Determinants of school dropout of teenagers in High School: a study considering individual, family and municipal characteristics

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Abstract: The study aims to evaluate the determinants of school dropout among teenagers between 14 and 17 years old in the Southern region in Brazil. We aimed to investigate specifically the influence of individual and family characteristics, likewise social and economic conditions of the municipality, on the decision to continue to study. To do that, a hierarchic logit model was applied to 2010 demographic census, along with other social and economic data obtained for the average of municipalities. Main results show that individual and family characteristics, likewise average social and economic indicators of municipalities affect significantly scholar conditions of students. In this case, they decide to stay at school observing the reality in which they are inserted. Therefore, it can be concluded that, besides policies that improve social and economic conditions of families, a group of coordinated actions is extremely important to favor employment levels and economic activity.

Keywords: School dropout. Teenagers. High Scholl. Social and economic indicators. Southern region.

Resumo: O presente estudo propõe analisar os determinantes da evasão escolar para os adolescentes com idade entre 14 e 17 anos da região Sul do Brasil. Especificamente, buscou-se investigar a influência das características individuais e familiares, assim como das condições socioeconômicas do município, sobre a decisão de permanecer estudando. Para tanto, aplicou-se um modelo *logit* hierárquico aos dados do Censo Demográfico 2010, em conjunto com outras informações sociais e econômicas que foram obtidas para a média dos municípios. Os principais resultados mostraram que as características individuais e familiares, assim como os indicadores sociais e econômicos médios dos municípios influenciam significativamente na condição escolar dos adolescentes. Neste caso, eles estão tomando a decisão de permanecer na escola a partir da observação em relação à realidade na qual estão inseridos. Conclui-se, assim, que além das políticas que melhoram as condições econômicas e sociais das famílias, é de fundamental importância um conjunto de ações coordenadas que contribuam para estimular o nível de emprego e a atividade econômica.

Palavras-chaves: Evasão escolar. Adolescentes. Ensino médio. Indicadores socioeconômicos. Região Sul.

Área 2: Desenvolvimento Econômico

Código JEL – O1, O15, I21

1. Introduction

According to United Nation's Program on Development (PNUD/Brasil, 2010), the universal primary education is one of the eight objectives of development in the millennium. Brazil, as member of United Nations (UN), is committed to the objective. This and other goals in the education area have been an issue of many researchers in several knowledge areas, including economics, which prove the clear influence of education on income level, well-being and social and economic conditions of individuals. (BARROS and RAMOS, 1992; KASSOUF, 1997; 2001; UEDA and HOFFMANN, 2002; RUSSO and DIAS, 2016).

The theory of human capital has been built on main theoretical foundation of studies on schooling, both referring to investment returns on education and concerning the increase of educational levels searched for individuals and families. Schultz's work (1973), named "Theory of Human Capital", is considered a milestone of this discussion. The author says that human capital is defined as part of the individual and, at the same time, as a source of satisfaction or future income. Schultz discussed the importance to invest on the human being, since that this initiative represents a source of economic growth. Mincer (1974) contributed to this discussion proposing a model that established a functional relationship between attaining school and work income. Becker (1993), in turn, defined investments on human capital as activities that affect well-being and future income of people. Those activities include education, work training, medical care and information on price and salary, which might differ among themselves concerning the invested amount and the return value.

One of the most important research that aimed to identify the factors that impact the decision of a higher level of school attaining is Becker and Tomes's work (1979), whose model aims to understand why parents maximize its usefulness, investing on human and non-human capital of their children and other family members. After that, several authors performed empirical studies, aiming to analyze the influence of family characteristics on the demand for education, or on the educational level obtained by the child during his/her life. Holmes (1999) developed a model that aimed to evaluate the determinants of child education based on data concerning to family and community characteristics and the environment where the decision was taken. Handa (1996) analyzed in which way parents took the decision about the education level of children.

Besides variables related to individual and family characteristics, some authors investigated the impact of the place of residence on the probability of the child or teenager to enter. Among contributions of international literature are the research developed by Case and Deaton (1999); Binder (1999); Summers and Wolfe (1977); Card and Krueger (1992) and Angrist and Lavy (2001). In Brazil, Vasconcellos (2003) carried out a frequency and school delay analysis on elementary school, from 1981 to 1999, emphasizing a possible causal relationship between family income and educational indicators. Pontili and Kassouf (2008) discussed the impact of representative variables of school infrastructure compared to those who indicated family characteristics on elementary school delay. Albernaz, Ferreira and Franco (2002) verified if different school variable might be a measure of effectiveness and/or equity on Brazilian educational quality.

Recently, the interest to discuss methodological aspects related to particularities of databases used on research about schooling has increased. Guo and Zhao (2000) say that the social structure is formed by hierarchical levels, because a group of students, for instance, in classrooms, belongs to a certain school. As for individuals and their families, they are successively part of a community or neighborhood and a city. Because of that, estimates of a regression that concerns to interpret or analyze investments on education must respect the composition of variables in multilevel groups. Ilie and Lietz (2010), considering this methodological aspect, raised by literature, estimated a linear regression model in three levels, to investigate the determinants of proficiency in Mathematics for 21 European countries. Soares

(2005) also estimated a hierarchical regression model in three levels aiming to analyze the proficiency of Brazilian students, when they finish the fourth grade of elementary school. Riani (2005) used a multilevel logistic model to estimate the probability of progression by grades of Brazilians in school age for elementary, middle and high school.

In Brazil, public policies for education, according to Barbosa (2006), have always shown a relation between education and development, through educational projects that had the objective to prepare qualified workforce to follow the demands of economic growth in the country. For high school, a technical conception and a narrow bond between education and work were established, aiming that the student, after the school cycle, is able to enter immediately in the labor force.

The paper aims to evaluate the determinants of school dropout teenagers between 14 and 17 years old in the Southern region in Brazil Specifically, it aims to verify how much of individual and family characteristics of one person affect his condition referring to level of education. This research also evaluates if social and economic conditions of the municipality, especially those associated to the labor market profile, have influence on school dropoutin high school. This paper applied an adequate method estimated, because other analysis did not consider multilevel group for estimations the data about individual and family characteristics of this population was obtained from 2010 Demographic Census information.

According to the Brazilian law (BRASIL, 1996[1]; 2013), basic education is mandatory and free from 4 to 17 years old, allowing public and free access to elementary, middle and high school for those who did not complete it in proper age. However, the compulsory requirement of high school was set by the Federal Law n. 12,976, from April 4, 2013, and its implementation has been gradual by the three branches of the government (federal, state and municipal). As a result, the current law does not affect the object of this study, given that it was not in force in 2010. Consequently, in this paper the analysis of formal education was carried out from the understanding that the teenager and his/her family still have the right to choose between staying or not in the educational system, taking into account the social and economic context.

2. Methodological aspects

The level of formal education was used as a proxy of the human capital acquired by an individual[2]. Therefore, an EPF (Education Production Function) was estimated with the following functional model:

$$E_{zj} = g\left(I_{zj}, F_{zj}, M_j\right) \tag{1}$$

The formal education obtained by a teenager z, who lives in the city j, is one function of his/her individual and family characteristics, respectively indicated by vectors I_{zj} and F_{zj}. Individual characteristics were defined as: age, gender, the home situation (rural or urban), the state of the house, if he/she is working or not and if receives (or not) transferences from governmental programs. Family characteristics, in turn, were defined as: race, mother's schooling level, head of household's gender and per capita family income. M_j represents social and economic indicators: formal employee indicator, employee turnover rate, unemployment rate, log of GDP per capita, Gini index and Municipal Human Development Index.

2.2.1 The education choice model

[1] Law of Directives and Basis for National Education (LDB, in Portuguese)

[2] Becker and Tomes (1979); Becker (1991).

Breen and Jonsson (2005) say that the rational choice model, focused on the educational decision making, analyzes the choice of the child and his/her parents based on expected benefits, costs and the probability of success for different educational alternatives, taking into account the influence of social origins. For Jiménez and Salas-Velasco (2000), during the process of educational choice, the person decides not only when to enter, or not, in a private system of education, but also the amount of education that he/she intends to obtain in that specific level. In this case, there are many important factors that influence the decision process and the probability of scholar success would be one of these factors.

The person, when he/she needs to take decisions related to the teaching system, compares the options, which include the time spent on the educational system, the insertion in labor market and other alternative choices that could maximize a better use of his/her time, under a budget restriction (LONG, 2004). In the educational decision model discussed by Breen and Goldthorpe (1997), there is a central mechanism of risk aversion, in which the young person and his/her family decide to acquire a certain educational level based on his/her social class and on the purchasing power of the family. As a result, over the educational system, there are moments in which the teenager sees himself/herself before a decision of higher or lower risk. Higher risk: to stay in the educational system and increase the educational level; lower risk: enter in the labor market. In a population with n students, the *ith* student has a T_i limit that determines the minimum acceptable level of school attaining. T_i is the position of the social class from where the student originates. Besides, each student has a belief on the success probability in each risk option.

The young person also has a non-compulsory education system formed by a group of levels, $k = 1, \ldots K$, in which K is the last level of education possible to be obtained. Students who fail in a certain education level feel discouraged and might leave the system. Students who conclude a certain schooling level have the option to leave the system in that moment or to continue to a next level of education. The next level is called L_k, and the results obtained in the educational system may be classified in terms of expected utility, as described below:

$$U(S_k) = \max(U(L_k), V(k+1)) \tag{2}$$

In which $U(S_k)$ is the utility function of the expected success at the educational level k and $V(k + 1)$ is the expected utility function to continue at the educational level $k + 1$. The function V can be written as:

$$V(k) = \pi_k U(S_k) + (1 - \pi_k) U(F_k) \tag{3}$$

When π_k is the subjective probability of student's success at the k level.

The students take the decision to stay in the educational system, enrolling at the k level, if the subjective utility of this decision is higher than the subjective utility of having studied the previous educational level ($k – 1$). Mathematically:

$$V(k) > U(L_{k-1}) \tag{4}$$

$V(k)$ depends on the expected return for the permanence on the educational system in each level and on the subjective probability of success of the higher levels.

Figure 1 shows the decision process of the Brazilian teenager, between 14 and 17 years old, based on the theoretical approach proposed by Breen and Yaish (2006). In Brazil, the permanence on high school is encouraged, but not mandatory, leading the teenager and the family to choose between staying in formal education (FE) or abandoning it. In other words, the first choice is given by studying or not studying.

This teenager's choice is related to the probability of access and gains in sectors of activity in the labor market – agricultural activity sector (A), industrial (I) and services (S).

These probabilities are identified by parameters α, β e γ. The subscribed 1 refers to the conditional probability to enter in the agricultural sector; the subscribed 2 indicates the possibility of entering the industrial sector; and the probability to work in the service sector is given by 1 less the sum of the value of the other two parameters. At first, the parameter γ indicates the probability to enter in one of the three sectors of activity in case the teenagers take the initial decision to leave the educational system.

The permanence on the educational system leads the teenager to the possibility of success or failure at the education level where student is at. The π parameter represents the probability of success, while $\pi - 1$ indicates the failure possibility. Failure leads the teenagers to a situation of school delay and the low stimulus caused by this delay might lead him/her to abandon the education system and enter the labor market. In this case, the probability to enter in one of the three sectors of activity is given by β.

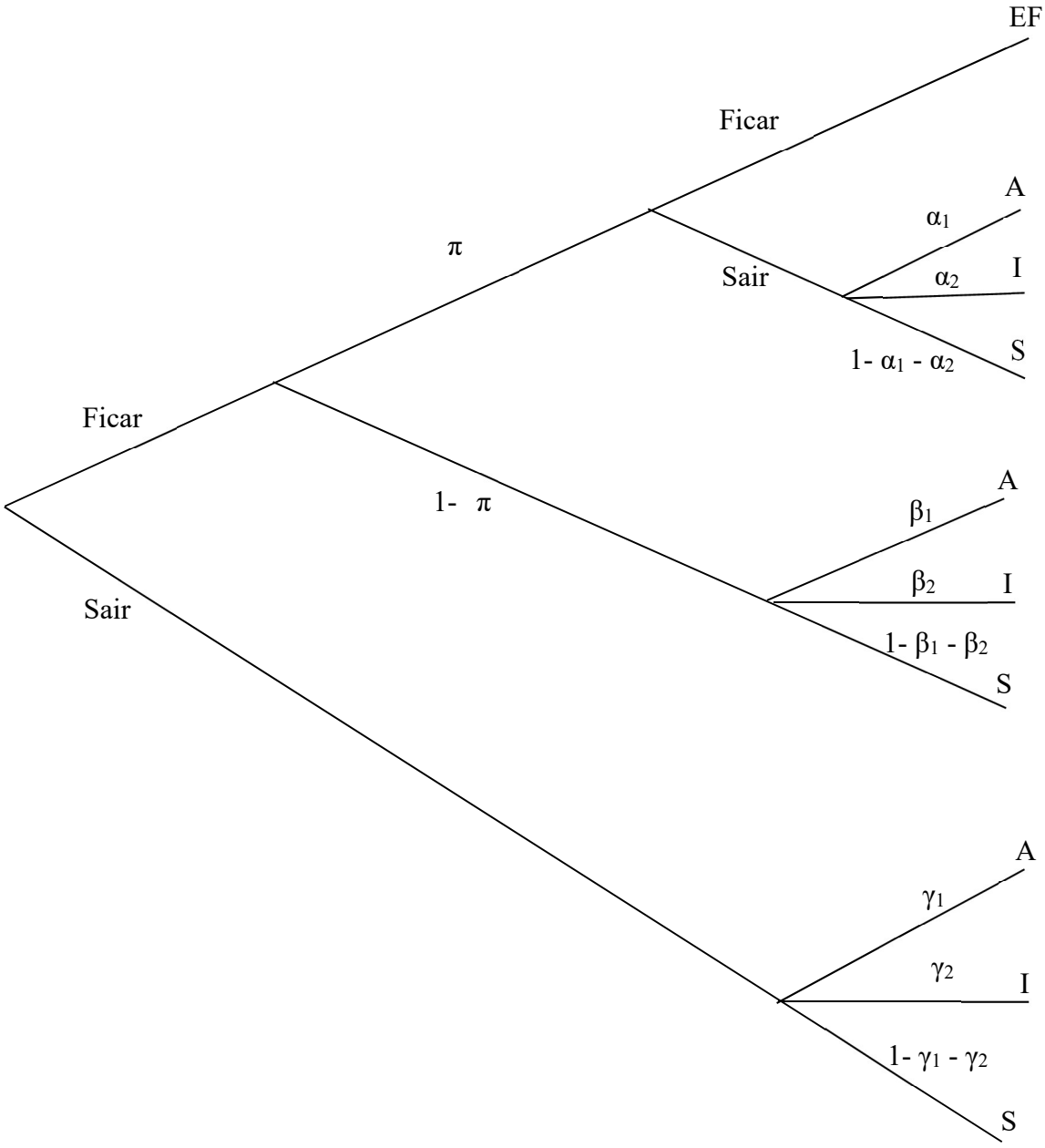

Figure 1. The process of the educational choice of Brazilian teenagers between 14 and 17 years old.
Source: Elaborated based on Breen and Yaish (2006).

The scholar success allows the teenager to conclude school at *k* level and, therefore, the student can choose between staying in the formal education and advance to the *k + 1* level or leaving the school system and enter one of the sectors of the producing activity, under α probability.

Breen and Yaish (2006) say that the entrance probability on producing sectors is different according to student's choice and his/her advance on the school system. Suppositions related to these conditional probabilities are: $\alpha > \beta > \gamma$ and then successively. In other words, the entrance probability in the labor market in a profession that the teenagers want, for both activity and remuneration, increases due to the permanence and the success in formal education.

Todd and Wolpin (2003) discussed a theoretical model in which the family decision to enroll and keep a child at school varies from year to year and depends on the knowledge obtained by the child during a certain school level. Besides, the preoccupation to investigate determinants of the school performance is present in many researches that used different proxies for this performance, among them: Barros *et al*. (2001); Ferrão, Beltrão and Santos (2002); Rios-Neto, Riani and Cesar (2003) and Ilie and Lietz (2010).

The EPF (Education Production Function), considering the process of rational choice of teenager and family, was estimated by the equation referring to the choice of staying or leaving formal education; in other words, the probability of the teenager not to study was calculated.

2.2.2 The hierarchical logit model

Some researches that evaluate education, both in Brazil and internationally, applied models that consider data distributed in two levels. The first is a group of variables of individual and family characteristics; and the second includes school or collective inputs. In this case, the database structure has hierarchical nature and *when treated in conventional way might cause a systematic bias of underestimation of the aggregate variable* (RIANI, 2005, p. 49). This is due to violation of one of the conventional assumptions of one regression analysis: error variance is constant, and it would exist. The use of hierarchical models has been one strategy used by some studies to solve this problem.

The so called "hierarchical regression model" or "multilevel regression model" has been increasingly used in research in the fields of human sciences or applied social sciences because the social structure is composed by hierarchical levels. According to Guo and Zhao (2000), one example of multilevel social structure is the case of students grouped in classes or schools; likewise the case of individual and his/her respective families, grouped in communities, neighborhoods and municipalities.

One regression model is understood as multilevel when explanatory variables are composed by a hierarchical structure and there is a random effect that interferes on variables of the first level. Therefore, interactions among covariances measured on different levels affect the result of the dependent variable; ignore the multilevel structure might result in bias on estimations of parameters; when the structure of groups on data is ignored and the independence assumption is violated, the classical regression model tends to underestimate the standard errors (GUO and ZHAO, 2000).

The understanding of a structure of a hierarchical regression model is usually started with the presentation of a linear multilevel regression model. In this case, a more didactical presentation usually uses just one explanatory variable, but the model can be easily expanded to several independent variables. Riani (2005) affirms that a more simplified model, containing an independent variable and the assumption that the variability on level 2 affects only the intercept, might be described as:

$$y_{zj} = \beta_{0j} + \beta_{1j} x_{1zj} + e_{zj} \quad (5)$$

$$\beta_{0j} = \gamma_{00} + u_{0j} \quad (6)$$

$$\beta_{1j} = \gamma_{10} \quad (7)$$

In which:
y_{zj} is a continuous variable dependent on the *zth* unit of level 1 and *jth* unity of level 2;
x_{1zj} is the explanatory variable;
β_{0j} is the intercept that suffers the random effect of the j*th* unit of level 2, whose representation is on equation 6;
β_{1j} is the inclination coefficient, which does not change itself in each unit of level 2.

Substituting equations 6 and 7, on equation 5, there is:

$$y_{zj} = \gamma_{00} + \gamma_{10} x_{1zj} + u_{0j} + e_{zj} \quad (8)$$

In this model, the random effect of level 2 is represented by u_{0j}, while the random error of level 1 is given by e_{zj}. It is assumed that both are independent and follow normal distribution with average zero and constant variances σ^2_{uo} e σ^2_e. Therefore, the variance of y_{zj} is a result of these two variances, given by:

$$\text{VAR}(y_{zj}) = \sigma^2_{uo} + \sigma^2_e \quad (9)$$

With the values of σ^2_{uo} e σ^2_e, it is possible to calculate the interclass correlation coefficient, which measure indicates how much the variability of the dependent variable is given by the variation between groups and whose equation is:

$$\rho = \frac{\sigma^2_{u0}}{\sigma^2_e + \sigma^2_{u0}} \quad (10)$$

The ρ statistic varies between 0 and 1; the closer to 1 the result, the higher is the variability of y_{zj}, which is related to differences between unities of level 2; otherwise, values closer to 0 indicate a higher homogeneity between unities of level 2 and low intergroup influence on y_{zj}.

On equation 8, the fixed part of the model, common to all individuals, is represented by γ_{00} and γ_{10}; the inclination parameter is the same for all unities of level 2; and the intercept is affected by the random effect, varying from one unit *j* to other, and being represented by $\gamma_{00} + u_{0j}$.

The model might be expanded, supposing the inclination also varies from one unit to other in level 2. Therefore, the equation system has the following composition:

$$y_{zj} = \beta_{0j} + \beta_{1j} x_{1zj} + e_{zj} \quad (11)$$

$$\beta_{0j} = \gamma_{00} + u_{0j} \quad (12)$$

$$\beta_{1j} = \gamma_{10} + u_{1j} \quad (13)$$

Substituting equations 12 and 13 on equation 11, there is:

$$y_{zj} = (\gamma_{00} + u_{0j}) + (\gamma_{10} + u_{1j}) x_{1zj} + e_{zj}$$

$$y_{zj} = \gamma_{00} + \gamma_{10} x_{1zj} + u_{1j} x_{1zj} + u_{0j} + e_{zj} \quad (14)$$

In the model represented by the equation 14, the random effect of the level 2 affects both the intercept (u_{0j}) and the inclination (u_{1j}); e_{zj} is the third component of the random effect, being this the error term of level 1. It is supposed that these three residual terms have normal distribution with average zero and constant variances: σ^2_{u0}, σ^2_{u1} and σ^2_e, respectively. *The residual aspects of level 2 are declared independent of those on level 1, but correlated among each other, with covariance given by* σ_{u01} (RIANI, 2005, p. 77).

Expanding the model even more, the existence of explanatory variables on several levels can be supposed. Conceptually, it is assumed that the independent variable y_{zj} and the explanatory variable X_{1zj} are on the individual level; on the group level there is the vector of explanatory variables Z_j and the equation system, being represented as following (HOX, 1998; VALENTE and OLIVEIRA, 2009):

$$y_{zj} = \beta_{0j} + \beta_{1j} X_{1zj} + e_{zj} \tag{15}$$

$$\beta_{0j} = \gamma_{00} + \gamma_{01} Z_j + u_{0j} \tag{16}$$

$$\beta_{1j} = \gamma_{10} + \gamma_{11} Z_j + u_{1j} \tag{17}$$

In which:
β_{0j} and β_{1j} are, respectively, estimated parameters of the intercept and the explanatory variable of level 1, assumed as random from equations 16 and 17;
u_{0j} and u_{1j} are the random effects of level 2;
γ_{01} and γ_{11} are the regression coefficients associated with the effects of explanatory variables on the group level in the structural link on the individual level;
γ_{00} and γ_{10} are, respectively, the values of the estimated intercept and the estimated inclination when Z_j is equal zero.

Substituting 16 and 17 in 15, there is:

$$y_{zj} = \gamma_{00} + \gamma_{10} X_{1zj} + \gamma_{01} Z_j + \gamma_{11} Z_j X_{1zj} + u_{1j} X_{1zj} + u_{0j} + e_{zj} \tag{18}$$

In general, when there are more than one explanatory variable on both levels, the subscript p is used for the first level p(p = 1, 2, ..., P) and the subscript q is used for the second level q(q = 1, 2, ..., Q). Therefore, there is the following general equation:

$$y_{zj} = \gamma_{00} + \gamma_{p0} X_{pzj} + \gamma_{0q} Z_{qj} + \gamma_{pq} Z_{qj} X_{pzj} + u_{pj} X_{pzj} + u_{0j} + e_{zj} \tag{19}$$

According to Valente and Oliveira (2009), the first part of the right side of the equation 19 ($\gamma_{00} + \gamma_{p0} X_{pzj} + \gamma_{0q} Z_{qj} + \gamma_{pq} Z_{qj} X_{pzj}$) is known as the fixed part of the model; and the second part of the right side is known as random. The term $u_{1j} X_{1zj}$ is understood as the interaction of random effects of inclinations and the vector of explanatory variables X.

In this paper, the dependent variable was binary and Guo and Zhao (2000) highlight that the binary variable model is equivalent to the linear regression model, except for the concept adopted for the dependent variable. In this case, the binary response for the individual z, in the group j, is defined as the probability of response equal 1, identified as $\eta_{zj} = \Pr(Y_{zj} = 1)$ and η_{zj} *is* modeled using a logit function.

In the hierarchical logit model, the general equation, assuming several explanatory variables on both levels, is given by:

$$\eta_{zj} = \ln\left(\frac{\pi_{zj}}{1-\pi_{zj}}\right) = \gamma_{00} + \gamma_{p0}X_{pzj} + \gamma_{0q}Z_{qj} + \gamma_{pq}Z_{qj}X_{pzj} + u_{pj}X_{pzj} + u_{0j} + e_{zj} \quad (20)$$

being η_{zj} the log of one's success chance and π_{zj} the success probability for person z. The predicted value of η_{zj} can be converted in terms of predicted value of probability, following the equation:

$$\pi_{ij} = \frac{1}{1+\exp(-\eta_{ij})} \quad (21)$$

The resulting calculation of equation 21 is odds ratio. Therefore, if odds ratio is higher than one, it means that the coefficient of logit model has a positive sign and the independent variable associated to that coefficient increases the chances of the event occur. On the other hand, an odds ratio lower than one indicates the existence of a coefficient with negative sign, which means that the explanatory variable reduces chances for the event under discussion. For an odds ratio equal one, the coefficient related to it was equal zero and the explanatory variable does not affect the event (POWER and XIE, 1999).

In the model of equation 20, the probability density function is identical to that observed for a common logistic regression, the regression follows the maximum likelihood estimate and the solution requires macro and micro numerical interactions (HOX, 1998; GUO and ZHAO, 2000; VALENTE and OLIVEIRA, 2009).

The model of equation 20, likewise the odds ratio of equation 21, was estimated to ascertain the probability of one-person *z*, between 14 and 17 years old, living in South Brazil, has taken the decision not to study. For case, a hierarchical logistic model was estimated, and the software used was *HLM* (Hierarchical Linear and Nonlinear Modeling).

2.2.3 Database

Data refer to Southern region in Brazil (Paraná, Santa Catarina and Rio Grande do Sul States), using four databases: Annual Social Information Report (Rais), from the Ministry of Labor and Employment, IBGE's (Brazilian Institute of Geography and Statistics) regional accounts, PNUD/UN's Atlas of Human Development and IBGE's demographic census of 2010. The three first databases were sources to compose the municipal indicators and the last one was used to obtain variables at individual and family levels.

Variables of level 2

a) Annual Social Information Report (Rais):

The economic activities were grouped up in five sectors: farming, livestock, forestry production, fishery and aquaculture, extractive and manufacturing industry, construction, retail sales, repairing of vehicles and motorcycles and public administration, defense and social security (IBGE, 2015). As a result, the following variables were obtained: a) participation of the formal sectorial employment compared to the total formal employment; b) turnover rate of the formal sector.

b) IBGE's (Brazilian Institute of Geography and Statistics) regional accounts:

From where the following was obtained: a) the value of the Gross Domestic Product of municipalities, which was divided by the value of the respective total population and transformed in logarithm.

c) Atlas of Human Development in Brazil:

From where the following were obtained: i) Human Development Index in Municipalities

(HDI-M); ii) the Gini Index of municipalities.

Variables of level 1.
a) Demographic Census 2010:
The demographic census in Brazil has periodicity of 10 years and the last survey was carried out in 2010. Using microdata of the sample the following data regarding teenagers between 14 and 17 years old, living in South Brazil (Paraná, Santa Catarina and Rio Grande do Sul States), were collected: a) person's characteristics: age, gender, whether the person works or not (dummy), monthly receiving of social benefits – Bolsa Família or Child Labor Eradication Program (PETI) (dummy); b) logarithm of family revenue per capita; mother's educational cycle (dummy); mother's race or gender (dummy); gender of the head of the family (dummy).

Concerning variables that represent family characteristics, mother's school level and race are highlighted. These variables are used to get the influence of family's social condition on and dropout. Other studies developed to evaluate the obtaining of schooling by a certain population included the race or gender as an explanatory variable, and some cases in which this variable presented non-significant results occurred (VASCONCELLOS, 2003; FERRÃO, BELTRÃO and SANTOS, 2013). The inclusion of race or gender of the mother is an original contribution for Brazilian research, besides of the models were estimated by applying multilevel method.

The gender of the head of the family was included in regressions to indicate the effect of the family structure on teenager's schooling. Besides, there is the per capita income of the family, included in analyses to verify how the economic condition of the family affects the individual choice to study.

Dependent variables were created as following:
a) Teenagers between 14 and 17 years old in the Southern region in Brazil who attend school were considered if they answered: "yes, public school" and "yes, private school". On the other hand, they were not considered as attending school if they answered: "no, but already attended", "no, never attended school". Value 1 was attributed to the variable school dropout, when the teenager claimed not to be a student; and value 0 was attributed for cases that the answer was affirmative.

For all regressions the weighting factor for the sample was applied, which permits to perform the analysis for the total estimated population of teenagers.

3. School dropout: empirical evidences

In this topic, the results of the hierarchical logit model for school dropout of teenagers in South Brazil are analyzed. Regressions in two levels were carried out: the first contains individual and family characteristics and the second level includes municipal indicators. Family and individual characteristics would have been grouped up in two distinct levels in case two or more people belong to the same family. However, the age of the population in the sample was limited to between 14 and 17 years old; therefore, just a few cases where two or more teenagers belong to the same family were found. As a result, family and individual characteristics were included in the same hierarchical level.

Some initial estimates were performed, including in the estimated models activities of the services' sector in the total of formal employment as an indicator of economic dynamism. However, the coefficient for the employment indicator in the services' sector was not significant and, besides, this variable was highly correlated to other indicators included in the regressions. Therefore, the option was to disaggregate the services' sector according to activities listed at CNAE and the ones with lower correlation – compared to other variables – and significant

results were chosen.

3.1. Estimated models for school dropout of teenagers in South Brazil

In Table 1 the odds ratio is presented for school dropout considering adolescents between 14 and 17 years old in the Southern region of Brazil and, in case the odds ratio value was higher than one, the coefficient of the independent variable was positive; for an odds ratio lower than one, the coefficient of the independent variable was negative. In Table 1, in models from 1 to 6, independent variables of levels 1 and 2 were added progressively, starting with the null model (model 1). The models were estimated for central variables on average and the result of the model 1 indicates that the average variation of school dropout is significant, which justifies the inclusion of explanatory variables to better interpret the factors that affect this variation.

In the model 2 of the Table 1 variables that represent individual and family characteristics were included, obtaining significant results for most of them. Results indicate that school dropout decreases with age, starting to increase at advanced age groups. The school dropout probability is higher for boys and lower for those who receive any social benefit from the Brazilian government. Among individual characteristics, information about the work of adolescent and school delay are the ones with higher effects on school dropout chances. For both, an inverted relation is observed, in which young workers and with school delay have higher probability to leave school.

The result presented concerning the work of adolescent might be an indication of the existence of a substitution effect between school attendance and the decision to continue in the labor market. In this case, teenagers that have taken the decision not to work have higher chances to stay at school. According to Ferro (2007) for Brazil the participation in income transfer programs reduced the probability to be inserted in the labor market, for children and teenagers. The existence of substitution effect between work and education can be highlighted, given that these programs have direct and indirect effect on educational insertion of teenagers – the direct effect might be proved in the estimation of the parameter associated to the social benefit. The indirect effect is given by the fact that the income transference reduced chances to enter the labor market and the leaving of the labor market increases the chances to remain at school.

The variable mother's education had a high significance level among variable that represent family characteristics. The increase of mother's education reduced the probability of school dropout. As for mother's skin color, only the indicator for Asian people was not significant and the results indicate that children of black, brown and indigenous mothers have higher chances to leave school when compared to those of white-skinned mothers. On the other hand, when the mother is the responsible for the family, the risk of children to leave school is higher compared to families that have the father as the head of the family. Usually, in cases where women are the head of the family, the family has a single parent, which leads it to be socially and economically more vulnerable.

The per capita family income also affect the chance of school dropout and, in this case, the lower the family income, the greater the chances of a student dropping out school. As a result, the family structure influence on the individual decision to continue to study or leave school is extremely important.

Other studies from Brazil and other countries reached similar results, especially the one developed by Collares (2010), which demonstrated that the increase of one unit in the logarithm of the family unit increased the enrollment chance in 1.9 times in the public educational sector and in 2.8 times in private institutions. Education, from both father and mother, had also had positive effects on the enrollment rate, being higher among public rather than private

institutions. The author says results were compatible with the theoretical forecast, given that the decision to enroll in private institutions has a strict relation to the income, and the probability to enter in a public institution depends more on the encouragement and education of parents.

Riani (2005) evaluated the probability to attend school at the appropriate age. Comparing high school and elementary school, the author highlighted that the impact of individual features and family background was significant and way higher for high school, having a great impact of mother's education. Tansel (2002) showed that the income of adults in the family affected positively the enrollment decision and the increase of education among people between 14 and 20 years old, in Turkey. The author also found positive and significant result for father and mother's education, which led him to affirm that it would be necessary to adopt compensatory policies in population groups where fathers have low schooling level.

In model 3 of Table 1, it can be observed that the inclusion of municipal indicators changed odds ratio of some level 1 variables, and the hypothesis that municipalities present distinct values for the school dropout probability is acceptable. Among indicators initially included in the estimated model, Gini Index and the *ln* of per capita GDP were non-significant. The coefficient of HDI-M is significant and the odds ratio value indicates that in municipalities with higher HDI-M there is a decrease on the average of teenagers that leave school. The increase of the turnover rate, on the other hand, pushes up chances that teenagers leave school. The increase of the unemployment rate also pushes up significantly chances of the adolescent to drop out of school. For instance, the increase of 1 percentage point of unemployment rate increases the municipal average of school dropout in 12.3 times, and just 1.0 in the turnover rate. It is worth noting that a higher unemployment rate reduces chances to enter the labor market for the teenager, which are even harder in cases that adolescents are looking for their first job (POCHMANN, 2007).

Municipal indicators of formal employment were included in the regression presented in the model 4, which changed the result of the unemployment rate, which stopped being significant. The calculation of the unemployment rate takes into account the total employment of employed population, including formal and informal workers. The existence of a correlation among those economic indicators led the inclusion of employment indicators to interfere on the unemployment rate. In model 5 it was observed if there were significant changes in the results for employment indicators, when the indicator for the unemployment rate was excluded. There was a slight change of odds ratio values, but has not changed the interpretation concerning employment indicators.

For formal employment indicators, it is observed that only the indicator for construction industry was not significant. According to Rais data, in 2010, among formal workers in South Brazil inserted in the construction industry, 31.57% had completed elementary school; 12.05% had not finished high school; and 9.11% had not completed elementary school, they are 52.73% of total formal workers in the construction industry. This information reveal that jobs in the construction industry are mainly precarious, leading them to be little attractive for adolescents with higher education, which contributes to understand the non-significance of this indicator.

Other indicators of formal employment were significant and values for odds ratio were smaller than one, which reveals the existence of negative coefficient. In this case, the higher the employment levels at industry, or retail sales companies, or public administration, or farming, the lower the chances of school dropout at high school. This and other results previously described for municipal indicators confirm that social and economic conditions of the municipality affect the decision of school dropout, for both individual and family.

Table 1. Estimates of hierarchical models for school dropout among teenagers aged 14 to 17 years – Brazil – Southern region (*odds ratio*)

Continues...

EXPLANATORY VARIABLES	MODEL 1		MODEL 2		MODEL 3		MODEL 4		MODEL 5		MODEL 6	
	Odds ratio	Standard deviation	*Odds ratio*	Standard deviation	*Odds ratio*	Standard deviation	*Odds ratio*	Standard deviation	*Odds ratio*	Standard deviation	*Odds ratio*	Standard deviation
Intercept	0,1299*	0,0128	0,0797*	0,0180	0,0765*	0,0195	0,0732*	0,0210	0,0735*	0,0207	0,0719*	0,0199
Municipal indicators												
HDI-M 2010					0,6028*	0,4210	0,1361*	0,5250	0,1252*	0,5125	0,1340*	0,5327
Turnover rate					1,0093*	0,0013	1,0043*	0,0014	1,0044*	0,0014	1,0045*	0,0014
Unemployment rate					12,3433*	0,6967	3,3395	0,7529			2,0425	0,7679
Gini Index					0,7696	0,2652	1,1187	0,2846	1,1943	0,2804	1,0527	0,2799
Ln of Gross National Product *per capita*					0,9566	0,0327	0,8944*	0,0350	0,8930*	0,0342	0,8939*	0,0341
Indicator Industry Employment							0,6627*	0,1677	0,6067*	0,1571	0,7770	0,1623
Indicator Construction Industry Employment							1,1631	0,4077	1,0656	0,3974	1,2005	0,4004
Indicator Retail Sales Employment							0,3685*	0,2736	0,3417*	0,2669	0,4065*	0,2611
Indicator Public Adm Employment							0,3108*	0,1909	0,2758*	0,1738	0,4347*	0,2074
Indicator Farming Employment							0,5543*	0,2187	0,5372*	0,2129	0,7125	0,2131
Size of population (>= 50.000 was omitted)												
Population up to 4,999 habitants											0,8009*	0,0610
Population from 5,000 a 49,999 habitants											0,8946*	0,0376
Individual level variables												
Age			0,0262*	0,3042	0,0263*	0,3039	0,0263*	0,3039	0,0263*	0,3039	0,0264*	0,3039
Age squared			1,1499*	0,0098	1,1498*	0,0098	1,1497*	0,0098	1,1498*	0,0098	1,1496*	0,0098
Gender (boy=1)			1,1670*	0,0211	1,1683*	0,0211	1,1694*	0,0211	1,1698*	0,0211	1,1695*	0,0211
Residence situation (urban=1)			1,0068	0,0287	0,9810	0,0299	0,9691	0,0303	0,9755	0,0299	0,9638	0,0306
Works (yes = 1)			2,2616*	0,0286	2,2769*	0,0287	2,2813*	0,0287	2,2755*	0,0287	2,2839*	0,0287
Social benefits (yes = 1)			0,4652*	0,0601	0,4650*	0,0603	0,4662*	0,0604	0,4665*	0,0604	0,4670*	0,0604
School delay (yes = 1)			2,3319*	0,0342	2,3220*	0,0343	2,3150*	0,0343	2,3157*	0,0343	2,3123*	0,0343

Continuing...

EXPLANATORY VARIABLES	MODEL 1		MODEL 2		MODEL 3		MODEL 4		MODEL 5		MODEL 6	
	Odds ratio	Standard deviation	*Odds ratio*	Standard deviation	*Odds ratio*	Standard deviation	*Odds ratio*	Standard deviation	*Odds ratio*	Standard deviation	*Odds ratio*	Standard deviation
Residence state (SC was omitted)												
Paraná			0,9384**	0,0327	0,8543**	0,0357	0,9026*	0,0358	0,9134*	0,0354	0,8950*	0,0350
Rio Grande do Sul			0,7192*	0,0339	0,9220*	0,0357	0,7250*	0,0343	0,7297*	0,0342	0,7207*	0,0342
Mother's education (no education was omitted)												
Elementary School			0,6857*	0,0311	0,6857*	0,0314	0,6866*	0,0315	0,6868*	0,0315	0,6859*	0,0315
High School			0,5163*	0,0307	0,5170*	0,0310	0,5182*	0,0311	0,5184*	0,0311	0,5174*	0,0312
Higher education			0,4595*	0,0417	0,4626*	0,0419	0,4643*	0,0421	0,4640*	0,0421	0,4640*	0,0420
Mother's race (White-skinned was omitted)												
Black			1,1274**	0,0526	1,1269**	0,0528	1,1285*	0,0530	1,1301**	0,0530	1,1269*	0,0530
Asian			1,1651	0,1089	1,1632	0,1091	1,1647	0,1091	1,1645	0,1090	1,1642	0,1092
Brown			1,1927*	0,0229	1,1928*	0,0228	1,1958*	0,0228	1,1965*	0,0227	1,1956*	0,0228
Indigenous			1,5768*	0,1777	1,5634*	0,1770	1,5635*	0,1770	1,5654*	0,1771	1,5658*	0,1773
Gender of the responsible for the family (man=1)			0,8727*	0,0247	0,8757*	0,0245	0,8766*	0,0245	0,8761*	0,0245	0,8775*	0,0420
LN family income *per capita*			0,8542*	0,0092	0,8543*	0,0094	0,8535*	0,0094	0,8534*	0,0094	0,8538*	0,0246

Source: Research results.

Note: *Indicates significance at the 1% level; **Indicates significance at the 5% level; *** Indicates significance at the 10% level.

Becker (1991) indicates that a family defines its utility function considering goods that might be consumed in the present and in the future, dependent on a budget constraint. The decision to consume some of these goods might be understood as an investment decision, because it depends on the future return rate and on the possibility of well-being improvement, for both individuals and family, over time. Among goods that depend on the analysis referring to the return rate, the human capital is highlighted. For the author, the return of the investment on human capital is the salary rate obtained in the labor market. The labor market dynamics affects the salary rate and, as a result, the decision to invest on the human capital of children in families. For adolescents, the increase of formal employment availability in some sectors of economic activity and the decrease of unemployment rate favor to encourage the investment on human capital and, consequently, reduce school dropout.

The model 6 of Table 1 incorporates all variables of levels 1 and 2, adding binary variables for the size of population in municipalities. Results show that, in municipalities with small population, the probability of school dropout is lower compared to municipalities with great population (50,000 people or more). It is worth noting that employment indicators in farming and industry became non-significant when the size of population in municipalities is included. This result was expected given that, in some sectors, the choice to settle a company considers the population of the city.

4. Conclusions and remarks

The main objective of this paper is to evaluate the determinants of school dropout for teenagers aged between 14 and 17 years, from Southern Brazil. This study aims specifically to investigate the influence of individual and family characteristics, likewise social and economic conditions of the municipality, on the decision regarding the school level, of people with an ideal age to be at high school. In order to perform that, a hierarchical logit model was applied to data from 2010 Demographic Census, along with other social and economic information that was obtained for the average of municipalities.

Main results of estimated models highlighted the importance of individual and family characteristics on the educational decision of teenagers. Among individual characteristics, there is the higher probability of both school dropout among boys rather than girls. When in the labor market, most working adolescents are male, and they also receive higher remuneration than female workers. As a result, the trade-off between education and work is higher for working among male teenagers, which explains the higher interest and dedication of girls for school. Besides, the job increases in 2.26 times the probability of school dropout, but it has the effect to reduce school delay. Most working adolescents, independently of being boys or girls, are inserted in informal jobs. As a conclusion, the fact that the person is inserted in the labor market increases chances of school dropout; however, teenagers who choose to study but still need to work, have education as an opportunity to leave informality, which would explain the negative relationship between being in the labor market and school delay.

A very important aspect concerning family characteristics is the fact that mothers who have studied up to elementary school, high school or higher education contribute to reduce chances of both school dropout compared to mothers without education. Mother's race was also included in the estimated models as an indicator of social condition of the family, and the fact that the mother is brown, black or indigenous increases the school dropout of teenagers compared to a white-skinned mother. School dropout have negative and significant relationship with family income per capita. Besides, if the head of the family is a woman, chances of school dropout and delay increase, and likely because most of these families are single parent, therefore, women take care of kids alone.

Receiving a social benefit from the federal government also favors the reduction of

school dropout. This change on social benefit effect might be explained by the fact that government programs of income transference encourage to enter at school

The empirical contribution of this paper was the inclusion of indicators of the social and economic dynamics of municipalities as a source of explanation for dependent variables, as well as estimated by multilevel. Main results of estimated models highlighted the importance these variables. The HDI-M influences on school dropout, given that in municipalities with a better human development there is an average reduction this educational indicators. The employee turnover rate was included in regressions as an indicator of precariousness in the formal labor market, leading to increases of school dropout. Indicators of formal job at industry; and retail sales and public administration decreased dropout school. The unemployment rate had a higher effect compared to what was observed for other explanatory variables, proving its importance, in the condition of a thermometer of labor market conditions, from the point of view of teenager and family.

The conclusion for these groups of findings is that isolated public policies do not have the desirable effect on the educational level of teenagers. Once the importance of family and individual characteristics is proven, the maintenance and improvement of social policies already existing in Brazil, which aim to improve per capita family income and educational conditions of mothers and responsible people for the family, are suggested. Besides policies that improve social and economic characteristics of families, a group of coordinated actions that encourage employment levels and economic activities is extremely important. The teenagers decide to stay at school observing the reality in which they are inserted. Therefore, it can be concluded that, besides policies that improve social and economic conditions of families, a group of coordinated actions is extremely important to favor employment levels and economic activity

In spite of being approved in 2013, the law that aims to transform high school supply conditions similar to what has been observed since 1996 for elementary school (basic education as an obligation of government, family and society) the lack of effectiveness of this law has been observed in Brazil. Meanwhile, results of this research continue valid.

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