A multilevel analysis of school enrollment and education attainment in Brazil: demographic dividend versus municipal school factors[*]

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ABSTRACT

This paper combines two traditions in the field of education in order to analyze the determinants of school attendance and education attainment in Brazil. The first tradition is associated with the demographic dividend and the other one with the importance of municipal level school factors.

The innovation of this paper is to match microdata from the Demographic Census with municipal level aggregate data from the same census, and also with municipal level school data from the 2000 School Census. This matching allows the estimation of a hierarchical model for the determination of school enrollment and grade progression in Brazil.

One of our conclusions is that the demographic dividend had a stronger impact on school enrollment and a smaller effect on grade progression. On the other hand, the impact of school variables at the municipality level is stronger for grade progression than for school enrollment. This impact is stronger in the case of grade progression in fifth as compared to first grade. Finally, the impact of family level socioeconomic variables is strong in all models.

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1) Introdução

This paper combines two traditions in the field of education in order to analyze the determinants of school attendance and education attainment in Brazil, based on the 2000 demographic census. The major innovation of this paper is to match the microdata of the demographic census with municipal level aggregate data from the same census and municipal level school data from the 2000 school census in Brazil. This matching allows the estimation of a hierarchical linear model for the determination of school enrollment and grade progression in Brazil.

The first tradition in the field of education comes from the economic demography literature associated with the demographic dividend. The main contribution in this area is the classic work of COALE & HOOVER (1958) associating the decline in the youth dependency rate derived from a decline in fertility with a diminishing number of enrollments, leading to governmental savings in educational expenditures. If not all school age children were enrolled, then this demographic dividend could lead to an increase in school coverage, via enrollment rate. In the context of the National Research Council Report, SCHULTZ (1987) questions this relationship based on the idea that school budgets are not so elastic in the short run, in addition other inputs such a class size and teachers' salary could become the adjustment variable. Almost all studies testing the demographic dividend hypothesis did it with macro level data, without any sort of control for the family background variables. It is unclear whether this demographic dividend hypothesis could also be relevant to the determination of education attainment measured by grade progression.

The publication of the Coleman Report in the 1960's stressed the importance of socioeconomic status family variables and suggested the absence of school effects in educational achievement, a finding that was later extended to educational attainment studies. There were larger achievement differences within schools than among schools. This finding sparked a variety of studies in developed and developing countries, trying to capture the impact of school and

educational policy variables in two main educational outcomes generally considered as dependent dimensions: education achievement and attainment (BUCHMANN, 2002). A conceptual framework presented by BUCHMANN & HANNUM (2001) integrates family decisions about education (demand) with school and community factors (supply). Although a great deal of research effort has been devoted to the connection between each of these factors and the educational outcomes, there has been a limited research focus on the interaction between these factors and their potential impact on educational outcomes.

The paper will test the importance of the demographic dividend (in the supply and demand framework) in the determination of enrollment rates, extending it to debate on education attainment through grade progression. In addition, it will test the importance of municipal level school factors on education attainment, extending it to the determination of enrollment rates. All these tests will control for family level socioeconomic variables with special emphasis to mother's education.

2) Literature review

In this section we present the two frameworks in education that are discussed in this paper. Firstly, we review the main works in the demographic literature that are associated to the demographic dividends. Then, we present some papers that deals with the determinants of education, specially for Brazil.

2.1) Population growth impact upon the educational system

One of the first studies that analyzed the influence of fertility and age structure on public expenditures in educational was done by COALE & HOOVER (1958). They projected the school age population in India for the period between 1956 and 1986 with two hypothesis of future fertility rates, one low and the other high. In this last regime, the number of persons in school age would be much greater than for the first one. Beginning with the assumption that there is not a budget restrain for the government expenditure and that this expenditure is elastic, they concluded that in a regime of high fertility rates, with a greater number of

school age children, would implicate in a higher number of enrollments in the educational system with a greater public expenditure in education.

SCHULTZ (1981) criticized this study and showed empirically with data from 89 countries that this positive correlation between school age population growth and increase in govern expenditure did not occur. That is, due to the govern budget restrain, the public expenditure in education would not increase in the same rate as the number of students, what would implicate in a lower expenditure per student.

For this author, same factors can diminish the public expenditure per student. Services prices can decrease due to economies of scale. Or the quality of the public educational system can deteriorate because of lower teacher's salaries or higher rates of pupils/teacher (class size). With this background, Schultz analyzed the impact of school age population growth on the educational system, not only due to the increase in the enrollment demand but also in aspects related to the quality of the education being offered by the government.

SCHULTZ (1981) based his analysis on cross-section data for countries in the seventies, period of prosperity in the world economy. It is doubtful if the same results would have been obtained with data from the eighties, period of crisis. KELLEY (1996) replied Schultz study in a in a transversal analysis with data from this last period, for 42 countries, 30 of them underdeveloped. The results showed that the public expenditure in education increased as a proportion of the GIP with an enlargement of the levels of income per capita and with an increased in urbanization. But it was also showed that the demographic dynamics had no impact upon this proportion. Contrary to what was proposed by SCHULTZ (1987), it was not observed am impact of this dynamics on the class size or on the pupil/teacher relation. His is still a mother of debate if the class size is a good indicator of quality but, anyhow, KELLEY (1996) work does not corroborate Schultz hypotheses. If there is not a strong correlation between the pupils/teacher ratio and population dynamics, the only explanation for the lack of correlation between this last one and the public expenditure in education is the decline in the salaries and/or qualification of teachers. The author did not do any empirical analysis with

teacher's salary, but he discuss the possible correlation that exist between teacher's salaries and educational quality.

In Brazil, a paper done by RIANI (2002) studies the relation between the relative size of a cohort in school age and some educational indicators that analyzed both quality and quantity. She used cross-section data for primary education in municipalities in 1991. The results showed that a bigger cohort has a positive impact on the indicators, but less significant on quantity that quality.

2.2) The determinants of education

The second framework of research in education that is analyzed in this paper is the determinants of education. According to BUCHMANN & HANNUM (2001) there are three sets of factors that may have an impact on the demand and on the supply of education. The first one includes some characteristics of the family, such as family structure and socioeconomic level that influence the demand for education. The second group's aspects related to the school, as infrastructure, teacher and school organization. That last one, gathers communities factors such as capital stock and resources. These last two sets have an impact upon the supply of education.

One of the first studies that related family factors, including educational ones, with educational achievement was the Coleman Report (COLEMAN ET AL, 1966). This work concluded that the family background was much more important then school factors in the determination of educational achievement, a finding that was also extended to educational attainment studies. Many studies done by other authors, were based in this one, and same confirmed the results of the Coleman Repots but others did not.

Examples of this recent debate are the studies of HANUSHEK (1998 and 2002) and KRUEGER (1998 and 2000) that analyzed the relationship between school inputs and educational achievements.

HANUSHEK (1998) reviewed some papers that were published since 1994 that analyzed the impact of educational aspects (mainly the pupils/teacher ratio or

class size) on the achievement of students. The conclusion was that the variable was positive and significant in only 15% of the studies.

In another analysis, Hanushek uses data from the Student/Teacher Achievement Ratio STAR[1], done in the state of Tennesse in the USA. The main conclusion was that smaller classes (main aspect of the educational politic in the USA) had a positive impact only on pre-primary levels.

Another author that examined the star experiment was KRUEGER (1999). He included control variables for students and teachers such as sex and race for the former and schooling for the latter - differently than what was done by HANUSHEK (1998) that only described the data. The results suggested that the greater positive impact of small classes is observed in the first year of schooling, but the positive influence continues to be significant afterwards.

In an alternative perspective, LEE & BARRO (1997) analyzed the impact of families and educational factors (pupils/teachers ratio, public expenditure in education per capita, teachers real salary and length of the schooling year) on the dropout rates, on the repletion rates and on the score of achievement tests. The results indicated that family aspects had a significant influence on the educational achievement of students. School resources were also positive related to the student's performance, specially the pupils/teachers ratio.

In a review that included the main studies related to the determinants of education, BUCHMANN & HANNUM (2001) conclude that the impact of the quality of schools and teachers is greater in underdeveloped countries than in the industrialized ones. A similar conclusion was attained by HEYNEMEN & LOXLEY (1983). They studied a sample with 29 countries and found out that school variables were two or three times more important while explaining the differences observed in achievement tests in underdeveloped countries than in developed ones.

In Brazil, the majority of studies about the determinants of education concentrate the analysis on the impact of family characteristics and is important in educational studies, specially in works that deal with inequalities, because they

[1] STAR is a longitudinal study where the students remained in the same type of class (small/ big) during four years.

show that low income parents that have low schooling will normally transmit the same characteristics to their children.

Another important focal point of analysis that enables the design of more efficient public policies is the study of the supply side of education.

In this context, SIILVA & HASENBALG (2001) emphasize three different dimensions of the family's structure that influence the student's achievement. The first one would be related to the economic capital, that is the available budget that can be invested in the child's education. The second dimension is related to the family's educational resources, or cultural capital, (mainly the schooling of the family's head) that can improve or not the learning environment. The last one would be the family's composition, that many help or not specific actions of the individuals in a particular social structure.

These authors studied the impact of these three dimensions upon the progression of students between school years in Brazil with data from the 1999 PNAD survey. As expected, the results showed a positive relation between this progression and the economic and cultural capital and the contrary was observed for the social capital. The effect of the dependent variables increases till the fourth grade of the primary education level and then declines. This shows that the influence of the family's background is more decisive in the first half of this education level.

Some studies, as the one by MARTELETO (2001) gives particular importance to the number of brothers living in the same household. The hypothesis of this study is that an increase in this number would diminish the amount of financial and educational resources designated for each one of children less time, less energy and less attention from the parents for each one of them.

His results showed a negative correlation between the number of brothers living in the household and educational indicators, such as schooling and enrollment ratios. These effects were significant even after controlling the impacts of socioeconomic disparities. Although, the variable used as the number of brothers in the household can be biased to the possible trade-off that parents may face between high fertility rates or high schooling of their children. But this trade-off

would occur only if the parents have a rational choice in these issues, even in underdeveloped countries.

The studies that were cited here emphasize the importance of family aspects and individual attributes as determinants of educational achievements. These factors prove to be important for the education in Brazil.

On the other hand, analysis that showed on schools factors, teachers and community were studies only very recently.

On the first studies that related school variable and educational achievement was done by HANUSHEK, GOMES-NETO & HARBISON (1996). According to them, the fundamental question for the developed of educational politics is to determine which one of the educational inputs are more efficient in enhancing the proficiency of students. Their work used the longitudinal data from the EDURURAL project, which was done in northeast of Brazil between the years of 1981 and 1985. Based in this data, the authors analyzed many school inputs that could be divided in three groups: I) the school infra structure or hardware – the presence of electric energy and water supplies, the existence of restroom and availability of furniture for students and teachers; II) the software – books for the students, guides for the teachers, notebooks and office material; III) variables related to the quality of teachers - schooling, experience, salaries, pupils/teacher ratios, achievement in particular tests and participation in specific training courses.

Their results showed that for the rural northeast of Brazil, in general, the school physical quality, the hardware and the resources for the classrooms, the software, showed a positive relation with the educational achievement. On the other hand, the variables related to the teachers did not show any decisive importance to the educational attainment of students.

BARROS *et alii* (2001) also included variables related to the community and supply of education in their analysis of the determinants of schooling in the Northeast and Southeast of Brazil in 1996. They considered five groups of variables: I) family resources; ii) geographical and personal characteristics; III) quality and supply of education; IV) communitarian environment; V) time opportunity costs instead of going to school, the student could work).

Their results showed that the parents schooling, in particular the mother's one, was the main factor that influenced the educational achievement of the students. One more year in the schooling of parents had a greater impact than three more years in teachers' schooling. The authors painted out that although the improvement of parent's education would be more decisive in enhancing the schooling of the young generation; this would be very expensive due to the much greater population of parents as compared to the number of teachers.

The author also showed that the quality of the school infrastructure had a similar or even greater impact upon the education of students than the teachers schooling. This first factor was more important in the primary education level and less to in the secondary level.

We can conclude after this discussion that there are three sets of factors that one significant to determine the educational achievement. The ones related to the family background, the school characteristics and the communitarian aspects. The importance of the first group of variables was observed in all the studies that dealt with them. But for the second group, the scenario was not so clear. To understand the determinants of educational is an important step toward the development of better educational public politics and also to show how society and the parent's socioeconomic condition can interact in order to enhance the students educational achievement.

In this work, we estimated separately with a hierarchical model that family level and the other aspects. The family background factors were analyzed individually and the educational supply and demography impact were studied with data for municipalities.

3) Hierarchical Model

The methodology chosen for estimation is the hierarchical model (multilevel). The hierarchical models include the data hierarchical structure, assuming that the dependent variable is measured in its smallest aggregated level, while the independent ones are measured in the others. When compared to models estimated by Ordinary Least Square (OLS), such modeling brings

advantages since it deals with possible assumptions' breakage - independents errors with constant variation - due to the individual's dependency within the same unit (school, district, state, hospital, etc..).

This paper the first level estimates a logit (binomial) equation with individual/ family variables, the second level includes average variables at municipality level where the children live, that are regressed with the random coefficients.

A first estimation will test if the intercept is random coefficients at level 2. Equations 1 to 3 formalize the model.

(1) Level 1: $$P(e_{ij}) = F\left(\beta_{0j} + \sum_{k} \beta_{kj} X_{kij} + \varepsilon_{ij}\right)$$

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

(3) $$\beta_{kj} = \gamma_{k0}, k \geq 1$$

A second estimation will include level 2 "Z" variables at the municipality level, they are possible determinants of the random coefficients. Equations 4 to 6 explain the model.

(4) Level 1: $$P(e_{ij}) = F\left(\beta_{0j} + \sum_{k \geq 1} \beta_{kj} X_{kij} + \varepsilon_{ij}\right)$$

(5) Level 2: $$\beta_{0j} = \gamma_{00} + \gamma_{01} Z_j + u_{0j}$$

(6) $$\beta_{kj} = \gamma_{kj}, k \geq 1$$

The statistical package HLM was chosen to estimate the multilevel model 2.

It is important to emphasize that the level 1 independent variables were expressed by the durance in relation to the group's mean. In the case of the logistic hierarchical model this procedure presents an advantage because it makes easier to estimate the probabilities, since they can be obtained from the intercept. It smooth the simulation exercise of variations in some co-variables. For level 2 variables, their metric values were considered.

[2] HLM is a statistical package developed by SSI- Scientific Software International.

The proportion of the variance explained by the level 2 variables in the intercept can be estimated, following the notions of conditioned and non-conditioned variances formula described below (BRYK E RAUDENBUSH, 1992):

$$(7) \quad \%\ \text{of Explained Variance} = \frac{\hat{\tau}_{qq(non-conditioned)} - \hat{\tau}_{qq(conditioned)}}{\hat{\tau}_{qq(non-conditioned)}}$$

4) Data base and variables treatment

Two data base were used in this study: The Brazilian Demographic 2000 Census, form Brazilian Institute of Geography and Statistics (IBGE), the School 2000 Census, from Brazil, colleted by National Institute of Educational Studies and Research.

Personal, family and individual dwelling characteristics, as well as demographic characteristics were obtained from the first data set information about the district's school net were obtained from the School Census.

The independent variables used were chosen to catch both the coverage as well as the students flow in the primary School. For catching the coverage, the individual's likelihood to go to school was considered as a dependent variable. This variable was assumed as dichotomy, being "1" those who attend school and "0" otherwise. The sample included all children from 7 to 14 years old, giving at the end, 2.972.471 individuals.

With regard to the probabilities of 1st and 5th grade progressions, it is possible to say that they capture the students flow in the educational system as well as the coverage, since the school drop out also is reflected in this indicator.

The works of Robert Mare (1981) are very important to demonstrate the relationship between grade progression and average years of completed schooling. The connection between the two variables is completely analogous to one developed by demographers linking parity progression ratios and fertility.

Let us define:

(8) $$e_k = \frac{P_{k+1}}{P_k}$$

Then e_k is the grade progression probability to complete grade *k+1* conditioned on having completed grade *k*.

P_{k+1} = Number of people completing at least grade *k+1*

P_k = Number of people completing at least grade *k*

$e_{0,0}$ = 1 everyone completed at least grade zero.

$e_{0,1}$ = e_0 (completed at least grade 1).

...

(9) $$e_{0,k} = \prod_{j=0}^{k-1} e_j$$ Completed at least *k* years of study.

Letting "k" vary from 1 to 17, then the average years of study (*e*) is defined below:

(10) $$e = \sum_{i=1}^{\infty} \Pr(X \geq i) = \sum_{i=1}^{17} e_{0,i}$$

Nearly half of the gains in average schooling during the Brazilian postwar period (from nearly 3.5 to 7 years of study) was due to improvements in e_0. Other one fourth of this gain was due to the progression to fifth grade, e_4 (RIOS-NETO, 2001).

For modeling the progression probability in the first grade the following dependent variables categories were used: "1" for individuals who have one or more years of schooling and "0" otherwise. In this case, 10 years old children were selected, summing up 365.561 individuals.

Considering the probability of finishing the 5th grade, the dependent variable has the flowing values: “1” for those individuals who have five or more years of schooling and “0” for those who have only four years of schooling. The sample comprises 14 years-old children who have at least four years of study – that is 293.097 children.

The independent variables are divided in five sets: i) family environment ; ii) demographic pressure ; iii) supply availability; iv) quality of municipal school factors; v) individuals and dwelling characteristics.

Family environment variables were measured in the micro level and were obtained from Demographic Census. In this set is the mother’s education, female’s management and the household head’s occupation.

Mother’s education was measured through the years of completed schooling. The option of including solely the mother’s educations is due to the fact that many studies have show that, in Brazil, its impact over the children’s education is more important than the father’s education (BARROS *et alii*, 2001; RIOS-NETO, CEZAR & RIANI, 2001). It represents the family “cultural capital”, being the hypotheses that children from families with low cultural capital have lower performance in school, more chance to drop out and take a repeater since mothers with higher educational level see clearly the future advantages of educated children. Besides that, they are more qualified to support and to help their children’s learning process (SILVA & HASENBALG, 2001).

The female’s management variable intends to capture the familiar structure, considering if it is one parent household or not, then it is a proxy for the family social capital. It is a dummy being “1” for families headed by women and “0” otherwise.

Socio-occupational categories were also developed for the household head taking into account the educational level required to the occupation exercise, the kind of specialization of its function and the income level. All these were stratified in three occupational levels: high level, medium level e manual level. This aggregation was proposed by SILVA (1973 and 1985) who tries to present homogenous occupational categories. For avoiding loosing information about

families who didn't have their household heads busy, a fourth category was created for those who were inactive – unemployed or retired. In the regression, the reference category was manual.

It is important to emphasize that some well known family background variables, relevant to individual's school performance, as is the case of family per capita income and number of the children in the family were overlooked in this analysis. These variables are subject to simultaneous biased and it demands a more deep discussion. Besides that, the mother's education and the household head occupational category may have a strong correlation with these variables.

The demographic dividend was measured through the relative size of the cohort with ages suitable for Primary School - that is from those among 7 and 14 years-old. This variable, one of the most important focus in this analysis, will try if smaller pressure for education will result in a "window of opportunity" for the Brazilian education. These data set aggregated in its macro level and come from he Brazilian Demographic Census.

Another factor that is also a focus of analysis is the availability of educational supply. In this case, it will be measured by the ratio between the number of Primary School teachers and the 7 to 14 years-old population. With this indicator is possible to verify how the influence of educational services availability in each municipality on individual's school results, mainly according to school access. It will be measured in the macro level. The number of teachers was obtained from School Census and the 7 to 14 years-old population comes from the Demographic Census.

With regard to the quality of educational services, it was considered one set of variables linked to the school's infra structure quality. They were aggregated for municipalities and were obtained from the School Census. The school infra structure quality was measured by the perceptual of students who were in schools with library, sports court, computer and science labs.

The last set of factors (individual's features and household characteristics) is used as controls in the regressions. In this set are age, sex, skin color e place of residence (rural or urban). According to BARROS *et alii* (2001), they are important

variables because in Brazil it is well known that there are gender, skin color and household differences that are not explained by observable socioeconomic variables. Furthermore, the odds to drop out of school increases with age. All variables, but age, are categorical and were obtained from the Brazilian Demographic Census and measured in their micro level.

Table 1 and 3 show the descriptive statistics for all variables used in the model. With regard to the level 1 variables, it is possible to emphasize the low mean number of household headed by females, the sex homogeneity distribution and the high perceptual of household heads in the manual level.

As for the level two variables, it is possible to say that more than half of Primary School teachers do not have a graduate school bachelors and that there is a low perceptual of school facilities with sciences and computer labs.

TABLE 1: DESCRIPTIVE VARIABLES – LEVEL 1

Variable Name	School Enrollment		Grade Progression to First Grade (E0)		Grade Progression to Fifth Grade (E4)	
	Mean	SD	MEAN	SD	MEAN	SD
School frequency	0.95	0.22	-	-	-	-
Aproved from 1st grade	-	-	0.87	0.33	-	-
Aproved from 5st grade	-	-	-	-	0.84	0.37
Age	10.54	2.28	-	-	-	-
Situation of residence (Urban = 1; Not Urban = 0)	0.71	0.45	0.71	0.45	0.79	0.41
Race (White and yellow = 1; black and brown = o)	0.50	0.50	0.50	0.50	0.56	0.50
Sex (Men = 1; Women = 0)	0.51	0.50	0.52	0.50	0.49	0.50
Mother's education	5.15	4.06	5.18	4.06	5.65	4.08
Female headship	0.18	0.38	0.17	0.38	0.20	0.40
High level	0.07	0.25	0.07	0.25	0.08	0.28
Middle level	0.16	0.37	0.17	0.37	0.16	0.36
Manual level	0.49	0.50	0.49	0.50	0.49	0.50
Non-occupied	0.28	0.45	0.28	0.45	0.27	0.45

TABLE 2: DESCRIPTIVE VARIABLES – LEVEL 2

VARIABLE	MEAN	SD
Share cohort of people age 7 - 14	0.17	0.03
Ratio teachers and people age 7 - 14	0.06	0.02
Share of students in schools with sports court	0.41	0.33
Share of students in schools with library	0.51	0.32
Share of students in schools with computer labs	0.14	0.21
Share of students in schools with science labs	0.17	0.24
Population untill 4999	0.24	0.43
Population 5000 to 9999	0.24	0.43
Population 10000 to 19999	0.25	0.43
Population 20000 to 49999	0.18	0.38
Population 50000 to 99999	0.05	0.23
Population 100000 to 199999	0.02	0.14
Population more 2000000	0.02	0.14

5) Results Analysis

5.1) School enrollment

On table 3, it's demonstrated the results for the regression of probability to attend school. It has been estimated three models of regression. Model 1 considers the intercept with random effect (equation 1 to 3), while on models 2 and 3 were included independent variables of level 2 to settle the random coefficients of the intercept (equation 4 to 6). Model 2 has considered only the relative size of the schooling age cohort, restriction of supply and dummies for population size function as second level independent variables. Model 3 has considered the rest of the variables of level 2, only exception for the relative size of the schooling age cohort, because it has a large correlation with the variables associated with municipalities' socioeconomic development level. This case, the ratio teachers and children 7 to 14 years of age becomes a synthesis of supply and demand.

The analysis of random effect of model 1 (down in the table), shows that is acceptable the hypothesis of intercept has random effect, once it was with statistic significance. In orders words, it's acceptable that the cities show different means for frequency to school. On this simplest model, the estimated variance component for the intercept (0.3148) is nominated non-conditional variance. As long as variables of level 2 are included, variance become conditional and can be calculated as a proportion of the variance that is explicated by level 2 variables. On this case, it has been realized that on the second model, level 2 variables explain 13.47% of the intercept random component, while on the third model, 14.36% of the intercept random component is explained.

Going through the analysis of fix effect, variables of level 1 demonstrated with statistic significance for almost all the cases and with expected signal. The variables connected with individual attributes, age, sex, race and residence situation show that age has a negative relation with the frequency to school, and white women that live on urban areas have a higher probability to attend school.

About family background variables, it's observed that mothers schooling is more important between all the others variables, corroborating with the papers already mentioned.

Analyzing level 2 variables, it's observed that the most important factors to become possible the access to school is the relative size of the schooling age cohort and supply restriction. On model 3, where the demographic variable is excluded, the coefficient of the ratio between number of teachers and population on scholar age is bigger than this same coefficient on model 1. It happens because this variable is a synthesis of educational supply and educational demand.

TABLE 3: REGRESSION RESULTS FOR SCHOOL FREQUENCY – HIERARCHICAL MODEL

FIXED EFFECT	Model 1	Model 2	Model 3
Intercept	3.4360*	3.7554*	2.2348*
Share cohort of people age 7-14	-	-5.4874*	-
Ratio teachers and people age 7-14	-	7.4203*	9.2930*
Share of students in schools with sports court	-	-	0.0788
Share of students in schools with library	-	-	-0.0909
Share of students in schools with computer labs	-	-	0.1907*
Share of students in schools with science labs	-	-	0.4062*
Population untill 4999	-	0.2894*	0.4067*
Population 5000 to 9999	-	0.2238*	0.3372*
Population 10000 to 19999	-	0.1879*	0.3039*
Population 20000 to 49999	-	0.0981*	0.1891*
Population 50000 to 99999	-	0.1048*	0.1667*
Population 100000 to 199999	-	0.0812*	0.1134
Age	-0.0217*	-0.0220*	-0.0220*
Situation of residence (Urban = 1; Not Urban = 0)	0.6100*	0.6072*	0.6053*
Race (White and yellow = 1; black and brown = 0)	0.1547*	0.1402*	0.1396*
Sex (Men =1; Women = 0)	-0.1986*	-0.1989*	-0.1989*
Mother's education	0.1802*	0.1789*	0.1787*
Female headship	-0.2518*	-0.25215*	-0.2519*
High level	0.3000*	0.3131*	0.3133*
Middle level	0.0118	0.0150*	0.0143
Non-occupied	-0.1918*	-0.1862*	-0.1863*
RANDOM EFFECT	**Variance Component**	**Variance Component**	**Variance Component**
intercept	0.3148*	0.2724*	0.2696*
% explained variance - intercept	-	13.469	14.358

* Significant at 1% level.

5.2) Grade Progression Probabilities

The analysis concerning the progression in the first grade of elementary school (e_0) and progression in the fifth grade of elementary school (e_4), which results are on tables 4 and 5, has been considered the same models described on last section. Using model 1, it's realized on both cases, that the hypothesis which affirms the intercept coefficient has random effect is acceptable. In the case of grade progressions, when included the level 2 covariables, the variability of the intercept is better explained than in the models that analyze the school frequency. It should be emphasized the fact that for e_4 the level 2 variables (model 3) explain around 60% of the intercept randomly.

The results of effects of level 1 covariable aren't very different. It's emphasized the higher impact of family background variable in e_4 than in e_0.

About level 2 covariables, in both transition, the variables related with the demographic ratio (model 2) has statistic significance and negative signal. But, when it's increased variables associated with the school quality of the cities (model 3), the synthesis of supply and demand variable (ratio between teachers and population on scholar age) has not a statistic significance.

On this completely model, scholar quality variables have a higher impact on progressions than on frequency to school, when the transition for the higher grade (e_4) is bigger the impact.

TABLE 4: REGRESSION RESULTS FOR GPP 1st GRADE (Eo) – HIERARCHICAL MODEL

FIXED EFFECT	Model 1	Model 2	Model 3
Intercept	2.3751*	5.4426*	0.3381*
Share cohort of people age 7-14	-	-17.4144*	-
Ratio teachers and people age 7-14	-	-3.1584*	1.6421
Share of students in schools with sports court	-	-	0.3797*
Share of students in schools with library	-	-	0.3100*
Share of students in schools with computer labs	-	-	0.0737*
Share of students in schools with science labs	-	-	0.4156*
Population untill 4999	-	0.2663*	0.7032*
Population 5000 to 9999	-	0.2769*	0.6968*
Population 10000 to 19999	-	0.2110*	0.6461*
Population 20000 to 49999	-	0.1080	0.4593*
Population 50000 to 99999	-	0.0632	0.2857*
Population 100000 to 199999	-	0.0738	0.2008
Situation of residence (Urban = 1; Not Urban = 0)	0.5628*	0.5225*	0.5023*
Race (White and yellow = 1; black and brown = 0)	0.2495*	0.1878*	0.1846*
Sex (Men =1; Women = 0)	-0.4202*	-0.4224*	-0.4234*
Mother's education	0.1695*	0.1644*	0.1624*
Female headship	-0.0876*	-0.0902*	-0.0885*
High level	0.0796	0.0979*	0.0988*
Middle level	-0.0019	0.0301	0.0287
Non-occupied	-0.1935*	-0.1646*	-0.1632*
RANDOM EFFECT	**Variance Component**	**Variance Component**	**Variance Component**
intercept	0.5660*	0.4040*	0.3755*
% explained variance - intercept	-	28.6204	33.668

* Significant at 1% level.

TABLE 5: REGRESSION RESULTS FOR GPP 5th GRADE (E_4) – HIERARCHICAL MODEL

FIXED EFFECT	Model 1	Model 2	Model 3
Intercept	1.9750*	5.5343*	-0.1787
Share cohort of people age 7-14	-	-19.8379*	
Ratio teachers and people age 7-14	-	-6.0484*	-0.1462
Share of students in schools with sports court	-		0.5177*
Share of students in schools with library	-		0.4564*
Share of students in schools with computer labs	-		0.5094*
Share of students in schools with science labs	-		0.4880*
Population untill 4999	-	0.4795*	0.9227*
Population 5000 to 9999	-	0.3591*	0.7932*
Population 10000 to 19999	-	0.2403*	0.6993*
Population 20000 to 49999	-	0.1633*	0.5307*
Population 50000 to 99999	-	0.1788*	0.4107*
Population 100000 to 199999	-	0.0708	0.2078*
Situation of residence (Urban = 1; Not Urban = 0)	0.5476*	0.5187*	0.4819*
Race (White and yellow = 1; black and brown = 0)	0.4285*	0.3561*	0.3447*
Sex (Men =1; Women = 0)	-0.4957*	-0.5064*	-0.5131*
Mother's education	0.1864*	0.1833*	0.1812*
Female headship	-0.2515*	-0.2558*	-0.2570*
High level	0.6662*	0.6906*	0.6948*
Middle level	0.1478*	0.1775*	0.1829*
Non-occupied	-0.0567*	-0.0254	-0.0187
RANDOM EFFECT	**Variance Component**	**Variance Component**	**Variance Component**
intercept	0.4886*	0.2861*	0.1913*
% explained variance - intercept	-	41.4516	60.8429

* Significant at 1% level.

For a better view of the impact of the variables associated with school quality at the municipality level, it has been constructed figures with simulations of variation on the four aspects of scholar quality. Those simulations are useful for calculated the predict value according to the variation of the standard deviation on one unity up of the mean and the variation of the standard deviation on one unity down of the mean observed on the aspects of scholar infrastructure.

Observing figure 1, it can be realized that the aspects of scholar infrastructure of higher impact of 1st grade progression probability is the

percentage of schools which has sports courts. The increase of the standard deviation in comparison with the mean increase this probability in 2.42%. When the four aspects increase simultaneously, the probability goes 0.80 to 0.85, a 6.19% variation.

On figure 2, check out a higher impact of school quality variables for 5th grade progression probability. In same way as the last case, the percentage of students attended in schools which have sports courts is the variable with higher impact. When all the aspects increase together, the variations on this probability increase 12.20%, going 0.71 to 0.83.

FIGURE 1: IMPACTO DA VARIAÇÃO DA QUALIDADE DA INFRA-ESTRUTURA ESCOLAR DO MUNICÍPIO NA PROBABILIDADE DE PROGRESSÃO NA 1ª SÉRIE

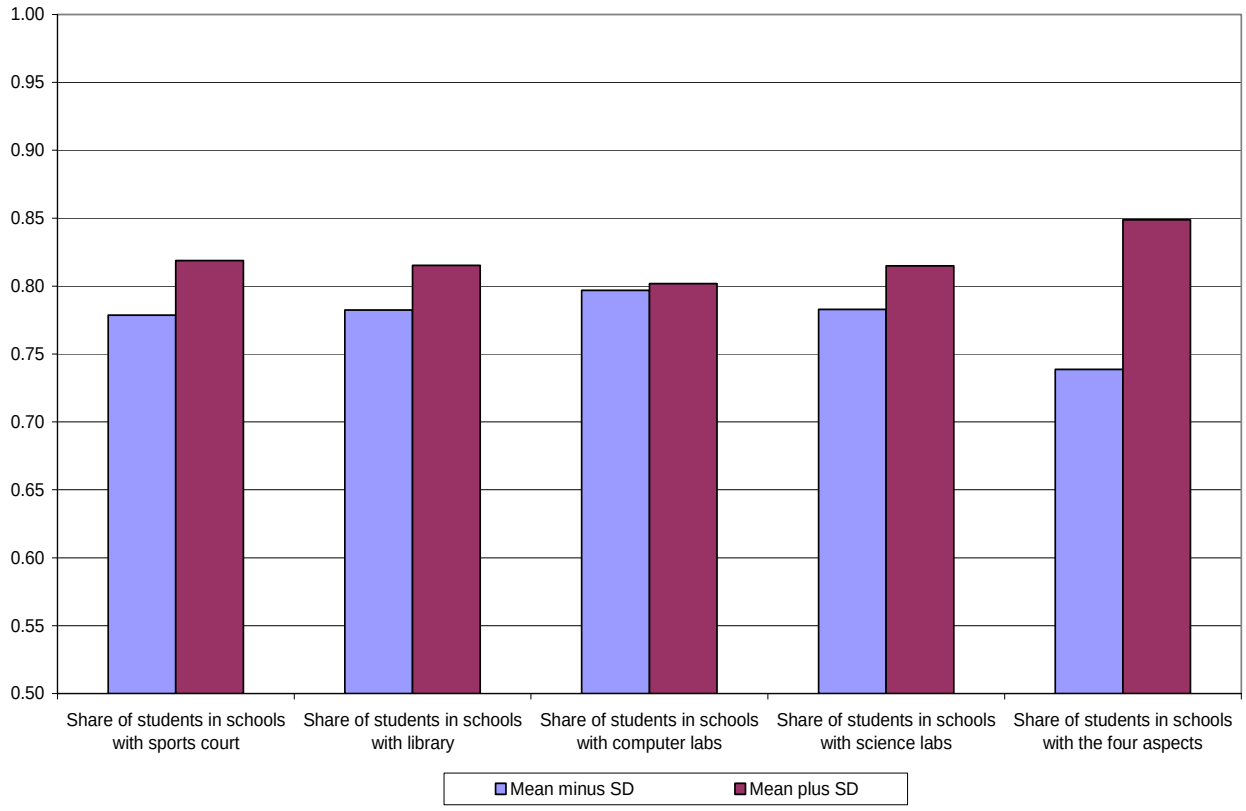
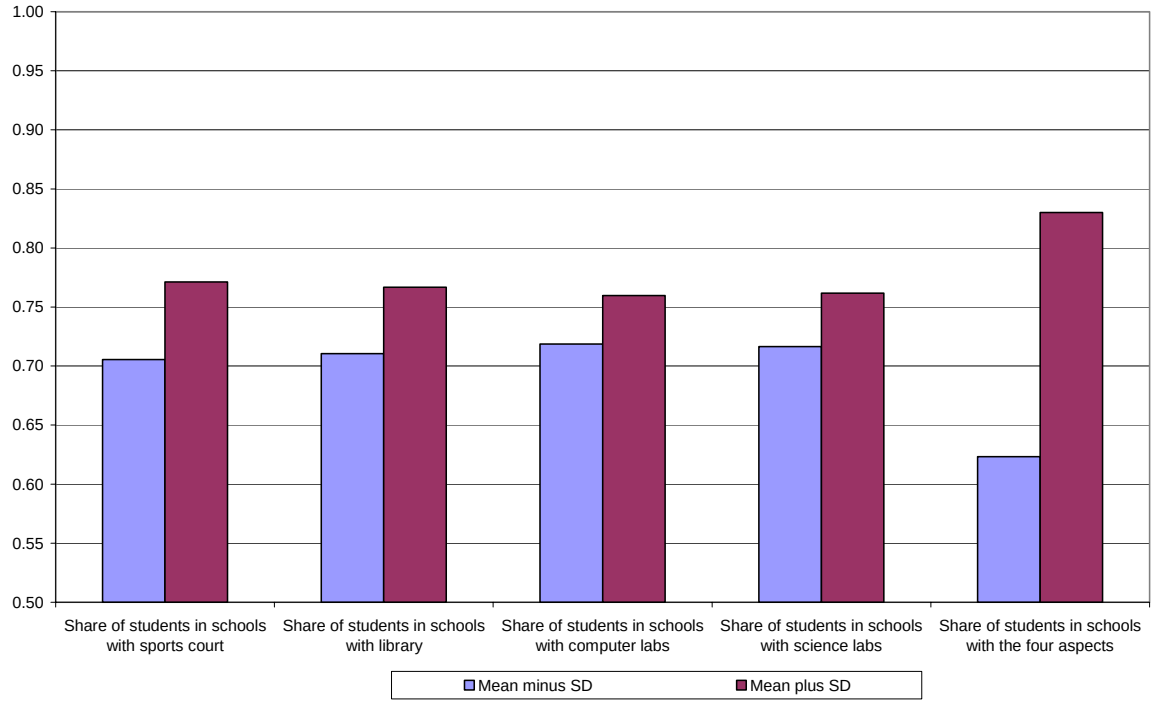


FIGURE 2: IMPACTO DA VARIAÇÃO DA QUALIDADE DA INFRA-ESTRUTURA ESCOLAR DO MUNICÍPIO NA PROBABILIDADE DE PROGRESSÃO NA 5ª SÉRIE



6) CONCLUDING REMARKS

This paper tested the importance of the demographic dividend and the municipal level school factors in the determination of enrollment rates and educational attainment through grade progression.

The methodology applied in the paper is the hierarchical model and the main source is the 2000 demographic census data basis. This base will provide the micro data and some municipal level variables. An additional source is the School Census 2000 collected by the Brazilian Ministry of Education.

Our conclusion is that the demographic dividend had a stronger impact on school enrollment and a smaller effect on grade progression. On other hand, the impact of school variables at the municipality level is stronger for grade progression than for school enrollment. This impact is stronger in the case of

grade progression in fifth grade. Finally, the impact of basic socioeconomic variables at the family level is strong and significant in all models.

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