rate or probability of persistency in poverty conditioned to P_{jd-1} in the expression (9) can be expressed as:

$$s_{jd} = \Pr\left[P_{jd} > 0 \mid P_{jd-1} = 1\right] = \frac{\Phi_2\left(z_j'\beta + v_{d-1}, x_j'\gamma_1 + \omega_{1,d-1}; \rho\right)}{\Phi\left(z_j'\beta + v_{d-1}\right)}, \tag{15}$$

and the transition rate can be represented by:

$$e_{jd} = \Pr\left[P_{jd} > 0 \mid (1 - P_{jd-1}) = 1\right] = \frac{\Phi_2\left(-z_j'\beta - v_{d-1}, x_j'\gamma_2 + \omega_{2,d-1}; -\rho\right)}{\Phi\left(-z_j'\beta - v_{d-1}\right)}, \tag{16}$$

where $\Phi(.)$ and $\Phi_2(.)$ are respectively the univariate and bivariate probability functions.

In this transition model, chronic poverty assessed by the expression (10) not only depends on the individual characteristics, represented by the vectors *x* and *z*, but also on a state dependence. This dependence is emphasized when the probability to be poor in *d* is considerably higher among those who were poor than among the non-poor in $d-1$.

The difference between the permanence rate and the transition rate indicate how much state dependence there is in the probability of remaining in poverty (STEWART & SWAFFIELD, 1999). According to Arulampalam *et al*. (2000), it is possible to identify a Genuine State Dependence (GSD) in poverty if it can be noticed differences between the vectors γ_1 and γ_2 in expression (13). The Aggregate State Dependence (ASD) and the GSD indicators are shown in Appendix II.

4.3. Estimation method for pseudo-panel data

Dynamic analysis of poverty normally requires longitudinal data in order to distinguish the chronic component from the transient one. However, surveys organized in panel format are scarce in some countries, including Brazil. For this reason, McKay and Lawson (2002) have proposed some alternatives to overcome this difficulty. According to these authors, it is possible to differentiate these two components using dynamic information from static data or repeated household surveys, as long as certain assumptions and limitations are assumed. One of the possibilities is to analyze the magnitude of poverty experienced by different social groups in a format of pseudo-panel (DEATON, 1985; VERBEEK & NIJMAN, 1992). These groups, supposedly homogeneous, can be obtained when cohorts or subgroups of the population are aggregated by geographic location, sex, race, etc. The

advantage of this method is that it estimates with a higher precision changes that occurred to the homogenous groups than can be obtained for individuals in panel analyses. The disadvantages are that these comparisons do not make any statement about the intragroup dynamics and do not recognize the distinction between chronic poverty and transient poverty within the group.

In the pseudo-panel developed in this study, the poverty evaluation for each cohort is given by the average of the individual poverty evaluations in the subgroup. If the poverty of cohort *j* was assessed by the income average, $\bar{y}_j = \sum_{ij=1}^{I_j} y_{ij} \Big/ I_j$, the presence of poor people inside the cohort could be ignored when this average is sufficiently high. Thus, the dependent variable to be estimated for each cohort *j* is a proportion of poor individuals in each one of them: $P_j = \sum_{ij=1}^{I_j} P_{ij} \Big/ I_j \in [0,1]$.

If the dependent variable is a proportion P_j of the n_j individuals who respond $P_{ij} = 1$, it is possible to make a probit regression, considering that all members of the cohort have the same vector of characteristics $\mathbf{x}_j$. Accordingly, an observation is established as $\lfloor n_j, P_j, \mathbf{x}_j \rfloor$, $j = 1,..., N$. Then, the population probability, $\pi_j = \Phi(\mathbf{x}'_j \boldsymbol{\beta})$, is estimated from the observed proportion P_j. Specifically in this analyses, in order to estimate consistently the transition model, it is necessary to do so with a log-likelihood function with components of a bivariate distribution, and applying an endogenous switching model for probit on grouped data. With the probabilities of each regime defined in expression (14), the proposed likelihood function is represented by:

$$\ln L = \sum_{j=1}^{J} n_{jd-1} \begin{bmatrix} Per_{jd} \ln \alpha_1 + (P_{jd-1} - Per_{jd}) \ln \alpha_2 \\ + (P_{jd} - Per_{jd}) \ln \alpha_3 + (1 - P_{jd-1} - Tran_{jd}) \ln \alpha_4 \end{bmatrix}. \qquad (17)$$

The estimators $\gamma_1, \omega_{1d-1}, \gamma_2, \omega_{2d-1}, \beta, v_{d-1}$ and ρ are obtained by the maximum value of the likelihood function. The marginal effects calculated from the estimated parameters are shown in the Appendix III. In order to verify the existence of correlation among the residuals, $\rho \neq 0$, a likelihood ratio test is taken, assuming, as a null hypothesis, ρ equal to zero.

Although P_{jd} is observed for n_{jd} individuals, an equivalent number of individuals in *d* equal to n_{jd-1} is considered for the proportion estimation. This equivalence assumption is necessary so that equations (12) and (13) are estimated under the same group size (statistically expanded and weighted), n_{jd-1}.

4.4. Data source and definition of cohorts

In order to analyze the dynamics of poverty the PNADs (*Pesquisa Nacional por Amostra de Domicílios*) from 1993, 1995, 1997, 1999, 2001 and 2003 were chosen as the databases. Thus, five transitions of two years are analyzed for each homogeneous group. In each period, the urban

individuals[7] born in certain years (from 1945 to 1968, or from 35 to 58 years old in 2003) and with non-negative household income[8] were selected. Within this universe, the heads of the household as well as their children, partners, other relatives and dependents have been considered. Therefore, the ones excluded from the analysis were the individuals who claimed to be pensioners, employees or relatives of the employees within the household, according to the PNAD classification.

Considering this sample subgroup, homogenous groups have been built with the use of individual characteristics such as: date of birth, race, sex, schooling, and region of residence. These attributes were included because they are not likely to be altered during the two years period[9]. Considering that a sub sample of at least 50 observations is representative for each homogenous group in each PNAD, the construction of these groups was obtained with the following categories for each variable:

- Birth date in three categories: people born between 1945 and 1952, between 1953 and 1960 or between 1961 and 1968;
- Race: whites (including Asians) or nonwhites (Blacks and Indians);
- Sex: male or female;
- Schooling: no education (0 or less than a year of formal education), incomplete elementary education (between 1 and 3 years of formal schooling), complete elementary education (between 4 and 7 years), complete middle education (between 8 and 10 years) or complete high school (above 11 years);
- Region: residents in the South and Southeast regions, in the West-Central and North regions or in the Northeast regions.

With these subdivisions, 180 cohorts have been constructed, which were analyzed in five transitions, what generated a total of 900 observations. As shown in the log-likelihood function (17), these 180 groups are weighted according to the number of individuals that each one represented in the sample, as suggested by Betti and Cheli (1999).

Due to the problem related to the model identification, it is still necessary to select some variables, which may affect initial poverty, but do not have any effect on the transition. Heckman (1981) suggests that the initial condition can be analyzed through individuals' characteristics that were observed before the entrance of the person in the labor market, such as the socioeconomic conditions of the parents. Considering reasonable the hypothesis that the family background only affects the starting point of the poverty dynamics, because one is about an inheritance factor, this work utilizes as

[7] The rural households have been excluded from the analyses due to three reasons: the existence of specificities in rural poverty that do not exist in urban poverty; the lack of representation of rural residences in PNAD samples; and the fact that poverty in Brazil has become essentially urban and metropolitan in the last years.

[8] The household income was deflated spatially by the index obtained in Ferreira *et al.* (2000), and temporarily according to the INPC (National Prices Index for Consumers).

[9] Given the age of the individuals in the sample, the great majority has already completed their education cycle. In according to Golgher (2004), less than 2% of the 25-year individuals are attending in elementary, middle or high schools. Moreover, approximately 10% of the Brazilian population is considered to be a migrant according to "fixed-date" Census question. However, the vast majority of these migrants change their municipality of residence within the same macro-region (GOLGHER, 2005). Consequently, they are migrants, but still live in the same area.

instrument the level of the parent's education for each cohort. The data was obtained from the PNAD of 1996. Important to point out that the election of this set of instruments was only carried after to compare it with other possible sets in relation its exclusion in the transition equation and inclusion in the initial condition regression.

TABLE 1
Descriptive statistics of the variables

Variable	Mean	Variable	Mean	Variable	Mean
d-1=1993	0.199	Female	0.527	father with no educ.	0.361
d-1=1995	0.199	no education	0.107	father with incomplete element.	0.284
d-1=1997	0.200	incomp. elementary education	0.136	father with complete elementary	0.239
d-1=1999	0.194	comp. elementary education	0.313	father with middle school	0.046
d-1=2001	0.208	complete middle school	0.148	father with high school	0.069
born between 1961-1968	0.412	complete high school	0.299	mother with no educ.	0.420
born between 1953-1960	0.344	South and Southeast region	0.553	mother with incomp. element.	0.254
born between 1945-1952	0.244	Northeast region	0.258	mother with complete element.	0.225
nonwhite	0.443	North and Center-West region	0.189	mother with middle school	0.045
				mother with high school	0.057

Source: own elaboration based on PNAD data.

Table 1 shows the proportions of each category for the variables used in the model. As can be seen, around 20% of the sample is obtained from each year (1993, 1995, 1997, 1999 and 2001). The group born between 1961 and 1968 represent 41% of the total, while those people born between 1953 and 1960 represent 34% and the individuals born between 1945 and 1952, 24%. Nonwhite people amounted to 44%, being a minority in comparison to the whites. Alternatively, women represent the majority of the sample, 52.7% of the total. The modal range of education level is of those who have completed elementary school (31.29%), followed by those who have completed high school (29.92%). Individuals with no education are 10.68% of the sample, while those having an incomplete elementary education are 13.26%, and with a complete middle school level, 14.48%. The South/Southeast region represents the larger group in the sample, with 55.26% of the total, followed by the Northeast region, with 25.84%, and finally the North/Central-West region, with 18.90%. The instrumental variables related to parents' education level in 1996 are also shown in the third column of the table. Among other results, 36.11% of the individuals had fathers and 41.96% had mothers with no education, indicating the low level of education of the parents, with rather inferior values in comparison to their children.

5. RESULTS

In this section the results obtained for the proposed model, as specified in the previous sections, are presented. There are two subsections. In the first one, the results obtained from the regressions are described. Subsequently, based on the results obtained from the regression, some simulations are made.

5.1. Regression results

Table 2 shows the results obtained with the use of a poverty line of 60% of the median of per capita household income for each analyzed period. This table shows the marginal effects and the estimated coefficients, along with their significance value, for the covariates of the model for the three conditions of poverty in focus: **initial** (static), **permanence** and **transition**.

The ρ parameter represents the association between specific unobservable factors in the initial condition with the other conditions. In specific model, the parameter is significant and negative. Such a sign indicates that, after controlling for the observed characteristics, groups with a higher propensity to poverty in the later period were less inclined to poverty in the future.

In Table 2, regarding the parameters of initial condition (the probability of being or not in poverty), the marginal effects for all the periods indicate that the propensity to poverty was higher in 1993. This reveals that circumstantial non-observed factors were more "perverse" in this year, which was before the implementation of the "Plano Real", when inflation was much higher. These effects were not very sensitive to the variation of the relative poverty line, but change considerably with the use of the absolute poverty lines (see Table A1 attached). Regarding the probability of permanence, there is no distinction between the marginal contributions of the fourth initial periods. They are all positive, significant with the same magnitude, and not much sensible. For the transition, the marginal effects were also positive and significant with higher values for 1995 and 1997, but these values are very sensible in the change of poverty definition. Whatever, this results show that the last period, from 2001 to 2003, was the one less touched by poverty in the transition phenomenon.

As far as the birth date is concerned, when younger cohorts (born in 1953-60 or 1960-68) were compared to the older one (1945-52), that was used as reference, all the coefficients were positive and significant and larger for the first group. This means that the older the person the less likely it is for the individual to be initially in poverty or to show permanent or transient aspects of poverty. However, considering that poor individuals have greater levels of mortality, older cohorts are in better situation since most of them do not survive over the time.

The race covariate is significant and positive when explaining initial and permanent conditions, but not so while dealing with transition that showed a non-significant coefficient. It was found that females are much more susceptible to being and remaining in poverty, yet showing less transition to poverty. In other words, when it comes to being poor, race and sex certainly plays a role in keeping non-whites and women in poverty; as far as the non-poor are concerned, to be white or not is indifferent and to be a woman reduces the chances of transition to poverty.

Although the education levels showed distinct effects on initial condition, their effects on dynamic aspects (permanence and transition) could be separated in two levels. In the probability of permanence, the education effect is significant only to distinguish individuals which completed or did not complete the middle school. On the other hand, when looking at the transition to poverty, the difference can be seen when observing whether the individuals have completed the elementary school or not.

TABLE 2

Regression results for 60% of the median of the per capita household income poverty line

(Robust Std. Err)	Initial condition			Permanence			Transition		
Covariates	**Marg effect**	Coef.	P>z	**Marg effect**	Coef.	P>z	**Marg effect**	Coef.	P>z
d-1=1993	**0.018851**	0.077934	0.000	**0.155759**	0.232352	0.000	**0.003795**	0.192178	0.000
d-1=1995	**0.008405**	0.035199	0.000	**0.149774**	0.392453	0.000	**0.007558**	0.333203	0.000
d-1=1997	**0.007378**	0.030939	0.000	**0.150021**	0.484468	0.000	**0.008777**	0.373412	0.000
d-1=1999	**0.009783**	0.040894	0.000	**0.148248**	0.205080	0.000	**0.003564**	0.181264	0.000
birth 1961-1968	**0.147327**	0.592759	0.000	**0.237628**	0.413539	0.000	**0.003980**	0.230896	0.000
birth 1953-1960	**0.073314**	0.296382	0.000	**0.187301**	0.089590	0.000	**0.000421**	0.035796	0.000
nonwhite	**0.016025**	0.067578	0.000	**0.147178**	0.100312	0.000	-0.000086	0.003693	0.242
female	**0.012162**	0.051562	0.000	**0.141664**	-0.080036	0.000	**-0.001013**	-0.047945	0.000
no education	**0.004458**	0.018733	0.000	**0.140180**	-0.023261	0.000	**0.006392**	0.278604	0.000
incomplete elementary	**0.020010**	0.082173	0.000	0.153471	-0.001437	0.793	**0.005402**	0.249102	0.000
complete elementary	**0.009057**	0.038066	0.000	**0.145297**	0.141798	0.000	**-0.001177**	-0.059084	0.000
S and SE region	**-0.082197**	-0.341671	0.000	**0.104079**	0.083233	0.000	**-0.005833**	-0.298993	0.000
NE region	**0.094891**	0.368452	0.000	**0.209735**	0.101045	0.000	**-0.000057**	0.011860	0.001
constant	-	-3.230803	0.000	-	1.239791	0.000	-	-2.664327	0.000
Instrumental variables									
father with no educ.	**0.124290**	0.551496	0.000						
father incomp. elementary	**-0.136351**	-0.605012	0.000						
father comp. elementary	**-0.036498**	-0.161949	0.000						
father with middle school	**-0.364212**	-1.616069	0.000						
mother with no educ.	**0.611922**	2.715203	0.000						
mother incomp. element.	**0.342938**	1.521674	0.000						
mother comp. elementary	**0.396289**	1.758403	0.000						
mother with middle school	0.001794	0.007963	0.806						
ρ	-0.321840			p < 0.000					
Log likelihood	-210092.03			**Number of obs**		427658			
Wald chi2(29)	71972.36			p < 0.000					
GSD test chi2(13)	829.16			p < 0.000					
ASD	0.922346			**GSD**	0.888567	(0.0585)			
Predicted probabilities	**alfa1+alfa2**	0.205955	(0.1867)	**alfa1**	0.191822	(0.1789)	**alfa3**	0.007265	(0.0048)
Conditioned probabilities				**s**	0.899765	(0.0635)	**e**	0.011197	(0.0113)
Chronic poverty		0.146837	(0.1655)						
Observed poverty		0.201341	(0.1853)						

Source: own elaboration based on PNAD data.

Regarding the uncontrolled regional factors, the South/Southeast (S and SE) region shows a negative effect on initial condition and transition when compared with the North/West-Central, area that was used as reference. However, to leave in this first region stimulates the permanence in poverty. As expected, due to the Brazilian geographic distribution of poverty, we found that in the Northeast region the effects of being in poverty and remaining poor are greater than in the North/West-Central regions. However, for the transition, the marginal effect of the Northeast region was sensible to change in poverty definition (see table A1 in annex). Thus, this transition effect is not different from that of North/West-Central regions.

In the relevant indicators of the model T-C, we can observe that for the poverty probability in last period, 89% is due to a True or Genuine State Dependence (GSD). Considering the difference between Aggregate State Dependence (ASD) and the GSD, we can see that from ASD only 4% is attributable to adverse characteristics among the individuals, while 96% is due to the GSD. According to Giraldo *et al*. (2002), if persistence derives from GSD, then the actions needed to alleviate families

from poverty during a certain period should reduce the future chances of these same families of falling back into poverty, breaking the "vicious cycle". On the other hand, if persistence is caused by heterogeneous characteristics, policies of monetary transference may be inefficient since they don't have any effect on the adverse characteristics. Thus, the results suggest that policies of transference income may be effective in reducing relative poverty levels.

When definitions of absolute deprivation are used as the poverty line (Table A1), the state dependence is significantly reduced. Such a result corroborates Yaqub (2003), because it confirms that there is a higher difficulty for leaving a situation of relative deprivation when compared to absolute deprivation. Also, as expected, the higher the critical value of the relative poverty line, the higher the identified state dependence.

Finally, 73% of observed poverty from 1993 to 2003 (0.2013 in Table 2) comes from a chronic problem or stationary propensity to poverty (0.1468) and 27% derives from vulnerability or transient poverty (0.0545). When the different poverty lines are compared, the deprivation with the highest likelihood of the chronic component is the situation of absolute indigence, where there is almost no probability of transition to this state, although the proportions are much smaller (Table A1).

5.2. Model's prediction

In order to distinguish the chronic from the transient poor, some simulations of predicted values for each individual within the sample are calculated according to coefficients estimated in the models above. When comparing the five macroregions in Brazil, as is shown in Table 3, we notice that the persistency rate (*s*) and the transition rate (*e*) are higher in the Northeast region. The values for the observed chronic and transient poverty are also higher for this region. Consequently, in this area, where the worst social conditions are identified, the probability to remain in poverty and also the probability to fall into poverty are higher. Another point that must be emphasized is the negative sign in the transient poverty in the West-Central region, since the level of chronic poverty is higher than the observed one. The last column in the table shows the ratio between transient and observed poverty.

As for the effects of the educational level, the probability of persistency is similar among those who haven't completed middle school, but is lower for the group with higher formal education. Regarding the transition, this equality of probabilities occurs above of complete elementary education. As expected, the observed chronic and transient types of poverty show a negative relation with schooling. But relatively, as is noticed by the data in the last column, the transient component of poverty is relatively more expressive among those without education and for those who have complete elementary education in which almost 40% of the observed poverty derives from vulnerability of these people. These groups may be more inclined to regular changes in the labor market, and therefore are more vulnerable to changes of poverty states. Last, but not least, those who have completed middle school showed the least chronic poverty level and did not have loss of well-being due to fluctuation.

TABLE 3

Predicted values for individuals' conditioned probabilities and poverty by their region, education, race and sex

	Conditioned probabilities		Poverty			
	s	e	Observed	Chronic	Transient	Trans/Obs
Region						
Southeast	0.886042	0.005574	0.115211	0.074987	0.040223	0.3491
South	0.883308	0.005536	0.114300	0.071552	0.042748	0.3740
Northeast	0.932478	0.021454	0.407015	0.290789	0.116226	0.2856
West-Central	0.896284	0.014958	0.171764	0.172823	-0.001059	-0.0062
North	0.902962	0.016082	0.307629	0.189867	0.117761	0.3828
Education						
no education	0.923615	0.025012	0.476701	0.286145	0.190557	0.3997
incomplete elementary	0.914135	0.017618	0.324938	0.217027	0.107912	0.3321
complete elementary	0.924598	0.006500	0.202526	0.123299	0.079227	0.3912
comp. middle school	0.865007	0.006741	0.069556	0.075308	-0.005752	-0.0827
Race/Sex						
Nonwhite men	0.930886	0.014898	0.280198	0.218123	0.062075	0.2215
Nonwhite women	0.923427	0.013744	0.319462	0.192499	0.126963	0.3974
white men	0.882867	0.007580	0.108306	0.090435	0.017871	0.1650
white women	0.871190	0.006903	0.121101	0.076873	0.044228	0.3652

Source: own elaboration based on PNAD data.

Regarding race, nonwhite people present the worst poverty indicators, irregardless of sex. In contrast, the characteristics which differentiate men from women are similar throughout the different races. Men present higher permanence and transition rates, having as a result a higher propensity to chronic poverty than the later. For women, the observed poverty is higher due to the large transient component, what can be easily observed in the last column. Similar to the evaluation made by Rocha (2003), we see that both sexes have similar results for observed poverty with a slight disadvantage for women. However, it is also noticed that the components of this poverty are highly distinct among sexes. This point may be due to the greater probability observed for women to leave the labor force.

Table 4 shows some other simulations for individuals in specific types of families classified in accordance to the household and to the head of the household characteristics. It is important to emphasize that there is a loss of information in this analysis, because the transient features were not followed over the time. In general, it is observed that besides having a low transition rate, individuals in single parent families without children have a high transient gain of well-being, which indicates the existence of a trade-off in the family constitution decision. On the other hand, individuals in families headed by a single parent woman are more vulnerable than those in families headed by a single parent male. The participation of these women in the labor market, marked by discrimination and segregation, probably makes them more susceptible to precarious occupations and unemployment thus, generating more vulnerability to the families they head[10].

[10] Barros *et al*. (1993) indicated that the existent inequality between men and women in the labor market have an impact on the different conditions of the families' life that these two types of workers head. Leme and Wajnman (2000) show that the discrimination among sexes explains a large part of this inequality.

The simulations (1) and (5), when compared, similar to the results regarding the individual, show that the completion of middle school education by the household head reduces the incidence of chronic poverty and generates significant transient gains due to his or her more favorable insertion in the labor market. The differences observed in the indicators reveals that education goes a long way in explaining the relative position of individuals in the income distribution, as suggested by Ferreira (2000), Ramos and Vieira (2000), and Menezes-Filho (2001).

TABLE 4

Predicted values for individuals' conditioned probabilities and components of poverty in selected types of household

	Household head									
	White					Nonwhite				
	s	e	C	T	T/(C+T)	s	e	C	T	T/(C+T)
(1). Employed, no middle school, married, with children (0-10 years) in the household	0.9141	0.0093	0.1266	0.0647	0.3382	0.9382	0.0173	0.2493	0.1547	0.3829
(2). (1) not married and without children in the household	0.8953	0.0078	0.0966	-0.052	-1.1757	0.9271	0.0139	0.1960	-0.1030	-1.1053
(3). (2) male head with children in the household	0.9151	0.0107	0.1405	0.0507	0.2652	0.9387	0.017	0.2483	0.1146	0.3158
(4). (2) female head with children in the household	0.9098	0.0092	0.1203	0.1692	0.5845	0.9373	0.0167	0.2405	0.2723	0.5310
(5). (1) with complete middle school	0.8656	0.0062	0.0654	-0.032	-0.9640	0.9105	0.0097	0.1379	-0.0260	-0.2269
(6). (1) unemployed	0.9027	0.0092	0.1177	0.3696	0.7585	0.9305	0.0161	0.2242	0.4321	0.6584
(7). (1) undocumented or job with no remuneration*	0.918	0.0118	0.1573	0.1777	0.5304	0.9416	0.0214	0.2961	0.2866	0.4918
(8). (1) self-employed	0.9123	0.0101	0.1335	0.0839	0.3859	0.9374	0.0191	0.2653	0.1754	0.3980
(9). (1) with private documented or public sector job	0.9142	0.0081	0.1137	0.0200	0.1496	0.9373	0.0141	0.2158	0.0764	0.2615
(10). (1) female head with paid domestic job	0.9056	0.0096	0.1224	0.0677	0.3561	0.9320	0.0142	0.2071	0.2134	0.5075

Note: * Does not include domestic jobs.
Source: own elaboration based on PNAD data.

Unemployment is a condition more associated to vulnerability to poverty than to the chronic state, as can be noticed in a comparison between simulations (1) and (6). Such a result is expected since to be unemployed is a transient condition related to a short-term performance of the economy. This leads one to believe, as shown by Ramos and Santana (1999), that the elimination of unemployment in the economy would have a modest effect on the reduction of structural poverty.

When family heads are self-employed or undocumented workers (see simulations (1), (7) and (8)), a high participation of the transient component is identified in the observed poverty. This fact highlights the importance of not simply protecting formal workers, but also informal ones with compensatory policies, such as unemployment insurance. The depressing effects that may occur on

aggregated demand and on the labor market demands over informal jobs, as emphasized by Ferreira *et al.* (2000), should also be considered. Besides this, it is also noticed a larger chronic character in simulations (7) and (8) when compared to the number (1). These two phenomena, chronic poverty and informal insertion in the labor market, may present a circular causality, that may induce the individual to pursue the so-called survival strategies (temporary/undocumented jobs) and thus become something more structural than circumstantial. This fragile position in the labor market can reduce the individual's capacity to improve his or her well-being, making the individual even more stigmatized in the labor market and, therefore, permanently poor.

As far as female domestic workers are concerned (simulation 10), a situation slightly better than those described above is observed both in relation to chronic poverty and to transient poverty. Nevertheless, for households with nonwhite women as heads, the transient component is greater than the chronic component.

Finally, the persistence rate of individuals in families headed by nonwhites is practically constant. That is to say, in the persistence of poverty, the race effect is more evident than the others. This aspect was emphasized by Henriques (2001), as he shows that black people are over-represented as a proportion of the poor in Brazil and face many hardships.

6. CONCLUSION

The estimation method based on a transition matrix was shown to be adequate for the analyses of poverty as a dynamic phenomenon with the use of information aggregated by cohorts. This method permitted to decompose poverty into two components (chronic and transient). However, as was pointed out above, the method has some limitations. The extension of the transition interval – every two years – and the aggregation of the data in homogenous groups ignore the intraperiod and intragroup dynamics. These may lead to a possible overestimated persistence rate and an underestimated transition rate. On the other hand, the results tend to capture more effectively a long-term outlook as opposed to a short-term view. Furthermore, they are liable to contextualize poverty as a collective, rather than individual phenomenon.

Regarding the results of the regressions, the last period analyzed (from 2001 to 2003) showed a more favorable conjuctural effects to poverty reduction in the three analyzed status: initial, persistence and transition. In the other periods these status were more similar, except for the initial condition that was more "perverse" in 1993, although differences were notices for distinct households. Among the uncontrolled factors in the transition period, we note that a higher propensity to poverty in the future is negative related to the current poverty (initial).

When the other characteristics are controlled, the effect related to birth date indicates that older individuals have a lower inclination to poverty, emphasizing that this result can be explicated in part by the differences in mortality rates between poor and non-poor. On the same token, an individual's race is a determinant factor when explaining the initial and permanence status. This, however, does not apply to transition. As was also observed, the sex effect increases the probability of women's permanence in poverty and reduces her chances of transition.

Regarding the educational effects, although they were significantly distinct in the initial condition, they could be dynamically categorized in two levels. In the estimated regressions, it was identified that the absence of elementary school made the people more susceptible to fall into poverty. However, this difference did not appear significantly in higher schooling. On the other hand, the great mark of mobility for the poor people is the middle education.

Analyzing the state dependence with regard to poverty, it was noticed that it is more difficult to escape from relative deprivation than from absolute deprivation (as indicated by Yaqub (2003)). Accordingly, using the first of these definitions as the poverty line influences the results that show that, in general, poverty in Brazil is essentially chronic.

As suggested by the Chronic Poverty Report 2004-05 (CPRC, 2004), the findings of this study demonstrated that individuals that are most susceptible to chronic poverty are nonwhite with low levels of education and living in the Northeast of Brazil. Another group also identified by the model, that was as well more inclined to chronic poverty was the families headed by self-employed and undocumented workers.

The highest poverty observed among women, in comparison to men, derives greatly from the transient character. Single parent families headed by women present a high component of transient poverty, as well as those headed by unemployed or informal workers. Another group in this situation is surprisingly made by individuals who have completed elementary school.

These analyses of poverty as a dynamic phenomenon that presents chronic and transient components might help the implementation of more efficient social policies against poverty. The groups more affected by the choric component require more attention regarding familial assets and human capital aspects and would also benefit from programs of income redistribution and transference. The groups most inclined to transient poverty need better opportunities of insertion and protection in the labor force by means of job policies, income generation, and social security.

REFERENCES

AMIS, P. (2002). *Thinking about chronic urban poverty*. CPRC Working Paper n.12, IDPM, University of Manchester.

ARULAMPALAM, W., A. L. BOOTH and M. P. TAYLOR (2000). Unemployment Persistence. *Oxford Economic Papers*, v. 52, n. 1, p. 24-50.

BARRIENTOS, A., D. HULME and A. SHEPHERD (2005). Can Social Protection Tackle Chronic Poverty?. *The European Journal of Development Research*, v. 17, n. 1, p. 8-23.

BARRIENTOS, A., M. GORMAN and M. HESLOP (2003). Old age poverty in developing countries: contribution and dependence in later life. *World Development*, v. 31, n. 3, p. 555-570.

BARROS, R. P., R. HENRIQUES and R. MENDONÇA (2000). A estabilidade inaceitável: desigualdade e pobreza no Brasil. In: HENRIQUES, R. (ed.). *Desigualdade e pobreza no Brasil*. IPEA, Rio de Janeiro, p. 21-47.

BARROS, R. P., L. FOX and R. MENDONÇA (1993). *Poverty among Female-Headed Households in Brazil*. Texto para Discussão n. 310, IPEA, Rio de Janeiro.

BAULCH, B. and E. MASSET (2003). Do monetary and nonmonetary indicators tell the same story about chronic poverty? A study of Vietnam in the 1990s. *World Development*, v.31, n.3, p.441-453.

BETTI, G. and B. CHELI (1999). Fuzzy Analysis of Poverty on an Italian Pseudo Panel, 1985-1994. *Metron*, v. 57, n. 1-2, p. 83-103.

BIRD, K. and A. SHEPHERD (2003). Livelihoods and chronic poverty in semi-arid Zimbabwe. *World Development*, v. 31, n. 3, p. 591-611.

BOSKIN, M. J. and F. C. NOLD (1975). A Markov Model of Turnover in Aid to Families with Dependent Children. *Journal of Human Resources*, v. 10, n. 4, p. 467-481.

BOURGUIGNON, F., C. GOH and D. I. KIM (2004). *Estimating individual vulnerability to poverty with pseudo-panel data*. Working Paper n. 3375, World Bank Policy Research.

BUHMANN, B., L. RAINWATER, G. SCHMAUSS and T. M. SMEEDING (1988). Equivalence Scales, Well-Being, Inequality and Poverty: Sensitivity Estimates across Ten Countries Using the Luxembourg Income Study Database, *Review of Income and Wealth*, v. 34, p. 115-142.

CAPPELLARI, L. and S. P. JENKINS (2002a). *Modelling Low Income Transitions*. Working Paper n. 2002-8, ISER, Colchester.

CAPPELLARI, L. and S. P. JENKINS (2002b). Who Stays Poor? Who Becomes Poor? Evidence from the British Household Panel Survey. *The Economic Journal*, v. 112, p. C60-C67.

CPRC (2004), *the Chronic Poverty Report 2004-05*. IDPM, University of Manchester.

CRUCES, G. (2005). *Income Fluctuations, Poverty and Well-Being over Time: Theory and Application to Argentina*. Economics Working Paper Archive at WUSTL, Labor and Demography 0502007.

DEATON, A. (1985). Panel data from time series of cross-sections, *Journal of Econometrics*, v. 30, n. 1-2, p. 109-127.

FERREIRA, F. H. G. (2000). Os determinantes da desigualdade de renda no Brasil: luta de classes ou heterogeneidade educacional?. In: HENRIQUES, R. (org.). *Desigualdade e pobreza no Brasil*. Rio de Janeiro: IPEA. p. 131-158.

FERREIRA, F. H. G., P. LANJOUW and M. NERI (2000). *A New Poverty Profile for Brazil using PPV, PNAD and Census Data*. Texto para Discussão n. 418, PUC-Rio, Rio de Janeiro.

FERREIRA, F. H. G. and J. A. LITCHFIELD (2000). Desigualdade, pobreza e bem-estar social no Brasil – 1981/95. In: HENRIQUES, R. (ed.). *Desigualdade e pobreza no Brasil*. IPEA, Rio de Janeiro, p. 49-80.

FOSTER, J. E. (1998). What is poverty and who are the poor? Redefinition for the United States in the 1990's: Absolute versus Relative Poverty. *The American Economic Review*, v. 88, n. 2, p. 335-341.

FOSTER, J., J. GREER and E. THORBECKE (1984). A Class of Decomposable Poverty Measures. *Econometrica*, v. 52, n. 3, p. 761-766.

GAIHA, R. and A. B. DEOLALIKAR (1993). Persistent, Expected and Innate Poverty: Estimates for Semi Arid Rural South India. *Cambridge Journal of Economics*, v. 17, n. 4, p. 409-421.

GALLOWAY, T. A. (2004). *To What Extent Is a Transition into Employment Associated with an Exit from Poverty?*. Memorandum n. 01/2004, Department of Economics, University of Oslo.

GIRALDO, A., E. RETTORE and U. TRIVELLATO (2002). The persistence of poverty: true state dependence or unobserved heterogeneity? Some evidence from the Italian Survey on Household Income and Wealth. *10th International Conference on Panel Data*, Berlin.

GOLGHER, A. B. (2004) Modelo Profluxo e Indicadores Derivados. In: RIOS-NETO, E. L. G. & RIANI, J. L. R. (eds.). *Introdução à Demografia da Educação*, ABEP, Campinas, p. 159-208.

GOLGHER, A. B. (2005) *Migração entre os estados brasileiros*. Universidade Federal de Minas Gerais, Belo Horizonte, mimeo.

GOODHAND, J. (2003) Enduring disorder and persistent poverty: a review of the linkages between war and chronic poverty. *World Development*, v. 31, n. 3, p. 631-648.

HARPER, C., R. MARCUS and K. MOORE (2003). Enduring Poverty and the Conditions of Childhood: Lifecourse and Intergenerational Poverty Transmissions. *World Development*, v. 31, n. 3, p.535-554.

HECKMAN, J. J. (1978). Simple Statistical Models for Discrete Panel Data Developed and Applied to Test the Hypothesis of True State Dependence against the Hypothesis of Spurious State Dependence. *Annals de INSEE*, Paris, p. 227-269.

HECKMAN, J. J. (1981). Statistical models for discrete panel data. In: MANSKI, C. F. and D. MCFADDEN (eds.) *Structural Analysis of Discrete Data with Econometric Applications*, MIT Press, cap. 3, p. 114-178.

HENRIQUES, R. (2001). *Desigualdade racial no Brasil: evolução das condições de vida na década de 90*. Texto para discussão n. 807, IPEA, Rio de Janeiro.

HULME, D. and A. SHEPHERD (2003). Conceptualizing Chronic Poverty. *World Development*, v. 31, n. 3, p. 403-423.

IADB (1998), *The Path Out of Poverty: The Inter-American Development Bank's Approach to Reducing Poverty*. Sustainable Development Department of IADB, Washington DC.

JALAN, J. and M. RAVALLION (1998). Transient Poverty in Postreform Rural China. *Journal of Comparative Economics*, v. 26, n. 2, p. 338-357.

JALAN, J. and M. RAVALLION (2000). Is Transient Poverty Different? Evidence for Rural China. *Journal of Development Studies*, v. 36, n. 6, p. 82-98.

LEME, M. C. S. and S. WAJNMAN (2000). Tendências de coorte nos diferenciais de rendimentos por sexo. In: HENRIQUES, R. (ed.). *Desigualdade e pobreza no Brasil*. Rio de Janeiro, IPEA, p. 251-270.

LWANGA NTALE, C., B. NDAZIBONEYE and J. NALUGO (2002). *Chronic poverty and disability in Uganda*. CPRC Working Paper, IDPM, University of Manchester.

MADDALA, G. (1983). *Limited dependent and qualitative variables in econometrics*. Cambridge University Press.

MCKAY, A. and D. LAWSON (2002). *Chronic Poverty: A Review of Current Quantitative Evidence*. Chronic Poverty Research Centre (CPRC), Working Paper n. 15.

MEHTA, A. K. and A. SHAH (2003). Chronic poverty in India: incidence, causes and policies. *World Development*, v. 31, n. 3, p. 491-511.

MENEZES-FILHO, N. A. (2001). Educação e desigualdade. In: LISBOA, M. B. and N. A. MENEZES-FILHO. *Microeconomia e sociedade no Brasil*. Rio de Janeiro: Contra Capa. p.13-49.

MENG, X., R. GREGORY and Y. WANG (2005). *Poverty, Inequality, and Growth in Urban China, 1986-2000*. Discussion Paper n. 1452, IZA.

MUELLBAUER, J. (1977). Testing the Barten Model of Household Composition Effects and the Cost of Children, *Economic Journal*, v. 87, p. 460-487.

NICOLETTI, C. (2003). *Poverty Analysis with Unit and Item Nonresponses: Alternative Estimators Compared*. Working Paper n. 2003-20, ISER, Colchester.

PNAD, *Pesquisa Nacional por Amostras de Domicílios*. Rio de Janeiro: FIBGE, 1993_2003.

PRITCHETT, L., A. SURYAHADI and S. SUMARTO (2000). *Quantifying Vulnerability to Poverty: A Proposed Measure, Applied to Indonesia*. World Bank, Working Paper Series n. 2437, Washington DC.

RAMOS, C. A. and R. SANTANA (1999). Desemprego, pobreza e desigualdade. *Conjuntura e Análise*, IPEA/MTB, v. 4, n. 11, p. 23-27.

RAMOS, L. & M. L. VIEIRA (2000). Determinantes da desigualdade de rendimentos no Brasil nos anos 90: discriminação, segmentação e heterogeneidade dos trabalhadores. In: HENRIQUES, R. (ed.). *Desigualdade e pobreza no Brasil*. IPEA, Rio de Janeiro, p. 159-176.

RAVALLION, M. (1988). Expected Poverty Under Risk-Induced Welfare Variability. *Economic Journal*, v. 98, p. 1171-1182.

ROCHA, S. (2003) *Pobreza no Brasil: Afinal, de que se trata?*. Rio de Janeiro, Editora FGV.

SAHN, D. and D. STIFFEL (2000). Poverty comparisons over time and across countries in Africa. *World Development*, v.28, p.2123-2155.

SEN, A. K. (1981). *Poverty and Famine: An Essay on Entitlement and Deprivation*. Oxford University Press.

SEN, B. (2003). Drivers of escape and descent: changing household fortunes in rural Bangladesh. *World Development*, v. 31, n. 3, p. 513-534.

STEWART, M. B. and J. K. SWAFFIELD (1999). Low Pay Dynamics and Transition Probabilities. *Economica*, v. 66, n. 261, p. 23-42.

SURYAHADI, A. and S. SUMARTO (2001). *The Chronic Poor, the Transient Poor, and the Vulnerable in Indonesia Before and After Crisis.* SMERU Research Institute.

VERBEEK, M. & T. NIJMAN (1992). Can Cohort Data be treated as Genuine Panel Data?. *Empirical Economics*, v. 17, n. 1, p. 9-23.

WORLD BANK (2003), *Inequality in Latin America and the Caribbean – Breaking with History?*.

YAQUB, S (2003). *Chronic poverty: scrutinizing patterns, correlates and explorations*. CPRC Working Paper n. 21, IDPM, University of Manchester.

YEO, R. and K. MOORE (2003). Including disabled people in poverty reduction work: 'nothing about us, without us'. *World Development*, v. 31, n. 3, p. 571-590.

APPENDICES

Appendix I – Derivation of the stationary measure

According to Boskin and Nold (1975), considering the probability of persistence, s_{jd}, and the probability of transition e_{jd}, the poverty probability is:

$$P_{jd} = s_{jd} P_{jd-1} + e_{jd}\left(1 - P_{jd-1}\right). \qquad \text{(I.1)}$$

Supposing the initial condition in which the individual is poor or non-poor with probability 1, the solution for this difference equation is:

$$P_{jd} = \left(s_{jd} - e_{jd}\right)^{d} + \frac{e_{jd}}{1 - s_{jd} + e_{jd}}. \qquad \text{(I.2)}$$

Let R_{jd} denote the poverty duration up to the period *d*, and define $\Delta R_{jd} = R_{jd} - R_{jd-1}$. Thus,

$$\Pr\left[\Delta R_{jd} = 1\right] = s_{jd} P_{jd-1} + e_{jd}\left(1 - P_{jd-1}\right).$$

Based on the equation (I.2), the solution for the expected poverty duration is obtained by the following equation:

$$\hat{R}_{jd} = \sum_{d=1}^{D}\left[s_{jd} P_{jd-1} + e_{jd}\left(1 - P_{jd-1}\right)\right] = \frac{\left(s_{jd} - e_{jd}\right)^{D} + D \cdot e_{jd}}{1 - s_{jd} + e_{jd}}.$$

For high values of *D*, the expected proportion of poverty over time of the *j*-person is expressed as:

$$\lim_{D\to\infty} P_{jD} = \lim_{D\to\infty} \frac{\hat{R}_{jD}}{D} = \frac{e_{jd}}{1 - s_{jd} + e_{jd}}. \qquad \text{(I.3)}$$

The stationary measure (I.3) equals the measure of chronic poverty expressed in (10).

Appendix II – Measures of state dependence

In order to measure the observed Aggregate State Dependence (ASD), Cappellari and Jenkins (2002a) have proposed the calculation of the difference between the probability of being poor for those who had been poor in the previous period and the probability of being poor for those who hadn't been poor. The ASD is represented by:

$$\text{ASD} = \left(\frac{\sum_{j \in \{P_{jd-1}=1\}} \Pr(P_{jd} = 1 \mid P_{jd-1} = 1)}{\sum_{j} P_{jd-1}} \right) - \left(\frac{\sum_{j \in \{P_{jd-1}=0\}} \Pr(P_{jd} = 1 \mid P_{jd-1} = 0)}{\sum_{j} (1 - P_{jd-1})} \right).$$

The measure of Genuine State Dependence (GSD), also proposed by these authors, is the mean difference between the predicted probabilities of being poor in d conditioned to the poverty status in the previous period. The GSD is represented by:

$$\text{GSD} = \left(\frac{1}{J} \right) \sum_{j=1}^{J} \Pr(P_{jd} = 1 \mid P_{jd-1} = 1) - \Pr(P_{jd} = 1 \mid P_{jd-1} = 0).$$

This article proposes similar measures for cases when poverty is measured in an individual and discrete form. The measure proposed for the ASD is given by the difference between the persistence rate and the transition rate considering the observed initial poverty status in the following way:

$$\text{ASD} = \left(\frac{\sum_{j=1}^{J} P_{jd-1} s_{jd}}{\sum_{j=1}^{J} P_{jd-1}} \right) - \left(\frac{\sum_{j=1}^{J} (1 - P_{jd-1}) e_{jd}}{\sum_{j=1}^{J} (1 - P_{jd-1})} \right). \qquad \text{(II.1)}$$

Conversely, the measure of GSD is the average difference between these rates for each individual and is represented by:

$$\text{GSD} = \left(\frac{1}{J} \right) \sum_{j=1}^{J} (s_{jd} - e_{jd}). \qquad \text{(II.2)}$$

This GSD measure, taking the individual as a reference, assures that the observed and non-observed heterogeneity are being controlled.

The expressions (II.1) and (II.2) can be used to measure state dependence in cases of individual discrete evaluation as well as in continuous evaluation or with the use of proportions, as was done in this study.

Appendix III – Calculation of marginal effects

The marginal effects of the variables on the probability of each regime, in the expression (14) are obtained in the following way:

$$\frac{\partial E\left[P_{jd-1} \mid z_j\right]}{\partial h_j} = \phi\left(z_j'\beta + v_{d-1}\right)\cdot \beta_h$$
$$\frac{\partial E\left[Per_{jd} \mid z_j, x_j\right]}{\partial h_j} = \phi\left(x_j'\gamma_1 + \omega_{1,d-1}\right)\cdot \Phi\left[\left(z_j'\beta + v_{d-1} - \rho\cdot\left(x_j'\gamma_1 + \omega_{1,d-1}\right)\right)\Big/\sqrt{1-\rho^2}\right]\cdot \gamma_{1h} \qquad \text{(III.1)}$$
$$\frac{\partial E\left[Tran_{jd} \mid z_j, x_j\right]}{\partial h_j} = \phi\left(x_j'\gamma_2 + \omega_{2,d-1}\right)\cdot \Phi\left[\left(-z_j'\beta - v_{d-1} + \rho\cdot\left(x_j'\gamma_2 + \omega_{2,d-1}\right)\right)\Big/\sqrt{1-\rho^2}\right]\cdot \gamma_{2h}$$

where h_j is a variable contained in z_j and x_j. Or else, in case of dummies, the marginal effects can be calculated in the following way:

$$\begin{aligned}
\frac{\partial E\left[P_{jd-1} \mid z_j\right]}{\partial h_j} &= \Phi\left(z_j'\beta + v_{d-1} \mid h_j = 1\right) - \Phi\left(z_j'\beta + v_{d-1} \mid h_j = 0\right), \\
\frac{\partial E\left[Per_{jd} \mid z_j, x_j\right]}{\partial h_j} &= \Phi_2\left(z_j'\beta + v_{d-1}, x_j'\gamma_1 + \omega_{1,d-1}; \rho \mid h_j = 1\right) \\
&\quad - \Phi_2\left(z_j'\beta + v_{d-1}, x_j'\gamma_1 + \omega_{1,d-1}; \rho \mid h_j = 0\right), \\
\frac{\partial E\left[Tran_{jd} \mid z_j, x_j\right]}{\partial h_j} &= \Phi_2\left(-z_j'\beta - v_{d-1}, x_j'\gamma_2 + \omega_{2,d-1}; -\rho \mid h_j = 1\right) \\
&\quad - \Phi_2\left(-z_j'\beta - v_{d-1}, x_j'\gamma_2 + \omega_{2,d-1}; -\rho \mid h_j = 0\right),
\end{aligned} \qquad \text{(III.2)}$$

where h_j is a binary variable.

TABLE A1

Marginal effects and aggregate indicators estimated for different poverty lines

Initial / Marginal effect	60% pc	50% pc	70% pc	80% pc	60% SR	60% OECD	60% MC	indigence	abs. pov.
d-1=1993	**0.01885**	**0.01326**	**0.02079**	**0.02799**	**0.02417**	**0.00821**	**0.01579**	**0.02724**	**0.14224**
d-1=1995	**0.00840**	**0.00583**	**0.00544**	**0.00587**	**0.01092**	**-0.00233**	**0.00814**	**-0.00245**	**0.00785**
d-1=1997	**0.00738**	**0.00722**	**0.00760**	**0.00396**	**0.01135**	**0.00105**	**0.00786**	**0.00141**	0.00015
d-1=1999	**0.00978**	**0.00278**	**0.00943**	**0.00948**	**0.00594**	**0.00095**	**0.00763**	**0.00079**	**0.01546**
birth 1961-1968	**0.14733**	**0.11636**	**0.17626**	**0.19888**	**0.13532**	**0.11226**	**0.13380**	**0.04617**	**0.19995**
birth 1953-1960	**0.07331**	**0.05821**	**0.09034**	**0.10373**	**0.06159**	**0.05263**	**0.06627**	**0.02308**	**0.10450**
nonwhite	**0.01603**	**0.01343**	**0.01945**	**0.02208**	**0.01312**	**0.00798**	**0.01503**	**0.00550**	**0.02667**
female	**0.01216**	**0.00987**	**0.01323**	**0.01409**	**0.01833**	**0.05434**	**0.01151**	**0.00561**	**0.01398**
no education	**0.00446**	-0.00004	**0.00679**	**0.00837**	**0.01683**	**0.01151**	**-0.00210**	**-0.00166**	**-0.01555**
incomplete elementary	**0.02001**	**0.01127**	**0.02679**	**0.03214**	**0.02167**	**0.01690**	**0.01539**	0.00022	**0.01139**
complete elementary	**0.00906**	**0.00510**	**0.01116**	**0.01425**	**0.00922**	**0.00759**	**0.00662**	**-0.00134**	**0.00472**
S and SE region	**-0.08220**	**-0.06561**	**-0.09681**	**-0.11163**	**-0.07227**	**-0.04321**	**-0.07736**	**-0.00523**	**-0.05974**
NE region	**0.09489**	**0.07535**	**0.11215**	**0.12278**	**0.09844**	**0.06608**	**0.08539**	**0.02675**	**0.05949**
father with no educ.	**0.12429**	**0.05633**	**0.23116**	**0.32418**	**0.16007**	**0.06150**	**0.12531**	**0.02085**	**0.24877**
father incomp. elementary	**-0.13635**	**-0.17733**	**-0.05753**	**0.01583**	**-0.11034**	**-0.14118**	**-0.12740**	**-0.11179**	**-0.03366**
father comp. elementary	**-0.03650**	**-0.08790**	**0.05679**	**0.12652**	**0.01156**	**-0.04080**	**-0.03099**	**-0.02414**	**0.16518**
father with middle school	**-0.36421**	**-0.38536**	**-0.31343**	**-0.27247**	**-0.29773**	**-0.29680**	**-0.33919**	**-0.17341**	**-0.28657**
mother with no educ.	**0.61192**	**0.52345**	**0.67960**	**0.69933**	**0.53167**	**0.48274**	**0.54932**	**0.19710**	**0.82907**
mother incomp. element.	**0.34294**	**0.30947**	**0.37246**	**0.36081**	**0.34037**	**0.26491**	**0.29200**	**0.13382**	**0.46018**
mother comp. elementary	**0.39629**	**0.34771**	**0.42845**	**0.43781**	**0.32957**	**0.26649**	**0.34323**	**0.12588**	**0.41465**
mother with middle school	0.00179	-0.01663	**0.10030**	**0.09606**	0.00443	-0.00717	**-0.06792**	**-0.04205**	**0.13383**
Permanence									
d-1=1993	**0.15576**	**0.11025**	**0.19776**	**0.24473**	**0.14507**	**0.09667**	**0.13679**	**0.03256**	**0.24786**
d-1=1995	**0.14977**	**0.10721**	**0.19114**	**0.23433**	**0.13999**	**0.09344**	**0.13322**	**0.03026**	**0.23016**
d-1=1997	**0.15002**	**0.10610**	**0.19274**	**0.23445**	**0.13927**	**0.09551**	**0.13352**	0.03164	**0.23650**
d-1=1999	**0.14825**	**0.10338**	**0.19053**	**0.23372**	**0.13455**	**0.09508**	**0.13066**	**0.03100**	**0.23198**
birth 1961-1968	**0.23763**	**0.17852**	**0.29819**	**0.35462**	**0.22069**	**0.16782**	**0.21479**	**0.06241**	**0.35684**
birth 1953-1960	**0.18730**	**0.13801**	**0.24139**	**0.29319**	**0.17186**	0.12713	**0.16832**	**0.04656**	**0.29657**
nonwhite	**0.14718**	**0.10657**	**0.19130**	**0.23560**	**0.13836**	**0.09645**	**0.13173**	**0.03430**	**0.24206**
female	**0.14166**	**0.10228**	**0.18560**	**0.22811**	**0.13898**	**0.11879**	**0.12701**	**0.03293**	**0.23141**
no education	**0.14018**	**0.09857**	**0.18366**	**0.22825**	**0.14349**	**0.09817**	**0.12004**	**0.03015**	**0.21574**

(to be continued)

incomplete elementary	0.15347	**0.10786**	**0.20057**	**0.24643**	**0.14685**	**0.10390**	0.13521	**0.03114**	**0.23620**
complete elementary	**0.14530**	**0.10383**	**0.18890**	**0.23219**	**0.13797**	**0.09756**	**0.12914**	**0.03107**	**0.23141**
S and SE region	**0.10408**	**0.07268**	**0.13993**	**0.17454**	**0.10111**	**0.07451**	**0.09095**	**0.02952**	**0.20085**
NE region	**0.20974**	**0.15573**	**0.26395**	**0.31593**	**0.20586**	**0.14180**	**0.18799**	**0.04907**	**0.27175**
Transition									
d-1=1993	**0.00379**	**0.00283**	**0.00064**	**0.00061**	**-0.00077**	**-0.00023**	**0.00319**	**-0.00457**	**-0.01038**
d-1=1995	**0.00756**	**0.00675**	**0.00571**	**0.00407**	**0.00425**	**0.00579**	**0.00528**	**0.00255**	**-0.00127**
d-1=1997	**0.00878**	**0.00327**	**0.00538**	**0.00864**	**-0.00027**	**0.00270**	**0.00374**	**0.00065**	**0.00299**
d-1=1999	**0.00356**	**0.00450**	**0.00206**	**0.00345**	**0.00067**	**0.00314**	**0.00161**	**0.00076**	**-0.00246**
birth 1961-1968	**0.00398**	**0.00380**	**0.00450**	**0.00461**	**0.00094**	**0.00217**	**0.00410**	**0.00116**	**0.00176**
birth 1953-1960	**0.00042**	**0.00116**	**0.00028**	-0.00019	**-0.00071**	**0.00082**	**0.00087**	**0.00031**	**-0.00052**
nonwhite	-0.00009	**0.00056**	**0.00046**	**-0.00038**	**0.00022**	**0.00117**	**0.00035**	**0.00035**	**0.00059**
female	**-0.00101**	**-0.00134**	**-0.00210**	**-0.00227**	**-0.00077**	**-0.00021**	**-0.00127**	**-0.00013**	**-0.00072**
no education	**0.00639**	**0.00691**	**0.00672**	**0.00310**	**0.00767**	**0.00815**	**0.00605**	**0.00543**	**0.00086**
incomplete elementary	**0.00540**	**0.00691**	**0.00572**	**0.00382**	**0.00661**	**0.00637**	**0.00571**	**0.00366**	**0.00120**
complete elementary	**-0.00118**	-0.00003	**-0.00106**	**-0.00136**	**-0.00054**	**0.00050**	**-0.00074**	**0.00096**	**-0.00091**
S and SE region	**-0.00583**	**-0.00458**	**-0.00577**	**-0.00557**	**-0.00574**	**-0.00437**	**-0.00531**	**-0.00134**	**-0.00117**
NE region	**-0.00006**	**0.00064**	**0.00005**	**0.00085**	-0.00006	**0.00039**	**0.00055**	**0.00184**	**0.00070**
ρ	-0.32184	-0.29312	-0.41100	-0.42747	-0.38188	-0.47381	-0.33875	-0.23771	-0.35599
ASD	0.9223	0.9179	0.9287	0.9318	0.9254	0.9172	0.9246	0.7952	0.8721
GSD	0.8886	0.8853	0.8965	0.8986	0.8963	0.8843	0.8925	0.7986	0.8594
Pd-1 (alfa1+alfa2)	0.2060	0.1614	0.2490	0.2903	0.1962	0.1508	0.1901	0.0590	0.2932
alfa1	0.1918	0.1495	0.2341	0.2738	0.1834	0.1397	0.1775	0.0473	0.2594
alfa2	0.0073	0.0070	0.0085	0.0082	0.0074	0.0078	0.0074	0.0050	0.0086
Persistence rate	0.8998	0.8952	0.9111	0.9138	0.9075	0.8949	0.9035	0.8041	0.8729
Transition rate	0.0112	0.0098	0.0146	0.0152	0.0112	0.0106	0.0110	0.0055	0.0135
Chronic poverty	0.1468	0.1194	0.1916	0.2120	0.1317	0.1233	0.1431	0.0472	0.2004
Observed poverty	0.2013	0.1582	0.2450	0.2855	0.1933	0.1489	0.1866	0.0577	0.2879

Source: own elaboration based on PNAD data and Rocha (2003).