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Household composition and academic performance in the elementary level in Brazil

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Abstract

Children with divorced parents or children living in single-parent families are expected to achieve lower academic performance in standardized tests when compared to children living with two biological parents. Nevertheless, the mechanisms of those disparities remain poorly addressed in the Brazilian literature. We compared the performance of students in the 5th-grade at the elementary level using Saeb of 2017 for Mathematics and Portuguese. The main objective was to address the differences between students living with: mother and father; mother and social father; mother only or with aggregates; father and social mother; father only or with aggregates; and other arrangements. Children living with their mother and a social father or with both biological parents had higher performances. Nonetheless, differences became insignificant when controlled by school infrastructure and location, household's socioeconomic status and household's social interactions. The results highlight the need for public policies to strengthen school and family resources invested on academic learning to overcome the challenges imposed by the new family configurations on children's achievement.

Keywords: Brazil, educational performance, household composition, family effects, school efficacy.

Composição domiciliar e desempenho acadêmico no ensino fundamental no Brasil

Resumo

Espera-se que crianças com pais divorciados ou que vivam em famílias monoparentais obtenham um desempenho acadêmico inferior em testes padronizados quando comparadas com as crianças que vivem com os dois pais biológicos. No entanto, os mecanismos dessas disparidades permanecem pouco abordados na literatura brasileira. Comparamos o

desempenho dos alunos do 5º ano do ensino fundamental em Matemática e Português utilizando o Saeb de 2017. O objetivo principal foi abordar as diferenças entre os alunos que viviam com: mãe e pai; mãe e padrasto; mãe somente ou com agregados; pai e madrasta; pai somente ou com agregados; e outros arranjos. As crianças que viviam com a mãe e padrasto ou com ambos os pais biológicos tiveram desempenhos superiores. No entanto, as diferenças tornaram-se não significantes quando controladas pela infra-estrutura e localização escolar, pelo nível socioeconômico do domicílio e pelas interações sociais no domicílio. Os resultados destacam a necessidade de políticas públicas para fortalecer os recursos escolares e familiares investidos no aprendizado acadêmica das crianças para superar os desafios impostos pelas novas configurações familiares.

Palavras-chave: Brasil, desempenho escolar arranjo domiciliar, efeitos de família, eficácia escolar.

Composición del hogar y rendimiento académico en la educación primaria en Brasil

Resumen

La literatura indica que los niños con padres divorciados o que viven en hogares monoparentales alcancen un rendimiento académico más bajo en las pruebas estandarizadas en comparación con los niños que viven con dos padres biológicos. Sin embargo, los mecanismos de esta disparidad aún han sido poco explorados en la literatura brasileña. Comparamos el desempeño de los estudiantes de 5º grado en la educación primaria utilizando el Saeb de 2017 para Matemáticas y Portugués. El objetivo principal fue abordar las diferencias entre los estudiantes que viven con: madre y padre; madre y padrasto; madre sola o con agregados; padre y madrasta; padre solo o con agregados; y otros arreglos. Los niños que vivían con su madre y padrasto o con ambos padres biológicos tuvieron rendimientos más altos. Sin embargo, las diferencias dejaron de ser significativas al controlar la calidad y ubicación de la escuela, la disponibilidad de recursos económicos y de aprendizaje en el hogar y las interacciones sociales en el hogar. Los resultados resaltan la necesidad de políticas públicas que fortalezcan los recursos escolares y familiares invertidos en el aprendizaje académico para superar los desafíos que imponen las nuevas configuraciones familiares al rendimiento de los niños.

Palabras clave: Brasil, desempeño educativo, composición del hogar, efectos familiares, eficacia escolar

1. INTRODUCTION

Part of the literature on social stratification has been focused on trying to establish the determinants of school trajectories. It is well known that children's social development is a conjoint project of the household and the educational system, thus, differences in household

arrangements might impact children's school performance in standardized tests, even after controlling for individual, household and school characteristics (Stevenson and Baker, 1987).

Some international studies show that children living in two-biological-parents families tend to have better educational outcomes when compared to children from divorced couples, living in single-parent families, or born outside the marital union (Amato, 2005; Babalis et al., 2014; Bernardi and Radl, 2014; Magnuson and Berger, 2009). Other studies found small or non-significant differences for this same comparison (Aughinbaugh et al., 2005; Foster and Kalil, 2007; Gennetian, 2005). For Brazil, literature is more scarce but shows evidence of a small family structure effect (Araújo and Siqueira, 2010; Lima et al., 2021; Martins e Teixeira, 2016; Menezes-Filho, 2012; Palermo, Silva e Novellino 2014).

The new household arrangements without two-biological-parents, which are sometimes called non-traditional, no longer can be considered the exception, as nowadays they form a large fraction of living arrangements in Brazil. According to Verona et al (2015) and Couvre-Sussai (2016), the proportion of single parenting increased sharply, especially among women. Moreover, divorce rates increased 500% from 1960 to 2010. As a result, a large proportion of the children no longer spend their entire childhood in a family with both biological parents, as a sizable proportion of this period is spent in a single-parent family or living with a stepparent, in particular, a stepfather (Amato, 2005; Magnuson and Berger, 2009).

Different factors affected these trends increasing the proportion of non-traditional household arrangements. The increasing relative female schooling levels (Whinter and Golgher, 2010), increasing female labor force participation (Juhn and Potter, 2006; Wanjman and Rios-Neto, 2000) and decreasing gender wage gaps (Hausmann and Golgher, 2014) enhanced female economic resources of single and divorced mothers. The proportion of informal unions has recently grown substantially, in part because informal unions are less expensive than formal marriage. Couvre-Sussai (2016) observed they had increased from 6.4% of all unions in 1960 to 36.4% of all unions in 2010, and they were particularly common among lower-income and less-educated couples.

The main objective of this paper is to analyze associations between household composition and school performance in Brazil taking into account different mechanisms that might explain family effects. We use the individual level grades from the Brazilian Basic Education Assessment System (Saeb) of 2017 to compare students' performance in

Mathematics and Portuguese in the 5^o grade of elementary level accordingly to the child's household arrangements. Whether the student lived: with his/her mother and father; with his/her mother and a social father; with his/her mother (only or with aggregates); with his/her father and a social mother; with his/her father (only or with aggregates); or in other arrangements. We investigate whether school features, geographical location, economic resources in the household, parental practices, and emotional distress are relevant to explaining differences observed in the outcomes by household composition.

This paper is divided into six sections. After this introduction, a brief literature review of household and school effects will be presented (second section), followed by the methodology (third section). The fourth section presents descriptive statistics, followed by the results of the econometric models (section five). Last section concludes the paper.

2. LITERATURE REVIEW

The relationship between household composition and educational attainment can be summarized by three main mechanisms, which are interrelated (Bernardi and Radl, 2014). The first mechanism is associated with economic resources. Single-headed households commonly have lower SES than households with two-biological-parents or with a biological parent and a new partner (McLanahan and Perchesky 2008). This is even stronger for solo mothers, who tend to earn lower incomes and have lower labor market participation when compared with men (Votruba-Drzal, 2006).

High-income parents, especially highly educated, also have a better capacity to stimulate the cognitive abilities of their children by providing a quiet environment to study, enough pedagogic resources to facilitate learning, and high-level interaction with school demands (Araújo and Siqueira, 2010; Martins and Teixeira, 2016). In fact, literature on social transmission of SES explains how high-income parents provide material, social, symbolic, and ideological resources by means of time, encouragement, money and/or assistance. Moreover, they provide norms and conditions for their children to better navigate the education system, they foster school trajectories by delaying school-to-work transition, translating into the future economic success of their children and the maintenance of social status (Palloni, 2006). Research for Brazil shows how children who have started to work earlier have worse performance in school (Araújo and Siqueira 2010; Lima et al 2012;

Martins and Teixeira 2016; Menezes-Filho 2007; Palermo, Silva and Novellino, 2014) highlighting the pervasiveness of SES on educational opportunities.

Lareau (2002) shows that in the USA families from different social classes presented parental styles that fostered different abilities and levels of social capital in their children. Middle and high-income parents helped their children to develop higher-order skills, like expressing needs and opinions and engaging in after-school programs. Low-income families, on the other hand, had to rely on local networks for caring for their children, who often spent time with older kids, in informal activities, or watching TV.

Alves and Cavenaghi (2013) observed that the household's SES affects all mechanisms, including interactions between parents and children, the next addressed topic. The second mechanism emphasized in the literature is based on the differences in parental quality time and practices, as well as cultural and social capital (Bernardi and Radl 2014; McLanahan and Perchesky, 2008; Palermo, Silva e Novellino, 2014). Children in two-biological-parent families might receive more parental time, attention, supervision, and monitoring than those children who live in uniparental households or in families with a stepparent. Moreover, children who live with both biological parents tend to receive more effective parenting and experience more cooperative co-parenting, both important for emotional development (Amato, 2005).

A study for Brazil showed how parental help with homework are crucial for student performance (Lima et al 2012). Andrabi et al. (2012) demonstrated the importance of maternal and child time use in understanding the unique role mothers play in the mechanisms promoting higher performances in test scores, such as discipline and language use. Households without a mother may devote less time and resources to children, which might have a negative influence on performance, at least when compared with uniparental households with a father.

As a third mechanism, Bernardi and Radl (2014) emphasized that financial instability and a child's emotional distress due to parental divorce might impact negatively on school performance. Moreover, parents and children who experience family structure transitions are likely to experience elevated levels of stress and conflict, with indirect effects on children's school performance by reducing parental warmth, support and nurturance (Amato, 2005; Magnuson and Berger, 2009). Nonetheless, Jekielek (1998) observed higher levels of well-being for children after the divorce in households with higher pre-disruption conflict levels.

That is, differently than proposed by Bernardi and Radl (2014), divorce might actually improve the well-being of children if pre-separation conflict levels were high. In these cases, school performance might even increase (Amato, 2005).

Piketty (2003) concluded that parental conflicts, rather than divorce per se, were detrimental to children's school performance. As the remarriage of a biological parent tends to improve children's standard of living, supervision, and assistance, one might assume that children might fare better in stepfamilies than in single-parent households. However, remarriage of the custodial mother (or father) can be followed by additional problems, as step-parents might face ambiguous parental roles and norms (Magnuson and Berger, 2009).

Some authors addressed associations between household structure and academic performance in Brazil. Menezes-Filho (2007) used the Saeb of 2003 and found that those living with at least one parent achieved higher performance. Araújo and Siqueira (2010) used the SAEB of 2005 and found that when the father lived in the household, there is a positive and significant effect on the performance in Mathematics of 4th Graders. Martins e Teixeira (2016) used the SAEB of 2013 for 9th Graders and found that students coming from uniparental households had worse performances than those coming from two-parent households. When a uniparental household is headed by the mother, performance is better than when it is headed by the father, which in turn is even worse than when it is headed by a non-family member. Palermo, Silva and Novellino (2014) used the Saeb of 2007 and found that living with both parents had an important effect on performance, which remained significant even after controlling for three hierarchical levels: student, classroom, and school characteristics. The authors explored performance and found significant correlates of low performance for children who worked outside the home, who worked in domestic work, whose parents had a low cultural level, who did not complete the homework assigned, and who had entered the school system at a later age. Lima et al. (2021) observed using the Saeb of 2015 that students from two-parent households had slightly higher proficiency in Mathematics in the 5th and 9th grades than those in single-parent homes, with smaller effects for older children compared to younger ones.

The relationships observed in the articles reviewed above are reduced or maintained when controlled by a myriad of factors that help to explain performance. For individual factors, a mother's education, and SES are by far the most important variables when it comes to students' outcomes as they foster important mechanisms. The majority of studies points out

that black students have lower performance even when controlling by SES (Araújo and Siqueira, 2010; Lima et al., 2021; Menezes-Filho 2007; Martins e Teixeira 2016; Menezes-Filho 2012, Palermo, Silva and Novellino, 2014).

The impacts of gender on education outcomes can also be observed and vary according to the discipline, in general, males have better grades in Mathematics while women tend to have better grades in Portuguese (Menezes-Filho, 2012, Palermo, Silva and Novellino, 2014). Students' characteristics, such as previous dropouts and age grade distortion, and delay to enter the school system are also important predictors of performance (Araújo and Siqueira, 2010; Lima et al., 2021; Menezes-Filho, 2007; Palermo, Silva and Novellino, 2014).

Although individual and household characteristics are important predictors of performance, school aspects matter. The school's academic climate, the teacher's qualifications and the existence of equipment, infrastructure and resources are important predictors of performance. Teacher's techniques, such as correcting exercises in class, and the teacher's age, race, education level, and years of experience also matters (Araújo and Siqueira 2010; Lima et al 2021; Martins and Teixeira 2016; Palermo, Silva and Novellino, 2014). Verbal aggression of teachers, possession of white weapons and not correcting the exercises in class were negatively correlated with performance. Neighborhood effects such as housing segregation and location are also important predictors of performance (Lima et al., 2021; Menezes-Filho, 2012).

This paper address the differences in academic performance in the Saeb of 2017 based on the mechanisms so far enumerated. By doing so, it could disentangle some of their effects while explaining the differences of diverse household arrangements.

3 - METHODOLOGY

This paper uses data from the 2017 Saeb to compare student's performance in Mathematics and Portuguese in the 5th grade of the elementary level. Saeb is an extremely rich database and has been extensively used to investigate academic performance (Araújo and Siqueira, 2010; Lima et al., 2021; Martins and Teixeira, 2016; Menezes-Filho, 2007; Palermo, Silva and Novellino, 2014). The database was developed in 1990 by the Ministry of Education and evolved to follow the purpose of being a large-scale diagnostic of basic education in Brazil, assessing Mathematics and Portuguese abilities of students in public and private schools. In general, students come from the 5th and 9th grades of the elementary level

or from the end of the secondary level. In addition to the results of standardized tests of academic performance, the database has information of the student's socioeconomic background. Moreover, school directors and teachers also answer specific surveys, including an extensive range of information about the school's internal and external environment, school infrastructure and the teacher's socioeconomic characteristics (Rodrigues et al., 2013).

We selected the 2017 database because it was the last year with the necessary information to classify the households by type as specified in the paper's introduction. We chose to work with Mathematics and Portuguese as results may differ between the disciplines concerning school and household effects. The database has 2134800 observations.

We use standard linear regression models to model academic performance of students. The dependent variable is the individual test scores in Mathematics or Portuguese, which is a continuous variable, approximately normally distributed, with mean 219 and standard deviation of 26 for Mathematics, and respectively 209 and 25 for Portuguese. The correlation between the results of Mathematics and Portuguese was 0.95.

The main variable of interest is household composition, concerning whether the student lived with: his/her mother and father; his/her mother and a social father; his/her mother (only or with aggregates); his/her father and a social mother; his/her father (only or with aggregates); or other arrangements without a father and a mother.

The controls could be grouped as individual's data, household characteristics and school and teacher's features, and violence. The individual data include: sex (1 – Male, 0 – Female); race (Blacks/Brows/Indigenous, Whites/Asians, Did not declare); the student's daily time in TV, in social media and in electronic games (Zero, 0 to 1, 2 to 3, 2 to 3, 3 and more); the student's working load in hours in domestic tasks in the household during school days (the same as previous variable); a categorical variable indicating when the student entered the school system (Day care, Pre-school, First year of elementary school, After the first year of elementary school); and dummies indicating whether the student worked, whether the student had previously failed in a grade or temporarily evaded and whether the student frequently did Mathematics and Portuguese homework.

Household characteristics used as controls include: dummies whether the household possessed TV, car or computer; the mother/social mother and the father/social father schooling level (Don't know, Less than half elementary, Less than elementary, Less than secondary, Secondary, Tertiary); and dummies for whether the student's parents encouraged

the student to pursue their academic goals, and whether the student lived in households with five or more individuals.

Concerning school features, the models include: a dummy whether the school was urban; dummies whether the classrooms, restrooms and the school in general were in good standards of conservation; a dummy whether the classrooms had enough illumination; and dummies whether the school had computer with internet, library, sports court, computers lab and science lab. Concerning the teachers, the variables were: the proportion of females; mean age; the proportion with a tertiary diploma; the proportion that felt overwhelmed by the working routine; the proportion that daily prescribed homework; the proportion facing high levels of student's indiscipline. Concerning violence, dummies were included indicating whether there were surveillance or policing in and around the school; and whether students and teachers suffered from physical and verbal aggression.

Besides all these variables, we also included interactions in the models: interactions between the availability of computers in the household and household type, as learning resources can be used more or less effectively depending on the household type; and interactions between doing homework and household type, as the quality and effectiveness of doing the homework might vary depending on household type.

The model was estimated by OLS with robust clustered errors by school:

$$Y_i = \alpha + \phi L_i + \beta X_i + \theta W_i + \lambda L_i J_i + \varepsilon_i,$$

where the dependent variable, Y_i , is the test score in math of the student i ; L_i is the categorical variable for household composition, the main variable of interest; X_i are the student's and household variables; W_i are the controls for the student's school and teachers; J_i is a subset of X_i , and ε_i are the errors.

We used Stata 12 to estimate the models. The main purpose of the multivariate analysis is to address the mechanisms that can explain differences in educational performance by parental family structure in Brazil, a rather different setting than previously analyzed (Amato, 2005; Aughinbaugh et al., 2005; Babalis et al., 2014; Bernardi and Radl, 2014; Foster and Kalil, 2007; Gennetian, 2005; Magnuson and Berger, 2009).

4. DESCRIPTIVE STATISTICS

This section presents descriptive statistics comparing school performance in Mathematics and Portuguese for the different household types (table 1) and for selected

explanatory variables (table 2). The section also depicts some of the differences between household types regarding socioeconomic and demographic features.

Table 1 shows the proportion of students in each household type in 2007 and 2017. The objective is to describe how the traditional and the non-traditional types evolved. The majority of the students lived with their biological mother and father, 62.4% in 2007 and 57.8% in 2017. However, notice that the proportion of students in this type decreased in the period in favor of non-traditional types. A sizable minority lived with the mother (only or with aggregates), 22.7% in 2007 and 25.0% in 2017, showing an increasing trend. The other compositions were less numerous. For mother/social father, the values varied from 4.9% to 6.7% in the period, also with an increasing tendency. The other arrangements were without a mother. One of them increased in proportion, father (only and with aggregates), from 2.9% to 3.6%. The other two showed stable numbers: father/social mother (1.2% in both years), the least numerous; and other arrangements (from 5.9% to 5.7%). Notice, however, the number of observations in each type is large, as more than 24 thousand students lived in the less numerous type, father/social mother, in 2017.

School performances varied between the six household arrangements. All differences were significant in Bonferroni tests. The highest value for academic performance was observed for households with mother and social father in both disciplines. Values were smaller for students living in households with both biological parents, a result not expected *a priori*. Notice that there are many factors that can be associated with these results. Most families with both biological parents might be “intact”, however, some parents may have built the household after the student was born or a temporal household dissolution might have occurred. Students in households with a mother/social father may have faced a divorce and a posterior union, or might have lived in a uniparental household for a period before the union. Although dynamics differ, school performance are similar between these two household arrangements, suggesting that changes have a short time span of influence and/or that positive and negative impacts for each arrangement have similar magnitude.

Students living in uniparental households with a mother showed worst academic performance than these two previous household arrangements, but larger values than the other three. These results suggest that mothers living without a partner could overcome many of the difficulties imposed by less economic resources and probably less availability of time (Bruschini, 2006). Crude comparisons between these three types of household arrangement

already discussed show that a father or a social father in the presence of a mother increases the academic performance in 2 to 3 points

Students living in one of the three household compositions without a mother had smaller values for school performance than others did. The presence of a mother, in a crude comparison between mother and other arrangements, is responsible for a 6 points increase. However, the households without a mother but with a father had slight larger values than other types of household, suggesting that the father had an effect of approximately 2 points. The households with a father/social mother when compared to father (only or with aggregates) indicated that a social mother had an effect of roughly 3 points.

Table 1 – School performance for households arrangements

Household composition	Proportion (%)		Discipline	
	2007	2017	Math	Portuguese
Mother/father	62.4	57.8	220.7	211.1
Mother/social father	4.9	6.7	221.6	212.1
Mother	22.7	25.0	218.4	209.3
Father/social mother	1.2	1.2	217.6	208.1
Father	2.9	3.6	214.5	205.3
Other types	5.9	5.7	212.8	203.6
Total	1983888	1990006	219.5	210.0

Source: Saeb, 2017

Note: all differences between household arrangements were significantly in a Bonferroni test

Table 2 compares the academic performance of different categories of selected explanatory variables. Some associations between these variables and academic performance corroborated the findings in the literature. Females had a slight higher performance than males, even in Mathematics. This was not at first expected as males tend to have better grades in Mathematics, while women tend to have better grades in Portuguese (Menezes-Filho, 2012, Palermo, Silva and Novellino, 2014). However, these results suggest that the educational gender gap is beginning at the first years of the elementary level.

White/Asian had better performances than Black/Pardo/Indigenous as expected (Lima et al, 2021; Martins e Teixeira 2016; Menezes-Filho 2012, Palermo, Silva and Novellino, 2014), especially when SES levels are not controlled. Students living in higher SES households, who did not work and who received parent's encouragement to study had higher performances also as expected. Notice that all differences in table 2 besides sex are greater

than the observed in the previous table for household arrangements. Last lines of the tables show the huge difference of close to 35 points for two specific profiles.

Table 2 – Academic performance for the different categories of selected variables

	Mathematics	Portuguese
Male	219.2	209.6
Female	219.9	210.6
White/Asian	224.4	214.5
Black/Pardo/Indigenous	216.7	207.4
Household with car	226.5	216.8
Household without car	211.2	202.0
Household with computer	225.9	216.5
Household without computer	212.1	202.6
Student worked	209.7	200.0
Student did not work	220.9	211.5
Student with parent encouragement	220.8	211.4
Student without parent encouragement	216.5	207.0
White/Asian female living in a household with car and computer, who did not work and with parent's encouragement	235.7	225.5
Black/Pardo/Indigenous male living in a household without car and computer, who did work and without parent's encouragement	201.5	191.7

Source: Saeb, 2017

Note: all differences between categories in the same variable were significantly in a Bonferroni test

Table 3 compares the household arrangements for selected variables for demographic, SES and the household's environment for learning aspects. Concerning the distribution of students regarding sex, approximately half of them, 50.4%, were male. Notice that the distribution is not even between the households types. Boys tend to live with a father (only or with aggregates) or with a father/social mother in greater proportion than girls. Conversely, girls tend to live in greater proportion than boys with their mother (only or with aggregates) or with mother/social father. The arrangements mother/father and other arrangements were closer to the overall picture. White/Asian children show greater propensity to live with both biological parents and lower propensity to live without both. Differences for the other types of households were small.

Households with mother/father and father/social mother tended to have a car and a computer in the household in greater proportions, indicating higher SES, besides a probable focus of the father in having these items. Households with a mother (only or with aggregates) had by far the smallest proportion for cars, but values for computers differed less, suggesting

a different focus in household expenditures (Golgher, 2016). Households with a father (only or with aggregates) and mother/social father showed intermediate values. Other arrangements had smaller values for computers.

Children living with their mother tended to work in smaller proportions in all three types, and the opposite was verified for households without mothers. Finally, households with a mother in all three types had the greatest proportion of children being encouraged to do school related work. This point and the presence of computers might partially explain the (super) mother effects. The lowest value for this variable was observed for other types of household, suggesting a detachment among the household individuals concerning the learning process.

Table 3 – Distribution of selected variables by household arrangement

Household arrangement	Percentage					
	Men	White/Asian	Cars	Computers	Student worked	Encouragement to do school related activities
Mother/father	51.1	38.3	60.3	55.8	11.7	75.8
Mother/social father	45.2	32.8	53.0	48.1	10.1	71.9
Mother	48.4	33.0	37.1	45.2	11.5	69.6
Father/social mother	53.0	33.8	60.5	53.2	15.2	64.4
Father	61.0	33.8	52.8	46.5	16.8	64.2
Other arrangements	50.8	30.3	46.0	44.8	14.1	61.6
Total	50.4	35.9	52.9	51.7	11.9	72.6

Source: Saeb, 2017

These last tables can be used to draw a general and approximate profile of the households. Those with mother/father have the highest proportion of Whites/Asians, highest SES, one of the lowest levels of the student's participation in the labor market and the highest value for encouragement. That is, all variables associated with a higher performance. The household type mother/social father shows a lower SES, although for the last two variables results were similar to the previous type. The household with a mother, although with a much lower SES, showed higher proportion of households with computers and lower numbers of working children, justifying the smaller difference observed in table 1. These results show that the mother acts as a buffer for low SES (Andradi et al., 2012). Households with father/social mother or with a father showed higher SES than household with mother (only or with aggregates), but students worked in greater proportion and levels of encouragement were

lower. That is, resources are not so effectively used to promote higher school performance. Finally, the type other arrangements shows high level of participation in the labor market and the lowest level for encouragement, indicating an even worst household atmosphere for academic learning.

5 – ECONOMETRIC MODELS

In this section, we investigate academic performance for students living in households with different compositions using standard linear models estimated by OLS with robust clustered errors by school. However, we do not claim that the associations observed in the models are causal, although they might provide some evidence. Tables 4 and 5 respectively present five models for Mathematics and the same five for Portuguese with an increasing number of controls. Notice that all models in each table have the same number of observations, hence the models are nested and comparisons are more insightful. The first model in each table has no controls, mimics the results presented in table 1, and are the benchmark for comparisons.

Most coefficients for household composition in model 1 in table 4 were negative and significant, indicating that the students' performance in Mathematics was higher in households with both biological parents than in households with mother (only or with aggregates), father/social mother, father (only or with aggregates) and other arrangements. Differences between the students living with father/mother and with mother/social father were non-significant, indicating the similarity in the academic performance of both types.

All the other models include controls. Models 2 to 5 include as controls variables associated with school, teachers and violence. Notice that urban schools and schools with better infrastructure and lower levels of depredation tended to have better academic performances. Concerning the teacher, schools with greater proportion of female teachers, younger teachers, with greater proportion of teacher with tertiary diploma, with non-overwhelmed teachers, who daily assigned homework for their students had better performances. Less violent schools had a better performance. Nonetheless, a result might be at first counter intuitive. The coefficients for police vigilance were negative and significant. That is, schools with more vigilance had worst performance, possibly due to an overwhelming poor atmosphere for learning that cannot be improved enough by the vigilance.

Comparing the coefficients for household type in models 1 and 2, differences between households with two biological parents and a mother/social father became negative and significant when the above-mentioned controls were included in the models. Students living with mother/social father tended to study in schools with better conditions for learning. For the three household types without a mother, the controls partially explained the differences between them and households with mother/father, factors not directly related to the household's dynamics of household transitions, but related indirectly to household's economic resources, such as household location, neighborhood and school features. The coefficient for households with mother (only or with aggregates) were approximate similar, indicating that the controls did not explain much of the difference in academic performance between this household type and those with mother/father. That is, even with lower SES levels, students living with mother (only and with aggregates) attended similar schools as those who lived with father/mother.

Models 3-5 include the controls for sex and ethnic group. In general, males had a higher performance than females after controlling for the other variables in the models. Whites/Asians had higher performance than Blacks/Browns/Indigenous, even after controlling for SES levels, among other controls. The model also includes controls for the existence of TV, cars and computers in the household, the number of dwellers, mother's/social mother's and father's/social father's educational attainment, proxies for SES and for learning resources in the household. Higher SES households had better performances, as expected. Besides, the models include whether the student had previously failed and/or temporary dropout with the expected results.

Concerning the coefficients for household type, notice that these controls explained most of the differences between them. Two household types showed positive and significant coefficient, mother/social father and mother (only or with aggregates). The results suggest that these types had lower SES levels, specially the last type which is plagued with lower economic and learning resources, which affect the performance of students. This is an indicative of the importance of conditional cash transfers (CCT) policies, which are mostly directed to women (Fiszbein et al., 2009). Notice that the coefficient for mother/social father became positive and significant. That is, after controlling for the variables already in the model, students that don't live with their biological father, but do live with a social father had better performances. Two tentative suggestions are made. First, the household might face less

stress, as the most stressful mother and father relations end with greater propensity due to selective divorce. Second, the mother might be able to choose a better partner after the experience of a first relationship and/or a first child.

The other three types without a mother showed negative and significant coefficients, although all there with smaller modulus in model 3. That is, SES levels partially explained the differences between them and the type mother/father.

Models 4 and 5 include the controls for the time the student began its schooling process, for the time spent by the student in the household doing domestic task in a school day and for the student's participation in the labor market. The model also incorporates the control for the encouragement that parents and social parents gave to their children and the amount of homework done by the students. Student who began to attend school before the elementary level, those who spent less time in domestic chores, who did not work and who did homework had better performances, as expected. Table 1 showed that students who received parent's encouragement had better performances. However, after controlling for the other variables in the models, the result reversed. This sign change suggests that students that were encouraged by their parents/social parents had better performance due to facts explained by the other variables in the models. The net effect is negative, possibly indicating the reverse causality, after all controls in the model, students with worst performance received further attention from their parents/social parents.

Another counter intuitive result is that those who spent more time in TV, internet and electronic games actual had better performances. This might be expected in less controlled analysis, as SES levels might be strongly correlated with time spent in these activities. However, notice that SES levels and other variables were incorporated as controls, including the amount of homework done by the student and the time spent doing domestic chores. Possibly, the time spent in these activities is more positively correlated to learning than other types of interests. Nevertheless, this point deserves further analyses, which are beyond the scope of this paper.

Comparing the coefficients for household type in models 3 and 4, the results for households with a mother were approximately the same. Households with a mother tended to have more time to effectively encourage and enforce a better time usage and atmosphere for learning. These results tentatively suggest that mothers are reasonable successful to buffer their children from precocious participating in the labor market or from doing a sizable

proportion of household chores (Ribeiro and Marinho, 2012). The coefficient for father/social mother became non-significant. That is, the unexplained differences between households with mother/father and father/social mother were explained by the controls in model 4. The time usage of students living with father/social mother was less learning oriented. A sizable proportion of unexplained differences continued for households with father only (or with aggregates) and other types of households, although the coefficients decreased in modulus.

Model 5 includes the interaction between the existence of a computer in the household and household type. The reference is the presence of computers in households classified as other arrangements. The model also includes interactions between the dummy for doing homework and household types with the same reference. The idea is that students might use computers or do homework with different levels of effort and efficiency in different household types. It was observed that to use computers or to do homework in a household with both biological parents is more learning enhancing. Households with father (only or with aggregates) had a less effective use for computers for learning and households with father/social mother had a more effective effect of doing homework.

Comparing the coefficients for household types between models 4 and 5, most differences in academic performance in the household types were explained in model 5. Two household types had positive and significant coefficients, two had non-significant coefficients and only one continued to have a negative and significant coefficient.

Table 4 – Econometric models with different sets of explanatory variables for Mathematics

Variables	Model 1	Model 2	Model 3	Model 4	Model 5
Mother/father			Reference		
Mother/social father	-0.0619 (0.108)	-0.415** (0.0890)	0.980** (0.0805)	0.927** (0.0828)	2.221** (0.147)
Mother	-2.788** (0.0759)	-2.408** (0.0613)	0.123* (0.0537)	0.216** (0.0552)	1.260** (0.0942)
Father/social mother	-2.436** (0.222)	-1.709** (0.185)	-0.513** (0.167)	-0.196 (0.174)	0.340 (0.322)
Father	-5.536** (0.142)	-4.008** (0.118)	-2.175** (0.103)	-1.792** (0.108)	-0.323 (0.191)
Other	-7.562** (0.132)	-4.490** (0.106)	-2.171** (0.0894)	-1.903** (0.0937)	-0.980** (0.159)
Urban school		13.85** (0.351)	11.36** (0.323)	10.90** (0.323)	10.86** (0.323)
Classrooms in good conditions		1.860** (0.310)	1.724** (0.282)	1.641** (0.279)	1.638** (0.279)
Bathrooms in good conditions		2.829**	2.379**	2.231**	2.231**

	(0.305)	(0.278)	(0.275)	(0.275)
Well illuminated classrooms	3.162**	2.725**	2.717**	2.717**
	(0.301)	(0.273)	(0.271)	(0.271)
School depreddation	-7.191**	-6.477**	-6.227**	-6.225**
	(0.275)	(0.250)	(0.247)	(0.247)
School with computers and internet	6.692**	5.718**	5.500**	5.497**
	(0.325)	(0.296)	(0.293)	(0.293)
School with library	1.963**	1.733**	1.512**	1.509**
	(0.289)	(0.263)	(0.260)	(0.260)
School with sports court	9.253**	7.569**	7.191**	7.186**
	(0.299)	(0.274)	(0.271)	(0.271)
School with computer lab	1.939**	1.723**	1.715**	1.715**
	(0.340)	(0.309)	(0.306)	(0.306)
School with science lab	0.321	-0.237	-0.0391	-0.0414
	(0.398)	(0.363)	(0.360)	(0.360)
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Proportion of males among teacher	-11.44**	-9.188**	-8.518**	-8.506**
	(0.498)	(0.454)	(0.453)	(0.453)
Teacher´s mean age	-0.356*	-0.524**	-0.491**	-0.491**
	(0.151)	(0.139)	(0.138)	(0.138)
Prop. of teachers with tertiary diploma	9.919**	9.273**	9.077**	9.072**
	(0.582)	(0.525)	(0.523)	(0.523)
Prop. of teachers feeling overwhelmed	-0.761*	-0.924**	-0.914**	-0.914**
	(0.361)	(0.327)	(0.324)	(0.324)
Daily homework	3.495**	3.896**	3.504**	3.504**
	(0.305)	(0.278)	(0.275)	(0.275)
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Policy vigilance	-6.448**	-5.235**	-4.994**	-4.991**
	(0.282)	(0.257)	(0.255)	(0.255)
Violence against teachers	-1.828**	-1.835**	-1.976**	-1.977**
	(0.353)	(0.319)	(0.316)	(0.316)
Violence against students	-4.779**	-4.401**	-4.388**	-4.388**
	(0.381)	(0.350)	(0.346)	(0.346)
Student´s indiscipline level	-10.49**	-9.366**	-9.059**	-9.057**
	(0.335)	(0.307)	(0.304)	(0.304)
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Male		0.545**	0.750**	0.751**
		(0.0356)	(0.0386)	(0.0386)
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Black/Pardo/Indigenous			Reference	
White/Asian		2.736**	2.576**	2.569**
		(0.0760)	(0.0761)	(0.0760)
Did not declare race		0.502**	0.649**	0.646**
		(0.0926)	(0.0946)	(0.0946)
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Household with TV		4.284**	3.605**	3.613**
		(0.0944)	(0.0970)	(0.0970)
Household with car		6.514**	6.306**	6.294**
		(0.0962)	(0.0949)	(0.0948)
Household with computer		4.253**	3.811**	3.143**
		(0.0680)	(0.0669)	(0.170)
Five or more dwellers in the household		-2.435**	-2.100**	-2.073**
		(0.0497)	(0.0495)	(0.0493)
<hr/>				
Mother´s/Social mother´s schooling attainment				
Unknown			Reference	
Less than 4 years		-2.414**	-2.150**	-2.149**
		(0.0850)	(0.0881)	(0.0881)
4 to 7 years		-1.061**	-1.003**	-0.999**
		(0.0822)	(0.0846)	(0.0846)
Elementary degree		-1.012**	-0.991**	-0.984**
		(0.0767)	(0.0799)	(0.0799)

Secondary degree	0.894** (0.0703)	0.549** (0.0722)	0.553** (0.0722)
Tertiary degree	-0.141 (0.0786)	-0.218** (0.0813)	-0.213** (0.0813)
Father's/Social father's schooling attainment			
Unknown		Reference	
Less than 4 years	-2.336** (0.0806)	-1.924** (0.0833)	-1.899** (0.0832)
4 to 7 years	-0.580** (0.0830)	-0.336** (0.0860)	-0.325** (0.0860)
Elementary degree	-0.767** (0.0832)	-0.547** (0.0865)	-0.547** (0.0865)
Secondary degree	0.815** (0.0768)	0.715** (0.0802)	0.696** (0.0802)
Tertiary degree	0.232** (0.0821)	0.347** (0.0835)	0.331** (0.0835)
Previous failure	-4.296** (0.0840)	-3.393** (0.0842)	-3.395** (0.0842)
Previous temporary dropout	-4.100** (0.0889)	-2.880** (0.0904)	-2.891** (0.0904)
Student began school			
Nursery		Reference	
Pre-school		0.648** (0.0858)	0.642** (0.0858)
Elementary level at 1 st year		-2.394** (0.105)	-2.392** (0.105)
Elementary level after 1 st year		-1.700** (0.105)	-1.699** (0.105)
Daily time in TV, internet and electronic games			
Zero hours		Reference	
0 to 1 hours		0.0132 (0.0993)	0.0205 (0.0992)
1 to 2 hours		2.953** (0.100)	2.955** (0.100)
2 to 3 hours		2.776** (0.127)	2.776** (0.127)
3 and more hours		3.599** (0.112)	3.606** (0.112)
Daily time doing domestic chores			
Zero hours		Reference	
0 to 1 hours		-1.369** (0.0862)	-1.375** (0.0862)
1 to 2 hours		0.154* (0.0891)	0.146 (0.0891)
2 to 3 hours		-4.141** (0.148)	-4.144** (0.148)
3 and more hours		-3.797** (0.138)	-3.801** (0.138)
Student worked		-3.641** (0.0799)	-3.627** (0.0799)
Student did homework		2.474** (0.0732)	2.299** (0.175)
Parents encouragement		-0.191** (0.0547)	-0.185** (0.0547)

Interactions: computer and household type					
Mother/father					1.242** (0.174)
Mother/social father					-0.108 (0.210)
Mother					0.141 (0.178)
Father/social mother					0.0110 (0.364)
Father					-0.709** (0.254)
Interactions: homework and household type					
Mother/father					0.520** (0.173)
Mother/social father					-0.355 (0.216)
Mother					-0.216 (0.179)
Father/social mother					0.757* (0.373)
Father					-0.291 (0.256)
Constant	224.4** (0.159)	200.9** (0.905)	195.2** (0.840)	194.9** (0.857)	194.4** (0.858)
Observations	1,273,645	1,273,645	1,455,023	1,273,645	1,273,645
R-squared	0.007	0.317	0.376	0.384	0.384

Source: Saeb, 2017

Robust standard errors in parentheses

** p<0.01, * p<0.05

Table 5 shows the results for the same five models, but for Portuguese. The results were quite similar to those of table 4 and only the coefficients for household types are shown. Comparing the results in table 4 and 5 for these coefficients, they are remarkably similar. That is, differences between household type dynamics in Mathematics and Portuguese did not differ much.

Table 5 – Econometric models with different sets of explanatory variables for Mathematics

Variables	Model 1	Model 2	Model 3	Model 4	Model 5
Mother/father					Reference
Mother/social father	0.114 (0.0999)	-0.316** (0.0817)	0.941** (0.0770)	0.919** (0.0758)	2.197** (0.137)
Mother	-2.216** (0.0707)	-2.021** (0.0566)	0.373** (0.0520)	0.442** (0.0513)	1.443** (0.0886)
Father/social mother	-2.185** (0.210)	-1.551** (0.173)	-0.306 (0.165)	-0.102 (0.163)	0.338 (0.304)
Father	-4.982** (0.133)	-3.639** (0.109)	-1.796** (0.102)	-1.475** (0.1000)	-0.0257 (0.180)

Other	-7.101**	-4.204**	-1.969**	-1.735**	-0.906**
	(0.124)	(0.0989)	(0.0886)	(0.0872)	(0.151)
Controls					
School related	No	Yes	Yes	Yes	Yes
Teacher related	No	Yes	Yes	Yes	Yes
Violence	No	Yes	Yes	Yes	Yes
Geographical	No	Yes	Yes	Yes	Yes
Sex and Ethnic group	No	No	Yes	Yes	Yes
SES variables	No	No	Yes	Yes	Yes
Children's time	No	No	No	Yes	Yes
Parent's involvement	No	No	No	Yes	Yes
Computer x household type	No	No	No	No	Yes
Homework x household type	No	No	No	No	Yes
Observations	1,273,645	1,273,645	1,273,645	1,273,645	1,273,645
R-squared	0.006	0.331	0.391	0.402	0.402

Source: Saeb, 2017.

Robust standard errors in parentheses

** p<0.01, * p<0.05

5 – Discussion and conclusion

This paper analyzed associations between household compositions and school performance. More specifically, we compared school performance in Mathematics and Portuguese in the fifth year of the elementary level in public schools in Brazil of children living in six different household arrangements, whether the student lived with: his/her mother and father; his/her mother and a social father; his/her mother (only or with aggregates); his/her father/social mother; his/her father (only or with aggregates); other arrangements without a father and a mother.

The highest values for school performance were observed for households with a mother and a social father, although differences for households with both biological parents were not large. Values for households with a mother showed intermediate results. The three household compositions without a mother had smaller values for school performance than others.

When controls for school, neighborhood, location, individual and household characteristics and social interactions were included in the models, children performance in households with a mother and a social father were even higher than the observed for those living with both biological parents. This suggests that, differently than the proposed by Bernardi and Radl (2014), and as observed by Jekielek (1998) in another setting, divorce and posterior union with another partner might actually improve the well-being of children if pre-separation conflict levels were high, promoting an increase in school performance.

Differences between children living in households with both biological parents and those living with a mother in a uniparental household were much smaller than differences between this first type of household and households without a mother. Uniparental households with a mother tend to have less economic resources and this was one of the main factors associated with differences in schooling performance when this type of households was compared to those with two biological parents. The results suggest that mothers in uniparental households can overcome many of the difficulties imposed by the lack of resources and time (Bruschini, 2006).

Households with a father with a social mother differed slightly from those with a father without a social mother. That is, while a social father seems to be a reasonable substitute for a father concerning the learning process, a social mother is far from having a similar effect as a mother on academic performance.

The main factors that explain the differences in academic performance between households with a mother (only or with aggregates), with a father (only or with aggregates) and without a father and without a mother and those with both biological parents are directly linked to economic resources for the first and for the how the children spend their time, the parent's (or other adults) involvement in the learning process and the quality of the interactions in the households seems to be decisive factors for the other two types.

Amato (2005) suggested that increasing the proportion of children who continuously grow up with biological married parents would only modestly improve the overall well-being of U.S. children, as many other causes other than family structure promotes differences in school performance. Thus, as stated by Foster and Kalil (2007), policies seeking to improve child well-being by changes in living arrangements may be not very effective. Nevertheless, according to Aughinbaugh et al. (2005), even if marital transitions do not show great effect on the children's cognitive assessments, other measures of well-being may be particularly touched. Therefore, small differences in childhood may be amplified in adulthood, suggesting the importance of inclusive policies while the child is in preschool and in elementary school.

Thus, the findings of this paper may be linked to policies designed to overcome some of the difficulties faced by adolescents and young adults in their transition to adulthood. For instance, individuals tend to have hyperbolic preferences (Oreopoulos, 2007), overweighting the present so much that future rewards are largely ignored and such preferences can lead to underinvestment in education (Levitt et al., 2012). Hence, policies offering incentives to stay

in school might improve lifetime outcomes, such as the Bolsa Familia program in Brazil (Fiszbein et al., 2009).

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Conceptualization, data curation, formal analysis, funding acquisition, investigation, methodology, project administration, resources, software, supervision, validation, visualization, writing – original draft and writing – review & editing.

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Conflict of interest

The authors declare no conflict of interest.

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