IMPACTS OF SOCIAL AND ECONOMIC FACTORS IN MUNICIPALITIES ON THE DETERMINANTS OF SCHOOL DELAY IN SOUTHERN BRAZIL

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Resumo: Nesta pesquisa, objetivou-se analisar os fatores que influenciam a probabilidade de atraso escolar, dos estudantes com idade entre 14 e 17 anos, residentes na região Sul do Brasil. Para tanto, estimou-se um modelo *logit* hierárquico no qual verificou-se os efeitos tanto das características individuais e familiares, quanto de indicadores socioeconômicos municipais sobre as chances de um adolescente atrasar-se na escola. Nos resultados obtidos comprovou-se que filhos de mães pardas, negras e de descendência indígena tem maiores chances de estarem em condição de defasagem escolar, na comparação com filhos de mães brancas. Do mesmo modo, quanto maior a escolaridade da mãe e maior a renda família *per capita*, menores as chances de atraso escolar. Dentre os indicadores municipais, tem-se que em municípios para os quais os indicadores de emprego formal são positivos, tem-se uma redução da probabilidade de atraso escolar. Destaca-se a forte influência da taxa de desemprego, pois um aumento do seu índice conduz a um aumento expressivo da defasagem escolar. Conclui-se, assim, que políticas públicas preocupadas em combater o atraso escolar entre os adolescentes devem ser realizadas de forma encadeada com estratégias que conduzam a melhoria das condições socioeconômicas dos municípios e à redução da precariedade do mercado de trabalho.

Palavras-chaves: Adolescentes. Atraso Escolar. Indicadores socioeconômicos. Mercado de trabalho. Municípios do Sul do Brasil.

Abstract: The main objective is to analyze the factors that influence the probability of school delay of students between 14 and 17 years old, living in the South region of Brazil. Hierarchical logit models were estimated in which tests show that the effects of both individual and family traits and municipal socioeconomic indicators affect the chances of an adolescent being behind in school. In the results obtained, it was found that children of brown, black, and indigenous descent mothers are more likely to be in school delay conditions when compared to children of white mothers. The increase in the mother's schooling and per capita family income reduces the chances of school delay. The positive indicators of formal employment were essential to reduce the probability of school delay. The strong influence of the unemployment rate is noteworthy since an increase in this index leads to a significant increase in the school delay. Thus, it can be concluded that public policies concerned with countering school delay among adolescents should be carried out in a way that is linked to strategies that lead to the improvement of the socio-economic conditions of municipalities and the reduction of the precariousness of the labor market.

Keywords: Adolescents. School delay. Socioeconomic indicators. Labor market. Municipalities in the South of Brazil.

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1. INTRODUCTION

Most developing countries have greatly expanded investment in education in recent decades, with considerable growth in enrollment rates expressed as a proportion of the eligible population. An important argument for expanding schooling in the developing world is that researchs on rate of return to schooling based on salary as well as other labor market

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results suggest high rates of return to investment in schooling, and especially primary schooling (Behrman and Deolalikar, 1991).

However, advances in the school system also carry problems, school dropouts and school delay have expressed the most common ones. Discussions on repetition, as well as its combination with school dropout, are often included in larger "waste" discussions, in the sense of indicating missed opportunities associated with not completing the school cycle. In developing countries, dropout and delay are complex phenomena that need to be understood in the context of socio-economic problems and inadequacies of the education system (Graeff-Martins, 2006). However, the two phenomena are quite different in their causes and consequences. Both tend to be together in both data and estimates and policy debate. The combination of high evasion and repetition rates was identified as one of the main failures of the Brazilian educational system (Gomes-Neto and Hanushek,1994).

Formal education and training on job would be the most critical investments in human capital since empirical evidence indicates the positive influence of high school and undergraduate education on personal income. Besides monetary gains, education is responsible for several non-monetary improvements in people's lives, such as investment in health, birth control, and increased popular participation in political issues (Becker, 1993). The family's decision to have their children attend school is based on two primary conditions: the rate of return on the child's investment in human capital and the altruism of the parents. Family altruism has been directly responsible for the allocation of a large fraction of resources. More than this, families are responsible for a sensitive part of economic activity, including the consumption of education, health, and other human capital goods for their members (Becker, 1991).

The family makes choices related to the education of their children, taking into account the economic factors and the possibilities of return for each level of education. In the rational choice model, educational decision making occurs through the analysis of the child's and his/her parents' choice based on the expected benefits, costs, and probability of success for different educational alternatives, considering the influence of social origins (Breen and Jonsson, 2005). In the process of educational choice, the individual not only chooses when to enter a particular level of education or not but also decides, simultaneously, the amount of education he or she intends to obtain for that particular level. In this case, there are important factors that influence the decision process, and the probability of school success (or of school delay) would be one of these factors (Jiménez and Salas-Velasco, 2000). Thus, school delay could lead to a preference for insertion in the labor market, which leads to the understanding that school delay is an indication of precariousness of the school system and early entry into productive activities (Breen and Yaish, 2006).

In Brazil, it is compulsory[d] to enroll children aged six years in the first grade of elementary school. If there is no failure or drop-out during the nine years of elementary school, a young person or adolescent begins the first year of high school at the age of 14, and also, in the case of failure or drop-out, the completion of primary education will occur at 16 or 17 years of age, depending on the date on which the student's birthday occurs.

Also, in the case of Brazil, it was only in the late 1990s and early 21st century that a set of public policies aimed at youth and especially to increase opportunities for students (Sposito and Carrano, 2003). The National Education Plan (PNE) approved in 2014, with a validity of ten years, includes in its guidelines the universalization of school attendance; the improvement of the quality of education; and the formation for work and citizenship, with emphasis on the moral and ethical values on which society is based. The third goal of the PNE includes the universalization, by 2016, of school attendance for the entire population between

[d] Federal Law Nº. 12,796 of April 4, 2013, amended some provisions of the LDB of 1996, among them, the compulsory high school and the minimum age for entry into primary education (BRASIL, 2013a).

15 and 17 years of age, in addition to raising the net high school enrollment rate to 85% by the end of the PNE's period of validity.

The Brazilian government expresses the concern about the country's primary and fundamental education in the Youth Statute, approved in 2013, which reveals the need to double the expansion speed of the last ten years, in case Brazil has as a goal a level of education corresponding to complete high school for young Brazilians (NOVAES *et al.*, 2006). The educational scenario in Brazil is bad, the rates of educational income are meager, and there are differences regarding the levels of education achieved by different social strata, as well as the indicators of the various regions of Brazil, states, and even between municipalities in the same state.

Brazil has enormous economic and social heterogeneity due to its territorial extension and forms of occupation. Therefore regionalized studies are essential to reflect better the phenomenon studied. The South region and its states - Paraná, Santa Catarina, and Rio Grande do Sul - can be compared in a more balanced way due to the similarity of per capita income level and productive structure. Despite this greater homogeneity of the states of this region, intraregional disparities prevail. Possible social and economic differences in municipalities may, to some extent, be reflected in the educational policies and educational trajectory of adolescents.

In Brazil, in 2012, the pass and failure rate in high school was 78.7% and 12.2%, respectively, while the dropout rate reached 9.1%. In the South region of Brazil, the failure rate was higher than that observed for the country (13.6%), while the dropout rate was lower, reaching 7.8%. In the state of Rio Grande do Sul, the high school dropout rate was 10.3%, 7% in Santa Catarina, and 6.2% in Paraná (Brazil/MEC/INEP, 2012). In 2012, 87.2% of the total of 14,000,422 Brazilian adolescents between the ages of 14 and 17 were studying. Of these, only 49.27% were attending any of the three high school grades, which corresponds to 6.02 million people. In the South region, 85.45% of the total young people and adolescents were students, of which 55.37% were in high school, totaling 901,589 individuals (IBGE/PNAD, 2012).

Given the above, the objective of this research was to analyze the factors that influence the probability of school delay of students between 14 and 17 years of age, living in the southern region of Brazil. More specifically, the impacts of individual and family traits on school delay were verified, and also the influences of municipal socioeconomic indicators on the probability of adolescents falling behind in school. The variables associated with municipalities are barely known to the Brazilian reality, so it is a contribution to the empirical literature.

To achieve the proposed objectives, a hierarchical *logit* model was applied to estimate the probability of school delay considering individual and family traits as first-level variables from the microdata of the 2010 Demographic Census. The municipal socioeconomic indicators were identified as level 2 variables from several databases, all for the year 2010. The 2010 Demographic Census is the only source of data that can be disaggregated at the municipal level, and that gathers individual characteristics of the Brazilian population.

2 METHODOLOGICAL PROCEDURES

Investment in human capital, both for individuals and families, is directly related to expectations of future returns. However, this investment implies direct costs associated with the sacrifice of the consumption of goods and services in the present period, in addition to opportunity costs related to the delay in entering the labor market. Investment in education is made to maximize lifetime wealth, so individuals and/or families will continue to invest as

long as the marginal rate of return to additional education exceeds the direct and indirect costs deemed relevant (Becker, 1962; Becker and Tomes, 1979; Becker and Tomes, 1986).

For an Educational Production Function, investment in human capital can be measured both by estimates that evaluate the choice of the ideal educational level to be attained by a child; and by estimates that analyze the factors associated with school delay. The socioeconomic factors of the family and the inputs from the community and school have significant importance in the educational outcome of children (Rios-Neto, Riani, and Cesar, 2003). The probability of a child or young person being in the ideal grade is related to the composition of family traits, which vary in the sense of improving educational indicators. In the Brazilian case, this effect decreases over time (Vasconcellos, 2003). In Brazil, the schooling of parents is a critical determinant of the schooling of children and young people, more than the family environment and other variables representative of educational and community services (Barros *et al*., 2001). The probability of school delay in Brazilian elementary school suffered a negative impact on the schooling of the person responsible for the family, of *per capita* family income, and of improvements in school infrastructure (Pontili and Kassouf, 2008).

School performance may be influenced by observed and unobserved individual traits (talent and willingness to continue studying), by the socio-economic conditions of the student, as well as by the economic and social conditions of the region where he or she lives (Leon and Menezes-Filho, 2002). The characteristics of the labor market also affect the dedication to studies, especially for adolescents living in developing countries (Souza *et al*., 2012). This is because, on the one hand, employment opportunities can be an alternative to formal education; on the other hand, the expectation of higher wages as a result of investment in human capital can mean a stimulus to stay and advance in school. Taking into account these thoughts, the model to be applied in this research was developed.

2.1. ECONOMETRIC MODEL

Some research developed for the analysis of educational factors employed data distributed on two levels, with the first level containing variables of individual and family traits, and the second level including school or community inputs. In this case, the structure of the databases has a hierarchical nature and, *when treated conventionally, can cause a systematic bias of underestimation of the aggregate variable* (Riani, 2005, p. 49). This is because one of the assumptions that the error variance is constant would be broken. The application of hierarchical models has been one of the strategies to solve this problem.

The "hierarchical regression model" or "multilevel regression model" has been increasingly used in research in the humanities or applied social sciences because the social structure is composed of hierarchical levels. Guo and Zhao (2000) state that an example of multilevel social structure is the case of students grouped into classes or schools, as well as the case of individuals and their respective families, grouped into communities, neighborhoods or municipalities.

Statistically, a regression model is understood as multilevel when the explanatory variables are composed of a hierarchical structure, and there is a random effect that interferes with the first level variables. Thus, interactions between covariances measured at different levels affect the outcome of the dependent variable; ignoring the multilevel structure may result in bias in parameter estimates; when the group structure in the data is ignored, and the assumption of independence is violated, the classical regression model tends to underestimate standard errors (Guo and Zhao, 2000).

The most simplified multivariable model, containing an independent variable and the assumption that level 2 variability affects only the intercept, can be described as follows (Riani, 2005):

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

$$\beta_{0j} = \gamma_{00} + u_{0j} \quad (2)$$

$$\beta_{1j} = \gamma_{10} \quad (3)$$

Where:

y_{zj} is a variable that is continuously dependent on the *z*th unit of level 1 and the *j*th unit 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 in equation 2;

β_{1j} is the slope coefficient, which does not change in each unit of level 2.

Replacing equations 2 and 3 in equation 1 is obtained:

$$y_{zj} = \gamma_{00} + \gamma_{10}.x_{1zj} + u_{0j} + e_{zj} \quad (4)$$

In this model, the random effect of level 2 is represented by u_{0j}, and the random error of level 1 is e_{zj}. Both are assumed to be independent and follow a normal distribution with zero mean and constant variances σ^2_{uo} and σ^2_e. In this case, σ^2_{uo} is the variability between groups, and σ^2_e is the variability within the group. Thus, the y_{zj} variance is the result of these two variances and is given by:

$$\text{VAR}(y_{zj}) = \sigma^2_{uo} + \sigma^2_e \quad (5)$$

From the values of σ^2_{uo} and σ^2_e is calculated the intraclass correlation coefficient, whose measure indicates how much the variability of the dependent variable is given by the variation between groups, whose equation is:

$$\rho = \frac{\sigma^2_{u0}}{\sigma^2_e + \sigma^2_{u0}} \quad (6)$$

The ρ statistic varies between 0 and 1; the closer to 1 its result, the greater the variability of y_{zj}, which is due to the differences between the units of level 2; otherwise, values closer to 0 indicate greater homogeneity between the units of level 2 and little intergroup influence on y_{zj}.

In equation 4, the parameters of the fixed part of the model, common to all individuals, are represented by γ_{00} and γ_{10}; the slope parameter is the same for all units of level 2; the intercept is affected by the random effect, varying from one unit j to another and being represented by $\gamma_{00} + u_{0j}$.

The model can be extended, assuming that the slope also varies from one unit to another of level 2. With this, the system of equations is now composed as follows:

$$y_{zj} = \beta_{0j} + \beta_{1j}.x_{1zj} + e_{zj} \quad (7)$$

$$\beta_{0j} = \gamma_{00} + u_{0j} \quad (8)$$

$$\beta_{1j} = \gamma_{10} + u_{1j} \quad (9)$$

Replacing equations 8 and 9 in equation 7 we have:

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

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

In the model represented by equation 10, the random effect of level 2 affects both intercept (u_{0j}) and slope (u_{1j}); e_{zj} is the third component of the random effect, this being the error term of level 1. It is assumed that these three residual terms have a normal distribution with zero mean and constant variances: σ^2_{u0}, σ^2_{u1}, and σ^2_e, respectively. *Residuals in level 2 are assumed to be independent of, but correlated to, level 1 residuals, with covariance given by* σ_{u01} (Riani, 2005, p. 77).

For models with many explanatory variables and several levels; at the individual level the independent variable is y_{zj}, and the vector of the explanatory variables is X_{1zj}; at the group level the vector of the explanatory variables is Z_j, and the system of equations is thus represented (Hox, 1998; Valente and Oliveira, 2009):

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

$$\beta_{0j} = \gamma_{00} + \gamma_{01}.Z_j + u_{0j} \quad (12)$$

$$\beta_{1j} = \gamma_{10} + \gamma_{11}.Z_j + u_{1j} \quad (13)$$

Where:

β_{0j} and β_{1j} are, respectively, estimated parameters of the intercept and the explanatory variable of level 1, assumed as random from equations 12 and 13;

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 the explanatory variables of the group level on the structural relationship of the student level;

γ_{00} and γ_{10} are, respectively, the estimated intercept and slope values when Z_j is equal to zero.

Replacing 12 and 13 in 11:

$$y_{zj} = \gamma_{00} + \gamma_{10}.X_{1zj} + \gamma_{01}.Z_j + \gamma_{11}.Z_j.X_{1zj} + u_{1j}.X_{1zj} + u_{0j} + e_{zj} \quad (14)$$

In general, when there is more than one explanatory variable in the two 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). Thus, we have the following general equation:

$$y_{zj} = \gamma_{00} + \gamma_{p0}.X_{pzj} + \gamma_{0q}.Z_{qj} + \gamma_{pq}.Z_{qj}.X_{pzj} + u_{pj}.X_{pzj} + u_{0j} + e_{zj} \quad (15)$$

According to Valente and Oliveira (2009), the first part of the right side of equation 15 - $\gamma_{00} + \gamma_{p0}.X_{pzj} + \gamma_{0q}.Z_{qj} + \gamma_{pq}.Z_{qj}.X_{pzj}$ - is known as the fixed part of the model, and the second part of the right side - $u_{pj}.X_{pzj} + u_{0j} + e_{zj}$ - is known as the random part. The term $u_{1j}.X_{1zj}$ is understood as the interaction between the random effects of slopes and the vector of explanatory variables X.

In this research, the dependent variable was binary, and the binary variable model is equivalent to the linear regression model, except for the concept adopted for the dependent variable (Guo and Zhao, 2000). In this case, the binary response for individual z, in group j is defined as the probability of response equal to 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 at both levels, is given by:

$$\eta_{zj} = \ln\left(\frac{\pi_{zj}}{1-\pi_{zj}}\right) = \gamma_{00} + \gamma_{p0}.X_{pzj} + \gamma_{0q}.Z_{qj} + \gamma_{pq}.Z_{qj}.X_{pzj} + u_{pj}.X_{pzj} + u_{0j} + e_{zj} \quad (16)$$

being η_{zj} the log of the individual's chance of success and π_{zj} the probability of success for individual z. The predicted value of η_{zj} can be converted into the predicted value of the probability, according to the equation:

$$\pi_{ij} = \frac{1}{1+\exp(-\eta_{ij})} \quad (17)$$

The calculation resulting from equation 17 is called *the odds ratio*, or chance ratio. Thus, if the *odds ratio* is higher than one, it means that the *logit* model coefficient has a positive sign, and the independent variable associated with that coefficient increases the chances of success of the event under study. On the other hand, an *odds ratio* smaller than one indicates the existence of a coefficient with a negative sign and the fact that the explanatory variable reduces the chances of success for the event in question. For an *odds ratio* equal to

one, the associated coefficient was equal to zero, and the explanatory variable does not affect the event (Power and Xie, 1999).

In the model of equation 16, the probability density function is identical to that observed for a common logistic regression, the regression follows the maximum likelihood estimation, and the solution requires macro and numerical microinteractions (Hox, 1998; Guo and Zhao, 2000; Valente and Oliveira, 2009).

The models of equation 16, as well as the odds ratio of equation 17, were estimated to investigate the probability of a student *z*, aged 14 to 17, living in the southern region of Brazil, having fallen behind in his studies. We used the software *HLM* (*Hierarchical Linear and Nonlinear Modeling*).

2.2. DATABASE

The following databases were used in the research: Annual Social Information Report (Rais), IBGE Regional Accounts, Brazilian Human Development Atlas, and 2010 Demographic Census. The first three databases were the sources for the elaboration of municipal indicators, and the last one was used to obtain the variables at individual and family levels.

The Annual Social Information Report (RAIS) is an important data collection tool of the Ministry of Labor and Employment (MTE) that aims *to supply the needs of control of labor activity in the country, as well as to provide data for the elaboration of labor statistics and the availability of labor market information to government entities* (BRAZIL, 2013b). At RAIS the number of formal jobs at municipality level is available, its database has been used to calculate the municipal indicators called: participation of formal sector employment in relation to the total of formal jobs in the sectors: agriculture, livestock, forestry, fishing, and aquaculture; extractive and processing industries; construction; trade, repair of motor vehicles and motorcycles; public administration, defense, and social security. From this database, the formal sector's turnover rate was also calculated.

From the IBGE (Brazilian Institute of Geography and Statistics) Regional Accounts were obtained the Gross Domestic Product (PIB) of the municipalities, which was divided by the value corresponding to the total population and its information was transformed into *logarithm* to be used as an economic variable at the municipality level. The IDH-M and the Gini Index of the municipalities in the South region of Brazil were extracted from the Atlas of Human Development in Brazil.

The 2010 Demographic Census was the source of data on adolescents between 14 and 17 years of age and their families for the three states of southern Brazil (Paraná, Santa Catarina, and Rio Grande do Sul) from which it extracted the variables: age, home situation, gender, work status, insertion in the formality, usual monthly receipt of social benefit - bolsa-família or Programa de Erradicação do Trabalho Infantil (PETI), state of residence and *per capita* family income.

The dependent variable the school delay was identified according to the adolescent's age. Students aged 14 were considered to be behind in school if they were still in primary school, in a period shorter than grade 8 or 9. For 15-year-old students, the identification of school delay was corresponding to those who were in any period of elementary school. At 16, the school delay was related to the fact that they were attending any periods of elementary school or the first year of high school. 17-year-olds who were in the first or second year of high school and any periods of elementary school were also identified as being behind in their studies. In addition, for the entire set of adolescent students in the sample, those who declared that they were attending youth and adult education were also identified as being behind in their studies. In all situations, the variable school delay received nomenclature 1 for cases

where this condition was confirmed and received nomenclature 0 when, on the contrary, the adolescent was attending a period appropriate for his or her age.

4. DESCRIPTIVE STATISTICS

The level 1 variables have a total of 162,245 observations, and the level 2 variables have 1,188 observations that the number of municipalities in the Southern region of Brazil (Table 1). The average unemployment of municipalities was 3% in 2010, and the turnover rate was 34.8%. Formal employment was distributed as follows: 26% in the industrial sector, 29% in public administration, and 19% in commerce. The Gini index and the IDH-M reached 0.46 and 0.71, respectively. Besides, 55% of the municipalities were small towns with a population of 5,000 to 49,999 inhabitants. Of the total number of adolescent students, 44% were behind in school. The average age of students was 15 years, 52% were boys, 72% lived in urban areas, and 28% were inserted in the labor market. The majority of the mothers of the students were uneducated, i.e., 57%, and only 8% with complete higher education; and 76% of the mothers were white. The families of these students were mostly male-headed, representing 79% of the total.

Table 1 – Descriptive statistics of the variables.

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VARIABLES	MEAN	SD	MINIMUM	MAXIMUM
Municipal indicators				
HDI-M 2010	0.71	0.04	0.55	0.85
Turnover rate	34.80	11.51	5.84	138.81
Unemployment rate	0.03	0.02	0.00	0.15
Gini Index	0.46	0.06	0.28	0.72
Ln of Gross National Product *per capita*	9.69	0.40	8.68	12.32
Industry Employment Indicator	0.26	0.20	0.00	0.89
Construction Industry Employment Indicator	0.03	0.04	0.00	0.64
Retail Sales Employment Indicator	0.19	0.09	0.00	0.50
Public Adm Employment Indicator	0.29	0.19	0.00	0.92
Farming Employment Indicator	0.09	0.10	0.00	0.72
Size of population				
Population up to 4,999 habitants	0.36	0.48	0.00	1.00
Population from 5,000 to 49,999 habitants	0.55	0.50	0.00	1.00
Population >= 50,000 habitants	0.09	0.28	0.00	1.00
Individual-level variables				
School delay (yes = 1)	0.44	0.50	0.00	1.00
Age	15.33	1.08	14	17
Squared age	236.13	33.33	196	289
Gender (boy=1)	0.52	0.50	0	1
Area of residence (urban=1)	0.72	0.45	0	1
Working (yes = 1)	0.28	0.45	0	1
Social benefits (yes = 1)	0.05	0.21	0	1

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VARIABLES	MEAN	SD	MINIMUM	MAXIMUM
Individual-level variables				
Residence state				
Paraná	0.38	0.49	0	1
Rio Grande do Sul	0.25	0.43	0	1
Santa Catarina	0.37	0.48	0	1
Mother's education				
No education	0.57	0.50	0	1
Elementary School	0.17	0.38	0	1
High School	0.17	0.38	0	1
Higher education	0.08	0.27	0	1
Mother's race				
White	0.76	0.42	0	1
Black	0.04	0.19	0	1
Asian	0.01	0.07	0	1
Brown	0.18	0.39	0	1
Indigenous	0.01	0.04	0	1
Gender of the responsible for the family (man=1)	0.79	0.40	0	1
Ln family income per capita	5.94	1.22	0	12

Source: Research results.

The school delay is a problem that affects a large part of adolescents between 14 and 17 years of age and corresponds to 40.89% of Paraná's population and 40.23% of Santa Catarina's population in the (panel "a" of Figure 1). In Rio Grande do Sul, school delay is higher than in the other two states (50.32%). According to Menezes-Filho (2007), Brazilian school performance is much lower than that of countries with similar *per capita* income, mentioning Mexico, Tunisia, Turkey, and Uruguay. Souza *et al*. (2012) demonstrated that for every 100 students enrolled in the eighth grade at an adequate age, only 45% complete high school in an ideal condition, i.e., without school delay.

Panel "b" in Figure 1 shows that 45.9% of the residents in rural areas declared they were behind in their studies, while this percentage was 43.8% for residents of urban areas. In Brazil, the urban sector is much more advanced in educational terms when compared to the rural sector, presenting a lower rate of illiteracy among the population 15 years of age or older (Riani, 2005).

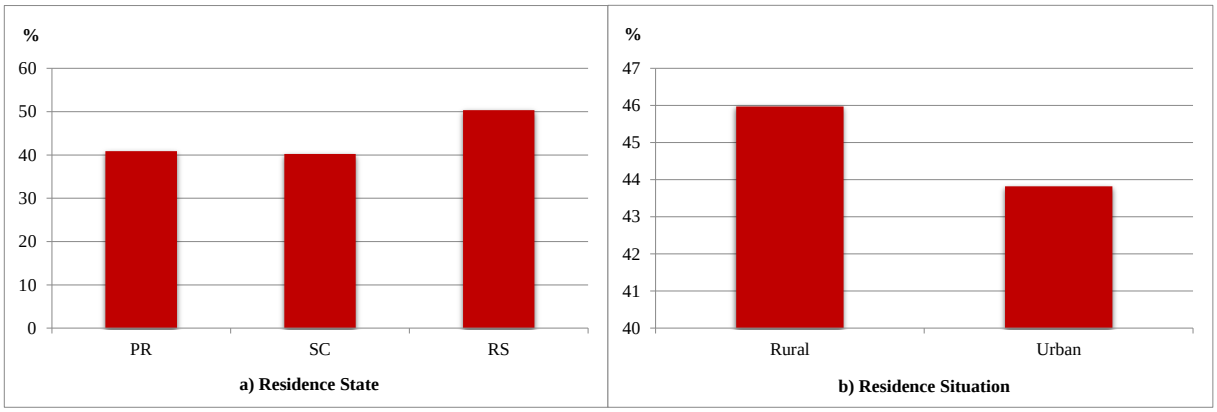

Figure 1 - Percentage of adolescent students lagging in school, aged between 14 and 17, living in the South region of Brazil, according to a) Residence State; b) Residence Situation.

It can be noted in panel "a" of Figure 2 that 36.9% of the female student had a delay in their studies, and for the male, it was much higher, 51.09%. The difference in the percentage of students with school delay who do not work and work is minimal, 44.82% and 42.24%, respectively. Filgueira, Filgueira, and Fuentes (2001) revealed the existence of a trade-off between education and work for young students in Latin America. According to Pochmann (2007), between 1995 and 2005, 65.3% of young Brazilians between the ages of 15 and 24 were active in the labor market, among whom only 46.8% were studying. In Brazil, the search for an increase in the level of schooling prevails, based on a combination with work activity, in which adolescent and young populations are characterized by being "worker/students" or "students/workers".

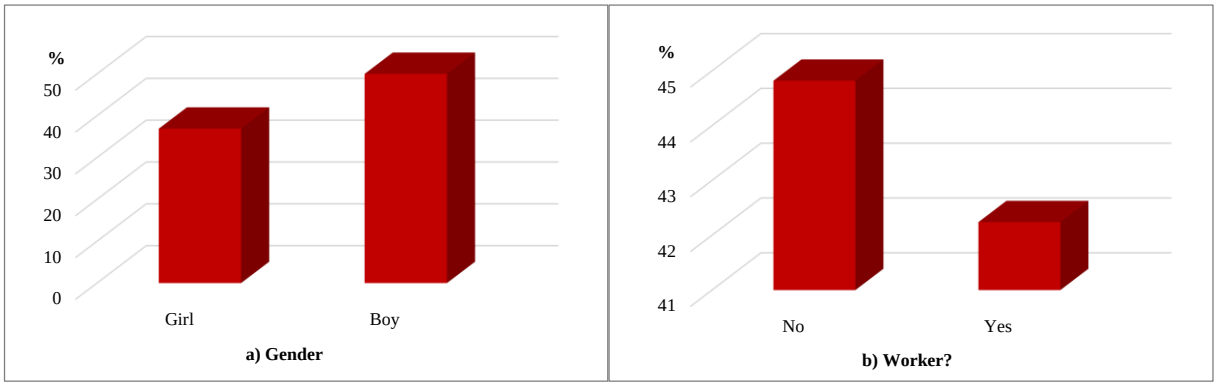

Figure 2 – Percentage of adolescent students lagging in school, aged between 14 and 17, residing in the South region of Brazil, according to: a) Gender; b) Worker.

The school delay of adolescent students, whose mothers were indigenous, is very high, followed by adolescents with black and brown mothers, 69.51%, 67.19%, and 57.96%, respectively. Among adolescents with white mothers, the school delay reached 43.04%, and for those with Asian mothers, it was 42.68% (panel "a" of Figure 3).

There is a tendency for a gradual increase in the conditions of school delay when the mother's schooling is reduced. Adolescents belonging to the group of mothers with complete higher education were only 18.76% behind in school, while for those included in the group of mothers with secondary education, the school delay increased to 31.21%. In the cases where the mothers had primary education, the school delay was 44.4% and reached 58.02% among those whose mothers were illiterate (panel "b" of Figure 3). These results are in line with other surveys, including Gomes's (2010) work in which it was proved that the mother's schooling and, therefore, family conditions contributed to improving the performance of students enrolled in public and private schools in the metropolitan region of São Paulo, Brazil.

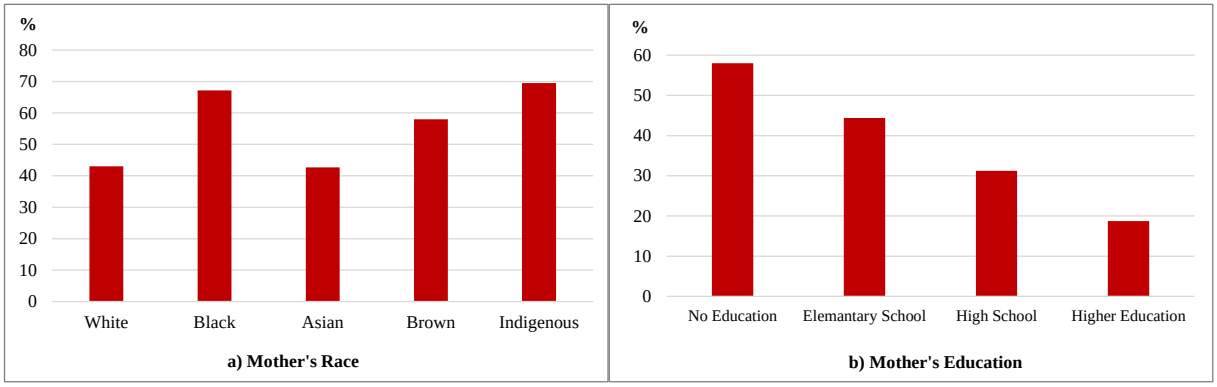

Figure 3 - Percentage of adolescent students lagging in school, aged between 14 and 17, living in the South region of Brazil, according to: a) Mother's race; b) Mother's education.

The gender of the person responsible for the family also seems to influence the school delay of adolescents living in the South region of Brazil (panel "a" of Figure 4). The number of adolescent students and delayed in school is 7.2 percentage points higher when they live in homes headed by their mothers, compared with families where the person responsible is male. Furthermore, 61.75% of adolescents belonging to families with *per capita* family income of up to half a minimum wage were behind in school. In the interval of *per capita* family income higher than half and up to one minimum wage, 48.66% of adolescents with school delay problems were found, and among those whose families had *per capita* income higher than two minimum wages, the delay was relatively low, 23.24% (panel "b" of Figure 4).

The proportion of children with school delay was higher for households in rural areas in Brazil, under the responsibility of women (Pontili, 2005). Handa (1996) showed that family *per capita* spending positively affected the enrollment rate for Jamaican people aged 13-19, and this effect was stronger for girls than for boys. According to Handa (2002), in Mozambique, interventionist public policies were able to raise *per capita* consumption for all families and generated positive impacts on the enrolment rate, particularly affecting families in more impoverished regions.

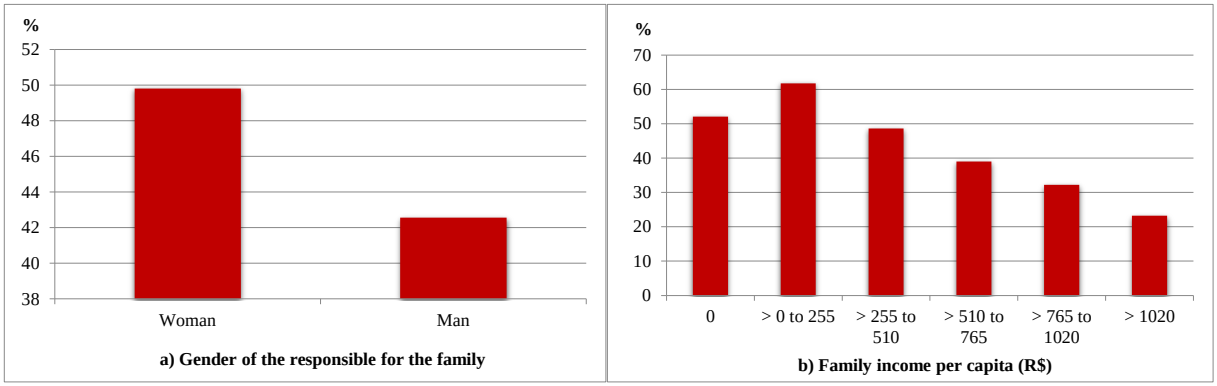

Figure 4 - Frequency of adolescent students lagging in school, aged between 14 and 17, living in the South region of Brazil, according to: a) Gender of the responsible for the family; b) Family income per capita (R$).

In Figure 5, it can be noted that the frequency of adolescents who are behind in school is higher for those aged 16 (46.75%). Among adolescents aged 15 and 17, the percentages were very close, 43.98% and 44.66%, respectively. Among adolescents aged 14, 41.96% had problems with school delay. These data are, according to Souza *et al.* (2012), who demonstrated that students with the proper age to attend a specific grade remain in the

education system and enroll in the next grade. Thus, the biggest problem of school flow in high school would be the difficulty in getting grade by grade approval. In this case, at later ages, an individual (or adolescent) may have faced repeated failure to pass, which would justify the higher percentage of individuals who are behind in school at the ages of 16 and 17.

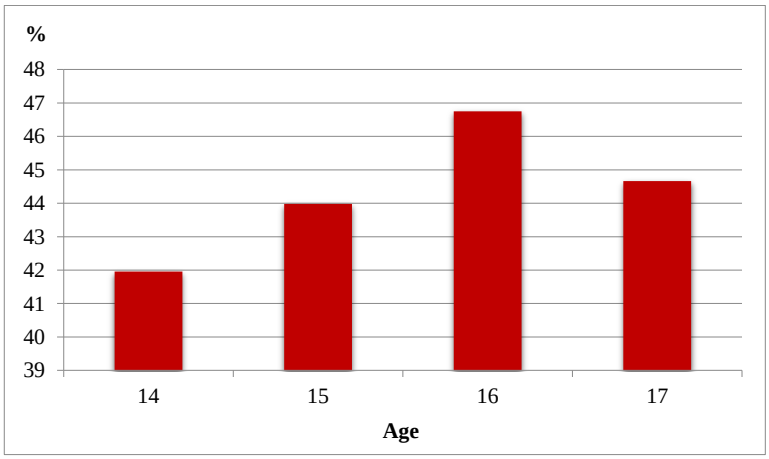

Figure 5 - Frequency of adolescent students lagging in school, aged between 14 and 17, living in the South region of Brazil, according to age.

5. DETERMINANTS OF SCHOOL DELAY: AN ECONOMETRIC ANALYSIS

Table 2 shows the results for the probability of school delay, and the strategy of estimating the models, including progressively the explanatory variables, was adopted. After preliminary tests, correlation and change in results were found. Model 1 confirms the existence of a random effect on the mean school delay, given the significance of the intercept of the equation, which changes in value with the inclusion of explanatory variables.

Model 2 shows the inclusion of level 1 variables, and model 3 presents the level 1 variables together with the first municipal indicators. The results show that for the Level 1 variables, the school delay is more significant among males, for adolescents who do not work and among those who receive social benefits. Wolfe and Behrman (1984); Pontili and Kassouf (2008); and Marteleto (2004) showed that female people have a better chance of advancing in studies than male people. According to the 2010 Demographic Census data, the percentage of working young men is higher when compared to women. Also, among adolescent workers in the South, who earned a minimum wage and a half, or more, 72.41% were male. The increase in the level of education contributes to reducing the poverty conditions of the female working population rather than the male population (Lopes, Pontili, and Almeida, 2012). Therefore, it is believed that for male students, the *trade-off* between education and work is more significant than for female students who make this decision. Thus, the dedication to studies is lower among young men, causing them to fall behind in school.

The school delay is less among working students. This result is consistent with the precarious insertion of students in the labor market since the vast majority of adolescent workers are inserted in the informal sector and receive remuneration of up to a minimum wage (Demographic Census, 2010). Thus, since these adolescent workers choose to remain in school and have the desire to change their current condition, moving from precarious and poorly paid occupations to higher-level occupations, this leads to a greater dedication to studies and reduces the chances of school delay when compared to non-working students.

The receipt of social benefits also contributes to increasing school delays, since the population eligible for these benefits is very poor, referring to families in which mainly the mother has low schooling. According to data from the 2012 School Census, 79.17% of

adolescents whose families received social benefits had uneducated mothers, and 17.92% had mothers who had only completed elementary school. Given the influence of the mother's level of education on the students' school performance, it is expected that the social benefit will also express the social and financial condition of the family. In Brazil, these benefits are conditioned on the enrollment of the children in school, but they are not conditioned on the student's performance, so the difficulties of these adolescents do not disappear with financial aid, which is minimal values.

Other social and economic characteristics of the family are essential determinants of school delay. For example, having mothers of black, brown, or indigenous ethnicity increases the probability of the student falling behind in the school cycle. The increase in *per capita* family income, and the fact that the father is responsible for the family also reduces the probability of school delay. Usually, in cases where women are responsible for the household, there is no partner within the household, they are single-parent families. This situation weakens these families socially and economically and interferes with their children's school performance.

Researches on factors that interfere with performance have grown significantly since the first half of the 20th century (Holmes, 1999; Tansel, 2002; Rios-Neto, Riani, and César, 2003). Thus, the importance of family participation in the child's education has been reaffirmed, together with public policies that contribute to improving the social conditions of the family and community environment in which the child or adolescent is inserted.

Attention is also drawn to the level 1 variable that represents the situation of the household, and its results indicate that the probability of school delay is higher in the urban area, when comparisons are made with the rural area. It was hoped, however, that the chances of school delay were higher in the rural area, considering that several studies report the difficulties faced by the rural population (Staduto and Kreter, 2014), especially by children and young students (Brazil, 2003).

The results for the employment indicators (model 3) show that the 1% increase in the unemployment rate increases the school delay of adolescents by 98.2 times. The impact of the unemployment rate on school delay is so strong that the inclusion of employment indicators in model 4 did not interfere with their level of significance, but only with the value of the ratio of chance, which nevertheless remained high (16.18). In addition, the increase in formal industrial employment, or formal employment in commerce, public administration, and agriculture, reduce the chances of adolescents falling behind in their studies.

According to Becker and Tomes (1979), investment in education continues until the individual, or the individual and his or her family, believe that the returns to be obtained from such investments are higher than the opportunity cost of consumption in goods and services at present. The results found for the labor market indicators show that adolescents who observe a promising formal labor market in their local reality and also the possibility of engaging in a less precarious occupation will study with more dedication and seek to finish high school.

Most of the formal jobs analyzed (industry, commerce, and public administration) are mostly in urban areas, on the other hand, in Brazil the unemployment rate in the urban area in the South was higher than in the rural area, being 4.59% in the first case and 2.3% in the second (PNAD, 2012). The demand for education is more significant in the municipalities with the most dynamic economy, but it is also in these municipalities that the unemployment rate is higher. Since the impact of the unemployment rate on school delay is more significant than the impact of formal employment indicators, this finding explains the fact that school delay was higher in urban areas[e].

[e] To confirm this finding, a variable represented by the mean of adolescents living in the urban area in the municipalities under study was created. The inclusion of this variable in the regressions would aim to verify the effect of the spatiality included in the regressions on the result for the variable indicating the situation of the

IDH-M has a positive effect on school delay, while the turnover rate has a negative effect. The logarithm of PIB *per capita* was significant only in model 3, and, in this case, increases in PIB *per capita* lead to an increase in school delay. In model 6, it is noted that in less populated municipalities, the school delay is lower when compared to more populated municipalities. It is believed that the indirect effect of the unemployment rate on the results of other variables, in this case, the municipal economic indicator (PIB per capita) and the population indicator. More populated municipalities and municipalities with high PIB *per capita* are also the municipalities where the unemployment rate is higher. Thus, even if the economic dynamics and wealth of the municipality are reasons for greater dedication to school, the indicator that adolescents and their families perceive more clearly is the unemployment rate, which discourages interest in studying and contributes to the increase in school delays.

Some studies are concerned with investigating the importance of community characteristics in the decision to obtain higher levels of education. Riani (2005) showed evidence for Brazil that the increase in the number of teachers available to teach in secondary school (at the municipal level) increases the probability of school attendance for the population between 15 and 17 years old. In Tansel (2002) estimates, population density and the teacher-student ratio were included, corroborating the idea that more densely populated communities interfere with the quality of education and reduce the likelihood of school enrollment, as well as increasing the teacher-student ratio. Wobmann (2003) verified the importance of school resources and teacher characteristics (such as salary and educational level) for students' school performance.

However, the contribution of this research was related to the concern to include economic indicators, especially those associated with the labor market, and social indicators that could capture the effects of the municipalities' characteristics on the school decisions of adolescents and their respective families.

The results presented here reveal that labor market conditions interfere with the school delay of adolescent students. These results resonate with human capital theory, especially the description by Simmons and Alexander (1978); Becker (1991); Schultz (1967) and Schultz (1973), for whom investment in education is associated with the rate of return, which is possible to be found when observing the dynamics of the labor market in the region or locality to which the adolescent and his family belong.

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household. However, the inclusion of this variable did not change the result for the situation of the household and still interfered with the results of other indicators. It was thus understood that the spatiality of the sample did not affect the individual-level variable for the situation of the household, and we opted for the exclusion of this variable at the municipal level.

Table 1 - Estimates of hierarchical models for school delay of adolescents between 14 and 17 years of age - Brazil - South Region - 2010 (*odds ratio*).

Continues...

VARIÁVEIS EXPLICATIVAS	MODEL 1		MODEL 2		MODEL 3		MODEL 4		MODEL 5		MODEL 6	
	Odds ratio	Desvio Padrão	*Odds ratio*	Desvio Padrão	*Odds ratio*	Desvio Padrão	*Odds ratio*	Desvio Padrão	*Odds ratio*	Desvio Padrão	*Odds ratio*	Desvio Padrão
Intercept	0,7841*	0,0135	0,7411*	0,0118	0,7160*	0,0121	0,6943*	0,0122	0,6997*	0,0122	0,6867*	0,0120
Municipal indicators												
IDH-M 2010					0,1197*	0,3791	0,0242*	0,4430	0,0198*	0,4294	0,0243*	0,4571
Turnover rate					1,0066*	0,0013	1,0020	0,0013	1,0021***	0,0013	1,0021***	0,0013
Unemployment rate					98,1968*	0,5725	16,1845*	0,6150			10,5684*	0,6002
Gini Index					1,1527	0,2182	1,0959	0,2308	1,2703	0,2274	1,0247	0,2229
Ln of Gross National Product *per capita*					1,0988*	0,0330	1,0544	0,0339	1,0511	0,0340	1,0529	0,0323
Industry Employment Indicator							0,4646*	0,1559	0,3777*	0,1503	0,5306*	0,1529
Construction Industry Employment Indicator							1,1007	0,3289	0,9001	0,3262	1,1310	0,3141
Retail Sales Employment Indicator							0,3683*	0,2643	0,3097*	0,2634	0,4018*	0,2548
Public Adm Employment Indicator							0,2881*	0,1640	0,2171*	0,1516	0,3782*	0,1852
Farming Employment Indicator							0,4599*	0,1744	0,4294*	0,1735	0,5649*	0,1743
Size of the municipality population (>= 50.000 was omitted)												
Population up to 4,999 habitants											0,8353*	0,0513
Population from 5,000 to 49,999 habitants											0,9052*	0,0309
Individual-level variables												
Age			3,2212*	0,1775	3,2495*	0,1775	3,2543*	0,1776	3,2477*	0,1776	3,2660*	0,1777
Squared age			0,9663*	0,0058	0,9660*	0,0058	0,9659*	0,0058	0,9660*	0,0058	0,9658*	0,0058
Gender (boy=1)			1,9830*	0,0173	1,9814*	0,0173	1,9817*	0,0173	1,1982*	0,0174	1,9816*	0,0173
Area of residence (urban=1)			1,1900*	0,0227	1,1741*	0,0232	1,1666*	0,0234	1,1787*	0,0233	1,1632*	0,0233

Continued...

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
Individual-level variables												
Working (yes = 1)			0,8197*	0,0199	0,8273*	0,0201	0,8291*	0,0201	0,8257*	0,0200	0,8299*	0,0201
Social benefits (yes = 1)			1,5440*	0,0332	1,5404*	0,0332	1,5408*	0,0333	1,5427*	0,0333	1,5418*	0,0333
Residence State (SC was omitted)												
Paraná			0,8913*	0,0312	0,8168*	0,0333	0,8104*	0,0323	0,8350*	0,0314	0,8065*	0,0318
Rio Grande do Sul			1,3354*	0,0280	1,2572*	0,0289	1,2592*	0,0285	1,2762*	0,0290	0,8058*	0,0283
Mother's education (uneducated was omitted)												
Elementary School			0,6369*	0,0169	0,6374*	0,0169	0,6378*	0,0169	0,6382*	0,0169	0,6376*	0,0169
High School			0,4007*	0,0200	0,4008*	0,0201	0,4011*	0,0201	0,4015*	0,0201	0,4009*	0,0201
Higher education			0,2413*	0,0405	0,2417*	0,0173	0,2419*	0,0405	0,2418*	0,0405	0,2418*	0,0405
Mother's race (white was omitted)												
Black			1,9942**	0,0544	1,988*	0,0547	1,9894*	0,0546	1,9939*	0,0545	1,9880*	0,0546
Asian			1,0674*	0,1202	1,0650	0,1199	1,0660	0,1200	1,0655	0,1201	1,0659	0,1200
Brown			1,5111*	0,0203	1,5062*	0,0203	1,5088*	0,0204	1,5107*	0,0204	1,5086*	0,0204
Indigenous			2,0164*	0,2043	2,0038*	0,2049	2,0003*	0,0205	2,0016*	0,2048	2,0016*	0,2049
Gender of the responsible for the family (man=1)			0,8076*	0,0173	0,8089*	0,0173	0,8093*	0,0173	0,8087*	0,0173	0,8097*	0,0173
LN family income *per capita*			0,8542*	0,0105	0,8066*	0,0106	0,8063*	0,0106	0,8059*	0,0106	0,8065*	0,0106

Source: Research results.

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

6. CONCLUSION

In this research, we analyzed the determinants of school delay, for adolescents aged between 14 and 17 years old in southern Brazil, applying a hierarchical logit model to the 2010 Demographic Census data, which included social and economic variables that were obtained for the average of the municipalities.

The main results of the estimated models highlighted the importance of individual and family traits on the probability of school delay, which is higher among young men when compared to young women. Furthermore, the fact of being working has the effect of reducing school delay. Most workers, regardless of whether they are male or female, are involved in informality. Thus, adolescents who choose to study but also need to work, see in education the opportunity to get out of informality, which would be an explanation for the negative relationship between insertion in the labor market and school delay.

A striking aspect concerning family traits is the fact that mothers with primary, secondary, or higher education contribute to the reduction in the chances of school delay when compared to mothers without any education. The color of the mother was also included in the estimated models as an indicator of the social condition of the family, and it was shown that the fact that the mother is brown, black or indigenous, increases the school gap of adolescents when compared to having a white mother. The school delay has a negative and significant relationship with per capita family income, and the fact that the person responsible for the family is female increases the chances of adolescents falling behind in their studies.

The results proved the hypothesis regarding the effect of municipal socioeconomic indicators. It was observed that the increase in formal employment in industry, agriculture, commerce, and public administration reduces the average number of adolescents lagging in studies. This effect was greater for employment indicators in public administration and industry. It was also found that: a) in municipalities with better human development, there is an average reduction in the education indicator, i.e., school delay; b) PIB *per capita* also negatively affects school delay. This means that in the most economically dynamic municipalities, there is a lower probability of high levels of school delay.

The turnover rate was included in the regressions as an indicator of labor market instability and showed that worsening formal employment conditions lead to an increase in the school delay. The unemployment rate had a greater effect than that observed for the other explanatory variables proving that it is an essential thermometer of labor market conditions from the point of view of adolescents and their families.

The results presented in this study proved that municipal social and economic indicators affect school delay. In this way, adolescents are deciding to dedicate themselves to studies from observations about the reality in which they are inserted. Since the local reality suffers the effect of the economic and social conditions of the region, the final decision of adolescents and their respective families is influenced by a set of economic and social factors chained together.

The conclusion for this set of findings is that isolated public policies do not have the desired effect on the educational level of adolescents. Considering the great importance of individual and family traits, it is suggested to maintain and improve the social policies already in place in the country, which aim to improve *per capita* family income, as well as the educational conditions of mothers and those responsible for families. In addition to policies that improve the economic and social conditions of families, it is of fundamental importance to have a set of coordinated actions that contribute to stimulating the level of employment and economic activity, especially in regions where the indicators are negative, characterizing the existence of poverty pockets.

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