

Household composition and school performance

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Key-words: Brazil, household composition, school performance

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Abstract

Most 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 social parent, in particular a social father. In general, it is believed that children from divorced couples and living in single-parent families tend to perform less well at school than children living in intact two biological parents families, even after controlling for parental characteristics. I compared school performance in the fourth series (or fifth year) in Brazil of children living in six different household arrangements. The highest values for school performance were observed for households with both biological parents, although differences for households with mother and a social father were not large. Values for households with a mother showed intermediate results. The three household compositions without a mother - father and a social mother, father (only or with aggregates) and other arrangements without a father or a mother - had smaller values for school performance than others. These observed differences in school performance were mostly explained by observable heterogeneity in school inputs, location, household economic and learning resources and household's interactions. The non-observable differences between households were sizable only for those with father and a social mother and father (only or with aggregates), suggesting mechanisms not captured by the controls of the econometric models.

1 - Introduction

Most 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 social parent, in particular a social father (Amato, 2005; Magnuson and Berger, 2009). Having as perspective that the child's social development could be regarded as a conjointly project of the child, the child's parents, and the educational institution (Stevenson and Baker, 1987), these changes in household arrangements might impact school performance.

In general, it is believed that children from divorced couples and living in single-parent families tend to perform less well at school than children living in intact two biological parents

families, even after controlling for parental characteristics. According to Amato (2005), children born outside the wedlock have not been studied as frequently as children of divorce, however, they are also more likely than children continuously living with both biological married parents to experience a variety of cognitive, emotional, and behavioral problems. Besides, the same tend to happen if the child lives with only one of his/her biological parents and his/her new mate (Piketty, 2003).

Many authors addressed the effects of family structure on school performance and related topics (For instance Amato, 2005; Aughinbaugh et al., 2005; Babalis et al., 2014; Bernardi and Radl, 2014; Foster and Kalil, 2007; Gennetian, 2005; Magnuson and Berger, 2009; Patterson et al., 1990; Thompson et al., 1988; Votruba-Drzal, 2006)) and results differed depending on the study. Some studies show that children living in two biological parents families tend to have higher levels of performance, while other studies found small or non-significant differences. Some authors analyzed time dynamics regarding differences between children living with both biological parents and those recently divorced (Amato, 2005; Jekielek, 1998; Kaye, 1989) and again results differed depending on the setting studied. This divergence in results was also observed in studies that compared boys and girls (Glick and Sahn, 2000; Kaye, 1989).

According to Bernardi and Radl (2014), the specialized literature describe three main mechanisms that might explain the observed associations between household composition and educational attainment. The first is the reduction in economic resources following a breakup, that may adversely influence children's cognitive development and behavior (Amato, 2005; Magnuson and Berger, 2009), as, on average, families with two-biological-parents tend to have higher household incomes and more assets than uniparental households. Children born outside the wedlock are also more likely than children continuously living with both biological married parents to experience a variety of cognitive, emotional, and behavioral problems (Amato, 2005).

Thus, children in poor families may be more sensitive to income changes than others (Votruba- Drzal, 2006) and higher income parents have greater likelihood of being less touched by the loss of economic resources (Bernardi and Radl, 2014). An extension of this reasoning, the impact associated to lower levels of economic resources may be smaller for those who restructure the households with another partner, especially among women that tend to command lower incomes and show lower labor market participation than men.

The second point emphasized by Bernardi and Radl (2014) are the changes in parental time and practices, and parenting stress. Children in two-biological-parent families might receive more parental time, attention, supervision, and monitoring than those in children in single and social-parent families. Moreover, they tend to receive more effective parenting, experience more cooperative co-parenting and are emotionally closer to both parents (Amato, 2005). Andrabı et al. (2012) demonstrated the importance of maternal and child time use in understanding the unique role mothers play in their children's lives and the mechanisms promoting higher performances in test scores.

Bernardi and Radl (2014) also emphasized the child's emotional distress due to parental divorce that might impact negatively on school performance. Parents and children who experience family structure transitions are likely to experience elevated levels of family stress and conflict, with indirect effects on children's school performance by reducing parental warmth, support, and nurturance (Amato, 2005; Magnuson and Berger, 2009). Jekielek (1998) observed higher levels of well-being for children after the divorce for households with higher pre-disruption conflict levels. That is, differently than the proposed by Bernardi and Radl (2014), divorce might actually improve the well-being of children if pre-separation conflict levels were high, and school performance might even increase (Amato, 2005). For instance, Piketty (2003) concluded that parental conflicts, rather than the divorce per se, were detrimental for children school performance.

According to Amato (2005), the reunion of a biological parent tend to improve children's standard of living, as well as supervision and assistance to children's problems. Thus, it might be assumed that children are in average better off in stepfamilies than in single-parent households. However, remarriage of the custodial mother (or father) can be followed by additional problems in part because social parents face ambiguous parental roles and norms (Magnuson and Berger, 2009).

Magnuson and Berger (2009) proposed another primary factor to explain differences in child well-being across family structures. They also recognized the importance of social selection. According to Black et al. (2005), Foster and Kalil (2007) and Piketty (2003), the impact of the different living arrangements per se is likely to be confounded with other factors that led the adults to involve selectively in relationships. For instance, the use of alcohol might result in unstable relationships between partners and may also affect parenthood with consequence to the children's school performance.

The main objective of this paper is to analyze associations between household compositions and school performance. More specifically, I compare school performance in the fourth series (or fifth year) 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 and a social mother; his/her father (only or with aggregates); other arrangements without a father or a mother.

Some recent trends in Brazil might have an effect on the results. Surkyn and Lesthaeghe (2004) described the main features of pattern transformation in household formation associated with the second demographic transition (SDT). Among those, divorce rates raised, as observed in the U.S. (Amato and Rogers, 1999) and in Brazil (Silva and Lazo, 2010). Therefore, there was an increase in single-parents households in Brazil, especially those headed by women, what may have a negative impact on school performance. However, women tend to be more household-focused than men (Golgher, 2016), what might have a positive influence on performance. Moreover, there was an increase in labor market participation of females (Juhn and Potter, 2006; Wajman and Rios-Neto, 2000), and female schooling levels are higher nowadays than for males in Brazil, and educational gaps in Brazil between sexes are increasing (Whinter and Golgher, 2010), and wage gaps are decreasing (Hausmann and Golgher, 2014). Based on the discussion presented in Bernardi and Radl (2014), these two trends might enhance female's economic resources of single and divorced mothers, which might have a positive effect on students' performance living with their mother (only or with aggregates).

Schooling levels increased remarkably in Brazil in the last decades and nowadays most individuals conclude the elementary level, which has become close to universalized (Lima, 2011), nonetheless, school performance is far from being satisfactory (Felício and Fernandes, 2005; Machado et al, 2008; Soares, 2005).

There are a myriad of factors that explain these low performance level, such as individuals features, household and family characteristics, location, school characteristics, and peer and contextual effects (Alves and Franco, 2008; Barros et al, 2001; Duflo et al. 2011; Espósito et al, 2000; Felício and Fernandes, 2005; Golgher, 2010a,b; Machado et al, 2008; Menezes-Filho, 2007; Soares, 2005). Moreover, some authors analyzed school performance in Brazil using the Saeb, the same database used in this paper (Araújo and Siqueira, 2010; Biondi and Felício, 2007; Felício and Vasconcellos, 2007; Fernandes and Natenzon, 2003; Rodrigues et al, 2011; Rodrigues et al,

2013; Rodrigues, 2014; and Soares and Alvez (2013). I included some of the features described by these authors as controls in my analysis and used similar databases. The focus of this paper, however, differ from those mentioned above, and is household composition.

I used as database the Prova Brasil of 2007 (Brazil exam) from the Brazilian National System for Evaluation of Basic Education (Saeb). Students of fourth and eighth series (or fifth or ninth years), and also those ending high school, in urban public schools with over 20 students do exams of Mathematics and Portuguese. I selected those in the fourth series (or fifth year). According to Magnuson and Berger (2009) associations between family structure and child well-being tend to differ by child age. Most studies that addressed this relationship have focused on adolescents, and less is known about the associations during middle childhood (Votruba-Drzal, 2006).

Besides, the Saeb collects data about the student's households economic and learning resources, the children's school environment, and school infrastructure, his/her teachers' and principals' characteristics, the students' behavior toward learning and his/her parents' participation in the educational process (Rodrigues et al., 2013). The database enable the use of a rich set of controls were used in the models. In addition, it counts with over 2 million observations.

The empirical strategy is the following. The school performance of students living in one of the six different household compositions were compared with the use of models estimated by OLS. I began the studies with models with mostly exogenous variables no directly associated with the household. Then, the models incorporated a greater number of controls associated to the household economic and learning resources and differences between household compositions were verified. After, controls related to household's interactions between adults and students were incorporated. The complete model was then applied to subgroups of the population.

The rest of the paper was divided as follows. Section II describe the methodology. Next section presents descriptive statistics. Section IV shows the results for the models estimated by OLS associating school performance with household composition. Last section, concludes.

2 -Empirical strategy and variables

The main objective of the paper is to associate school performance with household composition. In order to do so, I initially apply models estimated by OLS that are specified as follows:

$Y_{ijkl} = \alpha + \varphi\eta_{ijkl} + \beta X_{ijkl} + \delta Z_{jkl} + \theta W_{kl} + \gamma\psi_l + \varepsilon_{ijkl}$, where the dependent variable, Y_{ijkl} , is the test score (math or Portuguese) of the student i , in class j , in school k and in state l ; η_{ijkl} are the dummies for household composition, the main variables of interest, X_{ijkl} are the student's individual and household variables, Z_{jkl} and W_{kl} are respectively the controls for the students' class and school, ψ_l are the dummies for state, and ε_{ijkl} are the errors.

The dependent variables are the test scores in math and Portuguese, which are continuous variables, approximately normally distributed, respectively with mean 191.1 and 173.7 and standard deviation of 43.3 and 41.3.

Concerning household composition, the student answered whether he lived with his mother (yes or no). If the answer was no, he/she was questioned whether he/she lived with another women which was responsible for him/her. This same procedure was used to ask about the student's father. Using these two questions, the households were classified in six types, if 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); other arrangements without a father or a mother.

The models included different controls, as highlighted in the equation above. For a discussion about controls and explanatory variables used to analyze school performance in a Brazilian setting see Alves and Franco (2008), Andrade and Laros (2007), Araújo and Siqueira (2010), Barros et al (2001), Biondi and Felício (2007), Espósito et al (2000), Felício and Fernandes (2005), Felício and Vasconcellos (2007), Golgher (2010a,b), Laros et al (2010), Machado et al (2008), Menezes-Filho (2007), Rodrigues et al (2011), Rodrigues et al (2013) and Soares (2005).

The empirical strategy of the paper begins with a first group of models that include explanatory variables that are mostly exogenous from household composition. Directly associated with the class, I included the class duration (in hours), class size (categorical for number of students: 1 – 20; 21 – 30; 30 – 40; 41 and more) and time of the day of the class (Categorical: morning, mid-day, afternoon). Regarding the student's teacher, I included his/her age, experience,

squared experience to account for nonlinearities, and education. Characterizing the school, the variables are related to infrastructure (computers, library and illuminated and aired classrooms) and administration (type of administration: municipal, federal or state). Concerning violence, I included a categorical variable related to the perception by the principals of danger and drug consumption in their school. Finally, the models include geographical dummies for state. Many other variables could be used as controls, but the number of observations without missing would decrease sharply.

All these variables were included in the first group of models because they might influence school performance in mechanism not directly related to household structure. However, for instance, students might change their school or neighborhood because of a divorce, and this might have an impact on school performance. Different states might have different propensities for different household's arrangements, and because school performance is also different among them, I expect some influence. Households living in some neighborhoods might show a greater propensity to instability. Thus, the distribution among household arrangements is not spatially homogenous.

The second group of models include controls for sex (1–Male, 0–Female) and ethnic group (1–White/Asian, 0–Black/Brow/Indigenous). In general, it is expected that men have a better performance in mathematics and women in Portuguese, and that white/Asian have a better performance in both when compared to Black/Brow/Indigenous. Different ethnic groups might show different propensities for specific household's arrangements. Moreover, children might show a greater propensity to live with a divorced mother or father depending on the sex.

Many authors emphasized the importance of economic resources as a determinant for school performance (Amato, 2005; Bernardi and Radl, 2014; Magnuson and Berger, 2009; Votruba- Drzal, 2006). The database does not have information on income, however, presents the distribution of a rich set of assets in the student's household. I performed a PCA with polychoric correlation with rotation in order to build wealth-indexes. Results suggest that the existence of TV, refrigerator and bathrooms were highly correlated. As most households have these items, I created an indicator with those households with the three items and those that missed at least one (1 – Has all three items, 0 – Has two or less). This is an indicator of very low SES. The presence of computers and cars were also highly correlated. Nonetheless, as computers can be used as learning tools, I maintained both variables separately (1 – Has the item, 0 – Does not have). These are

indicators of higher SES. Also partially indicating economic resources but also learning atmosphere in the household, I included an ordered variable with the number of books in the household (0 – None, 1 – 1 to 20, 2 – 20 to 100, 3 – More than 100). The database also presents the schooling level of fathers/mothers or social fathers/mothers. However, a sizable minority of the students do not know this information and therefore I did not include this extremely important variable in the models due to the potential amount of missing observations.

Another point emphasized in the literature associating family structure and school performance is parental time, attention, supervision, and monitoring (Amato, 2005; Andrabi et al., 2012; Bernardi and Radl, 2014). The third group of models include variables directly associated with these points, although also related in some aspects with socioeconomic levels. The first two are related to working load in the household in domestic tasks in school days (Categorical: 0 – 0 hours, 1 – One or less, 2 – Two, 3 – Three and 4- Four or more), and to working in the labor market (1 – Yes, 0 –No). These two variables indicate the student's time scarcity for school related activities. Some studies indicate the importance of pre-school in posterior schooling achievements (Felício and Vasconcellos, 2007). I included a variable indicating the time the student entered the schooling system (Categorical: 1 – Day care, 2 – Pre-school, 3 – First year of elementary school, 4 - After the first year of elementary school). The next variable was obtained based on variables related to the parents' interaction with their children and with the children's school. I selected four variables with the use of PCA with polychoric correlation and rotation, encouragement to do homework, to study, to read and to go to school, and grouped them (1- Parents' encourage the student in all four domains, 0 – They encourage in three or less domains). The last two variables are associated with homework in math or Portuguese (1 – Frequently do my homework, 0 – I do my homework unfrequently, never or do not have homework). All these variables are related to family structure and parenting, as trade-offs can be made in the household.

The fourth group of models include the same variables as the third, but two specific pairs of groups in the population are compared: boys and girls; poor and non-poor, which was based in the low SES indicator. These four groups of models are presented in section 4.

3 – Descriptive statistics

This section presents descriptive statistics comparing the school performance in math and Portuguese for some of the variables presented in the previous section. Table 1 shows the results for household composition. The majority of the students lived with their biological mother and father, 62.4%, and a sizable minority lived with the mother (only or with aggregates), 22.7%. The other compositions were less numerous, ranging from 1.2% for father (only or with aggregates) to 5.9% for other arrangements types without a mother or a father, but all with above 20 thousand students.

The table also shows the school performance for the six household arrangement in math and Portuguese. The values with asterisks with the same number indicate that the values were not significant different in a Bonferroni test.

The highest values were observed for households with both biological parents, although differences for households with mother and a social father were not large, and not significant for Portuguese. Even without any control, these results indicate that differences between a biological father and a social father are small.

Notice that there are many factors affecting these results and I only focus my discussion on the time the student spent in different family structures and transitions between them. Most families with both biological parents might be “intact”, however, some parents may have built the household after the student was born or temporal household dissolution might have occurred. Students in households with a mother/social father may have faced a divorce and a posterior reunion and might have lived in single parents or multigenerational household for longer. Although dynamics differ, school performance are very similar, suggesting that they changes have a short time of influence and/or that positive and negative impacts have similar magnitudes.

Values for households with a mother showed intermediate results. These results suggest that mothers, as they tend to be more household focused than fathers, can overcome many of the difficulties imposed by less economic resources and probably less disposable time (Bruschini, 2006).

The three household compositions without a mother had smaller values for school performance than others, that is, the major difference is the presence of a mother (In a crude

approximation, 7 points). However, the households without a mother but with a father had slight larger values in math than other types of household, suggesting that the father have a greater effect in math (again in a crude approximation, 2 points) than in Portuguese (0 points). The households with a father and a social mother had a higher value for Portuguese than for father (only or with aggregates) and others households, indicating a positive effect of a social mother in Portuguese (2 points), but not in math (0 points).

Table 1 – School performance for households arrangements

Household composition	Math	Portuguese	Frequency	Proportion (%)
Mother/father	193.7	176.4* ¹	1237825	62.4
Mother/social father	193.0	176.2* ¹	97259	4.9
Mother	190.4	173.4	451207	22.7
Father/social mother	185.6* ²	168.4	22890	1.2
Father	185.3* ²	166.6* ³	57143	2.9
Other types	183.5	166.9* ³	117564	5.9
Total	192.0	174.8	1983888	100.0

Note: * results not significantly different in a Bonferroni test.

Source: Saeb, 2007

Table 2 includes results for sex and ethnic group. All differences in each category in each variables were statistically significant in a *t* test. As expected, males had a higher performance in math and lower in Portuguese. Nevertheless, notice that the difference in the first was much smaller than for the second. White/Asian had higher performance than black/brown/indigenous individuals. All the other variables used in the econometric models showed the expected results and all were statistically significant in a *t* test or a Bonferroni test. For brevity, I only show the results for preschool attendance and encouragement by parents. Notice that for some groups of variables the differences were around 20 points between the smaller and larger value, larger range than the observed for household types, such as for low SES indicator, domestic tasks, participation in the labor market

Table 2 – School performance for different groups in the population

Variable	Math	Portuguese	Frequency	Proportion (%)
female	191.6	179.9	1031880	49.7
male	192.8	170.0	1046193	50.3
Non-white	189.7	172.8	1282382	62.0
White	196.3	178.4	786431	38.0
Attend school since day care	196.8	179.4	785127	37.4
Attend school since pre-school	195.5	177.4	771931	36.8
Attend school since first year of elementary school	182.2	165.9	409071	19.5
Started attending school after first year of elementary school	177.6	160.8	134355	6.4
Parents or responsible do not encourage doing school related activities	176.3	156.5	210917	11.3
Parents or responsible encourage doing school related activities	195.2	178.3	1650332	88.7

Source: Saeb, 2007

All the results described in this section are simple comparisons between groups with a myriad of confounding factors. Next section presents the results for controlled analysis with models estimated by OLS.

4 – Econometric models

In this section, I intend to try to understand why students living in households with different compositions have different performances, however, without claiming that the associations are causal, although they might provide some evidence. The OLS models are shown with an increasing number of controls. As anticipated, the empirical strategy of the paper begins with models that include explanatory variables that are mostly exogenous from household composition: class duration, class size and time of the day of the class; school's infrastructure and administration; teacher's age, experience and education; perceived violence and drug consumption in the school; and geographical dummies for state. As already mentioned, all these variables were included in the models because they might influence school performance in mechanism not directly related to household structure.

Table 3 shows the results for four different models with different set of controls. Notice that all models have the same 1631213 observations, hence the models are nested and comparisons are more insightful. The upper panel shows the coefficients for household type for both math and

Portuguese. Notice that for easiness of comparison, the tables show the coefficient relative size when compared to the benchmark in the middle panel. Some of the coefficients do have overlapping confidence interval, and comparisons are illustrative. For brevity, the standard deviations are shown only in table 6. The lower panel shows the controls included in the models. Again for brevity, the results for controls are shown in table 6. Finally, it should be emphasize that the results may change for a different order of models presentation. The last table in this section will present the coefficients of some of the controls.

The first model has no controls, mimic the results presented in table 1, and is the benchmark. For Mathematics, all the coefficients for household composition were negative, indicating, as observed in table 1, that the students' performance was higher in households with both biological parents. For Portuguese, most coefficients were negative, but for households with a mother and a social father, which was non-significant. These results suggest some factors already discussed. The presence of the father may be more important for the performance on mathematics, a subject in which men tend to have a better performance than women, as shown in the previous section. However, the difference between having a father in the household or a social father is small for mathematics and insignificant for Portuguese. Households with one-parent differ markedly if the child lives with the mother or with the father. Children in uniparental households with mothers, even if they might have a worse financial situation and less economic resources, as described in the literature review, show better performance than those who live with their fathers. When comparing the differences between households with a mother and with a mother and her mate, and a father and a father and his mate, differences for the second pair are much smaller. That is, the women's partner seems to make a greater difference than a men's partner.

All the other models include controls. Model 2 includes the variables associated with school inputs, such as duration, size and time of class; the school's infrastructure and administration; and teacher's experience, age and education. Notice that the differences between all types of households and the reference, households with two biological parents, decreased from both subjects. The coefficients in this model for math were respectively 60, 88, 88, 89 and 79 of the magnitude in the benchmark for respectively households with mother/social father, mother only, father/social mother, father only and others. The numbers for Portuguese were similar for the last four household's arrangements: 89, 89, 92 and 80. These results suggest that a sizable part

of the differences between households is explained by differences in school inputs. Simply, students who live with both biological parents tend to go to schools with better inputs.

Model 3 included the controls for perceived violence. Results did not differ much from model 2. That is, divorce and households transitions could implicate in changes in household's location to systematically different levels of violence and social problems. Or, households in these regions might show greater instability. I did not find a strong evidence of this here.

Model 4 includes the 27 dummies for state. Notice that differences from the benchmark decrease even further and for mother/social father became insignificant also for math. These results indicate that the spatial distribution of students per household type differ non-randomly with school performance.

Table 3 – Econometric models with different sets of explanatory variables

	Math				Portuguese			
	Model 1	Model 2	Model 3	Model 4	Model 1	Model 2	Model 3	Model 4
	Coefficient							
Mother/father	ref	ref	ref	ref	ref	ref	ref	ref
Mother/responsible	-0.76*	-0.45*	-0.41*	-0.21	-0.17	0.11	0.14	0.25
Mother	-3.30*	-2.89*	-2.85*	-2.30*	-2.95*	-2.63*	-2.59*	-2.20*
Father/responsible	-8.00*	-7.03*	-6.98*	-6.32*	-7.91*	-7.02*	-6.97*	-6.46*
Father	-8.36*	-7.47*	-7.40*	-6.77*	-9.73*	-8.94*	-8.88*	-8.47*
Others	-10.17*	-8.07*	-8.06*	-6.20*	-9.50*	-7.59*	-7.58*	-6.01*
Adjusted R ²	0.0045	0.0416	0.0425	0.0797	0.0049	0.0378	0.0386	0.0708
	Relative size of the coefficient							
Mother/responsible	100	60	54	0	0	0	0	0
Mother	100	88	86	70	100	89	88	75
Father/responsible	100	88	87	79	100	89	88	82
Father	100	89	89	81	100	92	91	87
Others	100	79	79	61	100	80	80	63
	Controls							
Duration, size and time of class	no	yes	yes	yes	no	yes	yes	yes
School learning infrastructure and administration	no	yes	yes	yes	no	yes	yes	yes
Teacher's experience, age and education	no	yes	yes	yes	no	yes	yes	yes

Effects due to violence	no	no	yes	yes	no	no	yes	yes
Localization	no	no	no	yes	no	no	no	yes

Note: number of observations = 1631213. * Significant at 5%

Source: Saeb, 2007

Comparing models 1 and 4, roughly 30% of the differences between household types is explained by factors not directly related to the household's dynamics or transitions. Moreover, differences between households with two biological parents and a mother and a social father are non-significant when controls for school inputs, violence and state dummies were included in the model. For other household types, these variables explained from 40% for other household arrangements to 55% for father only. However, as emphasized in the introduction, differences in economic resources in the household may greatly impact on school performance. There are indirect effects of the household's economic resources already controlled in these models.

Table 4 shows the results for the previous models 1 and 4 and include two others that incorporate the explanatory variables associated with sex, ethnic group and the household's economic and learning resources. Notice that all models have the same 1278516 observations. Models 1 and 4 were already described in the previous table, and minor differences occur due to differences in the observations.

Model 5 includes the controls for sex and ethnic group. As described in table 2, males had a higher performance in math and lower in Portuguese than females, and white/Asian had higher performance in both subjects than black/brown/indigenous individuals. Comparing models 4 and 5, differences between households arrangements decreased slightly simply because the distribution of sex and ethnic group by household type is not random. For instance, for households with mother only the coefficient relative size for math decreased from 70 to 65 and increased slightly for Portuguese between 76 to 77 (remember that confidence intervals may overlap) because girls have a greater propensity to live with their divorced mother and boys with their father. Results not shown using multinomial logistic models indicate that differences are significant.

Model 6 includes the controls for low SES, basic household infrastructure, for higher SES, cars, and for learning resources, computers and books. Notice that differences between models 5 and 6 are reasonable small for most household types, but differ for uniparental households,

especially for mother (only and with aggregates). The results suggest that these types of household are plagued with lower economic and learning resources, which may affect the performance of students. Note that close to 40% of the difference between a mother household and a two biological parents household is explained by the economic and learning resources included in the model. This is an indicative of the importance of conditional cash transfers (CCT) policies, which are mostly directed to women (Fiszbein and Schady, 2009).

Notice that the coefficient for mother/social father became positive and significant for both subjects. 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 suggestion are made. First, the household might face less stress, as the most stressful mother and father relations do not further exist 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.

Table 4 – Econometric models with different sets of explanatory variables

	Model 1	Model 4	Model 5	Model 6	Model 1	Model 4	Model 5	Model 6
Mathematics					Portuguese			
Mother/father	ref	ref	ref	ref	ref	ref	ref	ref
Mother/responsible	-0.85*	-0.29*	0.07	1.39*	-0.21	0.21	-0.05	1.18*
Mother	-3.71*	-2.61*	-2.40*	-0.95*	-3.38*	-2.56*	-2.60*	-1.34*
Father/responsible	-6.92*	-5.12*	-4.98*	-4.77*	-6.60*	-5.10*	-4.69*	-4.47*
Father	-8.17*	-6.33*	-6.44*	-5.63*	-9.41*	-7.95*	-6.99*	-6.20*
Others	-9.35*	-5.23*	-4.97*	-4.50*	-8.44*	-4.86*	-4.86*	-4.44*
Adjusted R ²	0.0041	0.0788	0.0816	0.1007	0.0042	0.0688	0.0834	0.1039
Remaining coefficient relative size								
Mother/responsible	100	35	0	-	0	0	0	-
Mother	100	70	65	26	100	76	77	40
Father/responsible	100	74	72	69	100	77	71	68
Father	100	77	79	69	100	85	74	66
Others	100	56	53	48	100	58	58	53
Controls								
Duration, size and time of class; School learning infrastructure and administration; Teacher's experience, age and education; Effects due to	no	yes	yes	yes	no	yes	yes	yes

violence; and localization								
Sex and race	no	no	yes	yes	no	no	yes	yes
Basic household infrastructure and car	no	no	no	yes	no	no	no	yes
Computer and books	no	no	no	yes	no	no	no	yes

Note: number of observations = 1278516. * Significant at 5%

Source: Saeb, 2007

Table 5 complements the initial analysis with models that included explanatory variables related to time use and household interactions. Models 1 and 6 are the same discussed above, but for a different set of observations. Model 7 included the controls for time spent in the household doing domestic task in a school day and participation in the labor market. Comparing models 6 and 7, the main differences are observed for the households without the mother, especially for father and a social mother. In these households, the students seems to work in greater proportion in the labor market, possibly boys, or in the domestic chores, possibly girls. This had a negative impact on performance and partially explains the difference between households with mother and a stepmother.

Model 9 incorporates the control for the time the student began the schooling process, which is an important determinant of posterior school performance (Felício and Vasconcellos, 2007), and for the encouragement that parents and responsible give to their children and the amount of homework done by the students. Comparing models 7 and 8, a sizable proportion of the difference between households with both biological parents and the other types is explained by these variables. Two adults in the household tend to have more time to effectively encourage and enforce the necessity of discipline and hard work in their children. Even households with mother only seems to suffer from these aspects. 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, besides of not going to school before the elementary level (this last result not shown), however, due to time scarcity (Ribeiro e Marinho, 2012), they are unable to also effectively encourage and discipline their children at a greater extent than men.

Table 5 – Econometric models with different sets of explanatory variables

	Model 1	Model 6	Model 7	Model 8	Model 1	Model 6	Model 7	Model 8
Mathematics								
Mother/father	ref	ref	ref	ref	ref	ref	ref	ref
Mother/responsible	-0.98*	1.40*	1.81*	2.70*	-0.44*	1.08*	1.52*	2.41*
Mother	-3.87*	-0.98*	-1.06*	-0.23*	-3.50*	-1.34*	-1.42*	-0.56*
Father/responsible	-6.94*	-4.62*	-3.95*	-2.31*	-6.76*	-4.48*	-3.75*	-2.11*
Father	-8.31*	-5.65*	-5.31*	-3.64*	-9.39*	-6.11*	-5.74*	-4.05*
Others	-9.53*	-4.43*	-3.81*	-1.63*	-8.48*	-4.27*	-3.62*	-1.37*
Adjusted R ²	0.0042	0.1043	0.1296	0.1599	0.0042	0.1065	0.1404	0.1749
Remaining coefficient relative size								
Mother/responsible	100	-	-	-	100	-	-	-
Mother	100	25	27	6	100	38	41	16
Father/responsible	100	67	57	33	100	66	55	31
Father	100	68	64	44	100	65	61	43
Others	100	46	40	17	100	50	43	16
Controls								
Duration, size and time of class; School learning infrastructure, conservation and administration; Teacher's experience, age and education; Effects due to violence; and localization	no	yes	yes	yes	no	yes	yes	yes
Sex and race; Basic household infrastructure, car, computer and books	no	yes	yes	yes	no	yes	yes	yes
Labor market participation and time spent in domestic chores and	no	no	yes	yes	no	no	yes	yes
Time that the student began to study	no	no	no	yes	no	no	no	yes
Parents encouragement to do schooling activities and math and Portuguese homework	no	no	no	yes	no	no	no	yes

Note: number of observations = 1000164. * Significant at 5%

Source: Saeb, 2007

All the previous tables showed models with different sets of controls. The objective was to build the complete model while association with the discussion presented in the introduction of the paper. Table 6 has three different objectives, always presented model 8. The first is to show

the coefficients of the explanatory variables incorporated in the last two tables. The second is to show the standard deviation of the coefficients so to indicate which of the differences previously describe between models might be significant. The third was to compare different groups in the population, more specifically to compare boys and girls; and poor and non-poor.

I begin with the result for the controls. Notice that men had better results in math and women in Portuguese in all models, as observed in table 2 for the non-controlled analysis. Whites had a better performance in math and Portuguese while analyzing all individuals, boys, girls and the non-poor. However, notice that for poor individuals, the coefficient was negative and significant, indicating the black/brown/indigenous had a better performance. That is, in general black/brown/indigenous do have unexplained lower school performance than whites/Asian, but not among the poor individuals. This point should be emphasized and further analyzed in order to better target social policies.

Households with higher SES levels and with more economic and learning resources had better performance in all analyzed groups, including the poor. That is, the non-poor had better performance than the poor and the least poor among the poor had better school performances than the most poor.

Children who spent a large amount of time doing housework or working in the labor market had a much lower school performance in math and Portuguese. Thus, policies addressing child work should be incorporated in policies promoting the increase in school performance, pursuing synergies between them. In this vein, Glick and Sahn (2000) investigated the effects of parental education, income, and household structure on schooling of girls and boys in a poor urban environment in Guinea. They observed that the number of siblings under 5 years of age had a negative impact on girls' schooling but no effect on boys. They stated that domestic responsibilities specially impact girls' education and, therefore, policies that reduce the opportunity cost of girls' time, such as subsidized child care, might have a positive impact. Moreover, CCT policies might be effective here.

Children that went to day care and to preschool had a much higher performance than those that began in the elementary level in all models, showing similar results as in Felício and Vasconcellos (2007). This should be emphasized because a recent policy implemented by the Brazilian government changed what was previously considered the last year of preschool is now the first year of elementary school. The question to be addressed is "should we begin the formal

schooling process even earlier?” The results obtained here point to this direction, although I could not further exam the topic with the present database.

Children who lived in households where parents or adults actively participated in the learning process, encouraging the children in the household to do school related activities, including homework, had a much better performance than others. This point should also be emphasized as a north for policy. Schools should include the parents more effectively in the learning process, a policy that might have a remarkable positive result with low costs, and was also partially promoted by the Brazilian government.

Now I will focus the discussion in the comparisons between boys and girls. Amato (2005) and Kaye (1989) proposed that divorce would affect more boys, as divorced children tend to live with mothers, weakening the male role model. I did not observe this here, but the contrary. For households with a mother and a social father, boys show larger coefficients in math and Portuguese than girls, indicating that they are less touched by divorce if they have a stepfather. Or tentatively speaking, boys might be more sensitive to household levels of conflict and stress. Results for mother (only and with aggregates) differ slightly between the sexes, but also favor boys. That is, the male role might be important for boys, but not so decisive. Results for the father (only or with aggregates) again favors boys and at a larger extent, suggesting that the lack of a female role model is more decisive than the lack of a male role. Differently, the households classified as others showed a worst result for boys, suggesting the need of closer surveillance for boys by a mother and/or a father.

The comparison between non-poor and poor households has one remarkable result, which is for mothers (only or with aggregates), with a negative and significant coefficient for the first groups and a positive and significant for the last. This result indicates that women, who tend to be more household-focused than men (Golgher, 2016), are able to overcome many of the difficulties imposed by the lack of economic and learning resources in the household on school performance.

Table 6 – Econometric models with different sets of explanatory variables for different groups in the population

	All		Men		Women		Non-poor		Poor	
	Coef.	Std.	Coef.	Std.	Coef.	Std.	Coef.	Std.	Coef.	Std.
	Math									
Mother/responsible	2.70*	0.18	3.33*	0.29	2.16*	0.24	2.66*	0.20	3.00*	0.53
Mother	-0.23*	0.10	-0.07	0.15	-0.35*	0.13	-0.51*	0.10	2.14*	0.28
Father/responsible	-2.31*	0.39	-1.56*	0.56	-3.13*	0.53	-2.30*	0.41	-1.39	1.17

Father	-3.64*	0.25	-3.27*	0.34	-4.14*	0.36	-3.87*	0.26	-1.45*	0.66
Others	-1.63*	0.18	-1.71*	0.27	-1.57*	0.23	-1.86*	0.19	0.91	0.48
Male	3.73*	0.08	-	-	-	-	3.86*	0.09	3.05*	0.24
White	2.48*	0.08	2.49*	0.12	2.50*	0.11	2.84*	0.09	-1.79*	0.26
Basic infrastructure	6.53*	0.14	7.12*	0.21	5.95*	0.18	-	-	-	-
Car	2.82*	0.09	2.27*	0.14	3.39*	0.12	2.81*	0.10	1.79*	0.35
Computer	5.88*	0.10	6.24*	0.14	5.62*	0.13	5.84*	0.10	1.76*	0.44
Books	2.75*	0.05	3.04*	0.07	2.49*	0.07	2.94*	0.05	0.91*	0.15
Time spent in domestic chores: None	Ref.	Ref.	Ref.	Ref.	Ref.	Ref.	Ref.	Ref.	Ref.	Ref.
0 to 1 hours	-3.14*	0.11	-4.87*	0.15	-0.41*	0.17	-3.31*	0.12	-0.77*	0.34
2 hours	-5.13*	0.13	-7.38*	0.19	-2.06*	0.19	-5.38*	0.14	-2.00*	0.39
3 hours	-11.0*	0.16	-13.9*	0.24	-7.45*	0.21	-11.4*	0.17	-6.21*	0.45
4 and more hours	-15.5*	0.16	-17.0*	0.25	-12.9*	0.22	-16.3*	0.18	-8.12*	0.44
Work	-12.5*	0.12	-12.7*	0.16	-11.8*	0.20	-13.2*	0.13	-7.06*	0.31
Began in school in: day care	Ref.	Ref.	Ref.	Ref.	Ref.	Ref.	Ref.	Ref.	Ref.	Ref.
Preschool	-1.75*	0.09	-1.42*	0.14	-2.10*	0.12	-1.86*	0.10	0.12	0.30
First year of elementary school	-10.4*	0.11	-9.60*	0.17	-11.2*	0.15	-11.2*	0.12	-4.33*	0.32
After first year of elementary school	-12.9*	0.17	-12.4*	0.26	-13.4*	0.24	-13.4*	0.19	-8.53*	0.46
Parents/Social parents/others encouragement	9.46*	0.13	9.26*	0.18	9.71*	0.19	9.62*	0.15	8.43*	0.32
Math homework	7.06*	0.12	7.51*	0.17	6.48*	0.16	7.25*	0.12	5.25*	0.31
Portuguese homework	5.86*	0.11	4.66*	0.16	7.29*	0.16	5.98*	0.12	4.46*	0.30
Adjusted R ²	0.1599		0.1535		0.1668		0.1521		0.0834	
	Portuguese									
Mother/responsible	2.41	0.17	2.75	0.26	2.11	0.23	2.34	0.18	2.87	0.50
Mother	-0.56	0.09	-0.43	0.13	-0.65	0.13	-0.85	0.10	1.87	0.26
Father/responsible	-2.11	0.36	-1.45	0.51	-2.84	0.52	-2.16	0.38	-0.59	1.09
Father	-4.05	0.23	-3.83	0.31	-4.36	0.35	-4.44	0.25	-0.72	0.61
Others	-1.37	0.17	-1.31	0.24	-1.36	0.23	-1.55	0.18	0.82	0.44
Male	-7.76	0.08	-	-	-	-	-7.87	0.08	-6.22	0.22
White	2.08	0.08	2.19	0.11	1.98	0.11	2.41	0.08	-1.91	0.24
Basic infrastructure	7.12	0.13	6.98	0.19	7.11	0.18	-	-	-	-
Car	1.63	0.09	0.87	0.12	2.37	0.12	1.60	0.09	0.91	0.33
Computer	6.14	0.09	6.22	0.13	6.14	0.13	6.13	0.09	1.49	0.41
Books	2.69	0.05	2.96	0.07	2.43	0.07	2.90	0.05	0.66	0.14
Time spent in domestic chores: None	Ref.	Ref.	Ref.	Ref.	Ref.	Ref.	Ref.	Ref.	Ref.	Ref.
0 to 1 hours	-3.68	0.10	-5.16	0.14	-1.49	0.16	-3.86	0.11	-1.28	0.31
2 hours	-6.62	0.12	-8.23	0.17	-4.42	0.18	-6.87	0.13	-3.48	0.37
3 hours	-11.68	0.15	-13.32	0.22	-9.43	0.21	-12.07	0.16	-7.12	0.42
4 and more hours	-15.98	0.15	-16.10	0.23	-14.65	0.22	-16.82	0.16	-8.59	0.41
Work	-14.71	0.12	-14.60	0.14	-15.00	0.20	-15.30	0.12	-10.25	0.29
Began in school in: day care	Ref.	Ref.	Ref.	Ref.	Ref.	Ref.	Ref.	Ref.	Ref.	Ref.
Preschool	-1.82	0.09	-1.29	0.13	-2.32	0.12	-1.89	0.09	-0.46	0.28
First year of elementary school	-9.23	0.11	-7.92	0.15	-10.40	0.15	-9.89	0.11	-3.95	0.29

After first year of elementary school	-12.29	0.16	-11.10	0.23	-13.39	0.23	-12.54	0.18	-9.16	0.43
Parents/Social parents/others encouragement	11.89	0.13	10.93	0.17	13.15	0.19	12.03	0.14	11.00	0.29
Math homework	3.99	0.11	4.09	0.15	3.76	0.16	4.12	0.12	2.65	0.29
Portuguese homework	8.36	0.10	7.08	0.14	9.85	0.15	8.56	0.11	6.39	0.28
Controls	Duration, size and time of class; School learning infrastructure, conservation and administration; Teacher's experience, age and education; Effects due to violence; and localization									
Adjusted R ²	0.1749		0.1580		0.1735		0.1657		0.1056	
Number of observations	1000164		482633		517531		903881		96283	

* Significant at 5%

Source: Saeb, 2007

5 - Conclusion

This paper analyzed associations between household compositions and school performance. More specifically, I compared school performance in math and Portuguese in the fourth series (or fifth year) in urban 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 and a social mother; his/her father (only or with aggregates); other arrangements without a father or a mother.

The highest values for school performance were observed for households with both biological parents, although differences for households with mother and a social father were not large, and significant only for math. Values for households with a mother showed intermediate results. The three household compositions without a mother had smaller values for school performance than others. That is, the major difference in both subjects was the presence of a mother, however, the households without a mother but with a father had slight larger values in math than other types of household, suggesting that the father have a greater effect in math than in Portuguese. The households with a father and a social mother had a higher value for Portuguese than for households with a father (only or with aggregates) and other types of household, indicating a positive effect of a social mother in Portuguese, but not in math.

These observed differences in school performance were mostly explained by observable heterogeneity in school inputs, location, household economic and learning resources and household's interactions. The non-observable differences between households were sizable only

for those with father and a social mother and father (only or with aggregates), suggesting mechanisms not captured by the controls of the econometric models.

Thus, differences between household types per se are dwarfed by other factors while explaining school performance, as there are many other reasons for low school performance. 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, where the returns to achievement are largely delayed (Levitt et al, 2012). If students are myopic, policies offering incentives to stay in school might improve lifetime outcomes (Dearden et al, 2005). In this vein, in recent years a number of countries have introduced means-tested conditional grants in an attempt to encourage students to stay in school, as PROGRESA in Mexico, Familias en Acción in Colombia and the Bolsa Familia program in Brazil (Fiszbein and Schady, 2009; Schwartzman and Cossio, 2007). The findings presented in this paper may help the design of even more effective policies that might take into account factors associated with household composition and the regional distribution of household arrangements. .

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 promote 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. However, even if family structure might not influence remarkably the levels of cognitive and socioemotional problems in youth, do they lead to problems in adulthood? According to Aughinbaugh et al. (2005), an important unanswered question is how the parents' marital instability affects the child's ability to become well-adjusted and productive adults. The authors emphasized that even if marital transitions do not show great effect on the children's cognitive assessments, other measures of well-being may be particularly touched, such as different psychological mechanisms that decrease the probability of a youth's subsequent marriage and marital stability. 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.

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