DRAFT: PLEASE DO NOT CITE WITHOUT AUTHORS' PERMISSION

Version: 20 March 2011

Family Size and Adolescents' Education and Work in Brazil: Gender Differences

Letícia J. Marteleto
University of Texas at Austin
&
Laetícia R. de Souza
University of Wisconsin-Madison

Abstract:

There has been a long line of research focusing on the implications of family size on a range of children outcomes, particularly education. There has been less research looking at whether and how family size implies different meanings for adolescent boys and girls. Family resources (social, cultural, economic) connect family size to children outcomes: the more children the fewer resources per child. Most past research in this area has used a theoretical framework whereby children are conceptualized as receiving resources only. We expand such theoretical framework by considering that in some contexts children can also be resource providers, with important implications for understanding the different implications of family size for adolescent boys and girls. Considering a family dynamics in which adolescents receive and provide resources to the family unit, this paper expands past research by examining the implications of family size for two adolescent outcomes in Brazil: school enrollment and work. Brazil offers unusually high-quality nationally representative data with large enough sample sizes to implement a twin approach to examine gender differentials in the effects of family size on adolescents' outcomes. We use data from the 1997-2009 PNAD, a nationally representative household survey collected annually by the Brazilian Census Bureau (*IBGE).*

INTRODUCTION

There has been a long line of research focusing on the role of family size[1] on children's outcomes, particularly on education. Simply put, it has been theorized that family resources (social, cultural, financial) are diluted within families that have more children, and therefore the larger the family, the fewer the resources available per child, implying worse outcomes for each child (Blake 1981)[2]. In such framework, family resources connect family size and children's outcomes in that larger families imply in smaller per child resources. While most past research examining the role of family size on children's outcomes have conceptualized children as only receiving resources, children and adolescents are also resource providers in a large part of the world. Combining school and work is often the norm for adolescents in several developing countries. At the same time, in several contexts parents see the providing and receiving resources to the family through gendered lenses where adolescent boys often work for economic gain while adolescent girls perform household work. The broader and gendered conceptualization of family resources we incorporate has direct consequences for the implications of family size to adolescents' well-being and future life prospects.

The goal of this paper is therefore to examine the implications of family size to adolescents' education, work and household work in the Brazilian context. While we expand the more common educational outcomes to include two types of work to more broadly encompass the reality of adolescents' well-being in the Brazilian context, we also address methodological concerns about the joint determination of education and family size that have recently gained traction in the literature. While a long-recognized issue, only recently have researchers begun to address methodologically that parental predisposition likely shapes family size and children's schooling simultaneously. Parents who highly value children's *quality* may decide to have fewer children in the first place, which could explain the association found in past studies. Such new wave of research has reported sharp differences from early findings, with studies even reporting no significant effects of family size on children's education. This literature has examined children's educational outcomes using the arguably exogenous variation in

[1] We use the terms family size and sibship size as synonyms.

[2] Economic theory also posits a negative association while contending that parents make education investments in their children based on assessments of children's differential ability to contribute to the wealth of the entire family, therefore generating inequities within siblings (Becker 1981). Confluence theory also predicts a negative effect of family size on children's education and suggests that the mechanism lowering per child educational outcomes in larger families is family's average intellectual environment (Zajonc and Markus 1975).

family size induced by twins (Rosenzweig and Wolpin 1980; Rosenzweig and Wolpin 2000; Black et al. 2005; Cáceres-Delpiano 2006; Li et al. 2008; Black et al. 2010; Angrist et al. 2009) and by sibling sex composition (Angrist et al. 2009; Conley and Glauber 2006; Black et al. 2010). The use of twins as instrumental variable is based on the idea that the birth of twins is out of parents' control and results in an unexpected increase in family size of two rather than one. The birth of twins would arguably provide a source of random variation that is not associated with any measurable family background characteristics.

The significance for this work is both conceptual and methodological. First, it expands the outcomes commonly examined in the literature—educational outcomes— in this area to include adolescent's work inside and outside the household. This way, the present work goes beyond previous conceptualizations of family dynamics by considering that adolescents often receive and provide resources to the family unit and that the combination of these outcomes provides a more complete picture of adolescents' well-being. Second, this work focuses on the implications of gendered understandings of adolescence to the link between family size and adolescent's well-being. Finally, while past studies have examined the association between family size and children's education, most of the research in developing countries has not addressed that parental predisposition shapes family size and children's well-being simultaneously, therefore not appropriately assessing the implications of family size to adolescents' outcomes.

GENDER AND FAMILY SIZE IN BRAZIL

Our conceptual framework borrows from the dilution of resources hypothesis the idea that family resources consists of the key factor linking family size to children's outcomes. According to the dilution of resources framework, parents in larger families provide fewer resources per child, resulting in lower educational levels (Blake 1989). However, family resources are not fixed the way dilution of resources hypothesis poses, rather varying in their nature—cultural, social, economic—over time and across societies. While in most Western societies family resources are conceptualized as including parental resources only, resources coming from the extended family and from children themselves may play an important role in providing financial resources to the family unit. Adolescents may also perform household work, and take care and serve as mentors and teachers to younger siblings. Our

conceptual framework therefore considers that adolescents both receive and provide resources from/to the family unit and that how adolescents are seen as receivers or providers of resources depends on gendered views of work in Brazilian society. Gender is a key factor for understanding the consequences for youth of the intertwining of receiving and providing resources within the family unit, and therefore on the implications of family size to their well-being.

The implications of family size for adolescents' outcomes might differ for boys and girls not only because parental investments may be different depending on the child's gender, but also because adolescent boys and girls may be seen as resource providers to the family unit in a different way. There are three broad explanations for gender differences in parental investments in their children's education based on resource allocation dynamics within the family. Rational-choice theory based on altruistic behaviors predicts that parents are altruistic in investing in their children to maximize the well-being of the whole family (Becker 1981). Therefore, parents act reinforcing rather than compensating for differences in their children's endowments because they base their investing in children's education on expectations of future returns for the whole family. Sex differences in the long-term returns to education would therefore explain higher parental investments in sons' education over daughters' education found in other developing countries (Buchman 2000; Hsin and 2006; Parish and Willis 1993). When sex differences in returns to education equalize, parents would invest equally in sons and daughters' education. One study reports that Kenyan parents point specifically to sex differences in wages as a reason for investing in the education of sons rather than daughters (Buchmann 2000).

While altruistic models stress the future returns to education, the family-economy model distinguishes between short- and long-term returns to education, suggesting that several families cannot base their educational decisions on long-term returns to education if that risks them in the short run. Parents would not act based on future returns to education but rather on short-term conditions based on direct and opportunity costs to education. This framework would explain why in low-income families and in times of economic crisis parents pull their children out of school and place them in the labor market as a survival strategy (Duryea et al. 2007). Cultural norms regarding gender roles have explained differences in parental investments on children's education elsewhere (Buchman 2000). Because in some societies married daughters provide support to their husband's families while sons provide

assistance to their own families, cultural norms have explained differences on how family size impinges differently on female versus male education (Hsin 2006; Post and Pong 1998).

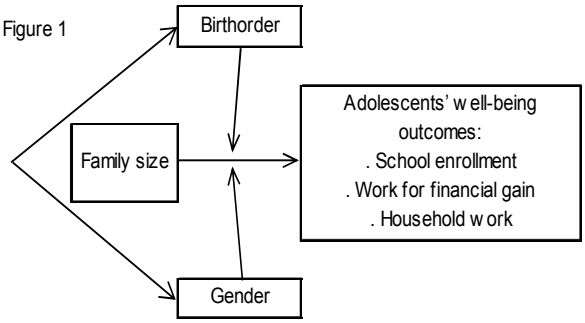
In addition to gender differences on parental investments towards their children's education, adolescent boys and girls can also be seen differently as resources providers to the family. While Brazilian society is not organized around explicit son preference cultural norms like some Asian societies, gender is understood through the lenses of a patriarchal culture, with potential important implications for the intra-family allocation of obligations. In Latin American societies, women's traditional domestic role implies that adolescent girls are often expected to perform household chores and care for younger siblings, a type of work that is significantly higher in larger families. While daughters have been traditionally expected to care for younger siblings and perform household work, sons work in the informal sector to secure additional income to complement family financial resources. This traditional gender allocation of work within families imposes gendered stereotypes and norms that suggest social control and responsibilities for daughters and more independence for sons. The implications of these gendered assignments of family roles can place boys and girls on very different educational and work pathways that will directly influence adolescents' perceptions of their own abilities and the socialization of girls and boys within their families.

The main empirical findings from the literature on gender and adolescent work in developing countries is indeed that significant differences exist in the nature of work time—boys spend more time working for pay or for family's economic gain, while girls spend more time on household work (Ilahi 2001; Larson & Verma 1999; Canagarajah & Coulombe 1998; Kramer 2002; Levison, 1993; Skoufias & Parker 2002). In Latin America, women's traditional domestic role has created pressures on adolescent girls to leave school earlier than boys in Mexico, a finding that is particularly true for early-born daughters, suggesting an important interplay between birth order and gender (Post 2001). Work is part the daily lives of Brazilian adolescents as working in the informal market has been a survival strategy for many families (Orazem et al. 2009). Indeed, young males were found to increase their participation in the labor market at higher rates than girls in Brazil as a result of economic crisis (Duryea et al. 2007).

If adolescent boys and girls are granted unequal resources and/or obligations by their parents, then family size may constrain the amount of family resources distributed (education) and provided (work and household work) in a different way for boys and girls. Here we provide a direct test of the implications of family size for boys' and girls' outcomes.

In addition to gender differences on the implications of family size for adolescents' outcomes, we also investigate whether educational resources are differentially allocated as a function of children's birth order. We compare adolescents of first, second and third orders with the main hypothesis that there are differences on the implications of family size for adolescents educational and work outcomes between first- versus second- and third-order children.

Figure 1



It is possible that in large families the optimal strategy could be to have some children providing resources to the family (taking care of siblings or working to contribute to family resources) while sending others to school to gain enough education to secure better jobs and old-age support. Under this scenario where some children may depend on money or labor support from siblings to attend school, we might find that in addition to gender, birth order also plays an important role in the implications of family size for adolescents' outcomes. In such context where siblings themselves play an important role on children's educational success by providing and receiving financial resources and performing household chores, the negative effect of family size can be buffered for some children in larger families and ultimately reversed (Buchman 2000; Pong).

DATA AND METHODS

Data

In this research, we use data from the 1997-2009 PNAD (*Pesquisa Nacional por Amostra de Domicílio*), a nationally representative household survey collected annually by the Brazilian Census Bureau (*Instituto Brasileiro de Geografia e Estatística, IBGE*). We use an analytic sample of 12 to 16 year-old adolescents to address the question of whether gender and birthorder drives the effect of family size on adolescents' education. The choice of analysis of 12 to 16 year-olds is both theoretical and practical. Theoretically, in Brazil, while primary school enrollment has recently reached universal levels, secondary school enrollment levels are far from ideal. Adolescents are at the most vulnerable age of dropping out of school, leading to dramatic negative consequences to adolescents' future well-being. In practical terms, because the PNAD is a household survey, the data does not allow for a count of the total number of siblings for those who do not live with their parents. Since our focus is family size and most adolescents ages 12 to 16 live with at least one parent in Brazil (92.6%), the use of this sample permits analyses of adolescent outcomes accounting for sibship size. To accurately include family size in the models, we therefore restrict the sample to children of the head of the family. We tested for differences in the samples of children and non-children of the head of the family and did not find significant differences between the two groups. Another issue with using household data to examine total number of siblings at the family level also found in previous research is that we may be missing children living outside the household (Conley 2004; Li et al. 2008). A few years of the PNAD survey offer the number of living children mothers have. We compare the difference between this measure and the measure generated by counting the number of children living in the household. We restrict our analyses to children of mothers younger than 40 years of age as a way to ensure this is a young sample of mothers who are not likely to have older children living outside the household.

Analytical Strategy

We first examine the relationship between family size and each of our five outcomes of adolescent well-being (school enrollment, enrollment in private school, labor force participation, work for pay more than 10 hours per week, household work and worked in household for more than 10 hours per week) using Ordinary Least Square (OLS) regression models. We control for adolescents' age, mother's education, father's education, mother's age and father's age. We also control for family income (nominal value as of 2001), which is a desirable control variable in studies of this kind that

very few studies were able to use due to recollection issues. We also include variables for urban versus rural residence and region of residence. First, we run OLS regressions, of school enrollment, years of schooling, work and household work on mother's education, father's education, mother's age, father's age, region of residence, urban/rural, age, sex and sibship size. We then use a twin (TW) approach to attempt to establish the causal effect of family size on each of our educational outcomes. We estimate our models separately by gender and birth order in order to examine whether the difference in coefficients is statistically significant.

The Validity and Limitations of Using Twins as Instrumental Variable

The Validity of Using Twins as Instrumental Variable

The argument for using twins as an instrumental variable is that the birth of twins implies in an increase in family size that is out of the control of parents' desired family size, which would purge the endogeneity between family size and children's education. The use of twins as an approach to handle endogeneity bias has been implemented in several ways. Rosenzweig and Wolpin (1980) have first used a twins ratio—the number of twin births divided by the number of pregnancies—in an attempt to eliminate the selectivity problem, while in a later paper they have examined first-born children separately (Rosenzweig and Wolpin 2000). Three recent papers have proposed examining the outcomes of n^{th} order children in families of n+1 or more children, using the birth of twins at the n^{th+1} order as instrumental variables (Black et al. 2005; Angrist et al. 2009; Black et al. 2010). Selecting a sample of children at a birth order lower than that of the twin birth avoids selection problems that arise because families who choose to have another child after a twin birth may differ from families who choose to have another child after a singleton birth. We follow this approach to construct our instrumental variables and to implement our two-stage least square models (2SLS). We first restrict the sample to families with at least two children and examine the educational attainment of the first-born (twin at second pregnancy as instrumental variable). Next, we restrict the sample to families with at least three children and examine the educational attainment of the first- and second-born children (twin at third birth as instrumental variable).

For the research questions we attempt to answer in this paper, a good instrument should be correlated with family size and only be correlated with our educational outcomes through family size, that is, the

occurrence of twins should be a random event in the population at large. A possible threat to this assumption of randomness of twins is a choice of new reproductive technique such as In Vitro Fertilization (IVF)[3]. About 25% of pregnancies with IVF result in the birth of twins. The issue arises because parents who make use of IVF treatments—and are therefore more likely to have twins—are potentially different from the parents who do not use IVF. The correlation of twin births and unobserved family characteristics is by definition untestable. While we cannot control for different tastes between parents who opt and do not opt for a reproductive technique, we can control for observable differences such as parents' education and income. Following past research (Black et al. 2005, 2010), we examine whether the occurrence of twins is associated with observable family characteristics to find that the probability of having a twin birth is uncorrelated with parents' educational levels and family income in any given year we examine.

Results

Table 1 provides summary statistics for all of our analytic samples of adolescents ages 12-16: first-born adolescents in families of two or more children; first- and second-born adolescents in families of three or more children; and first-, second- and third-order adolescents in families of four or more children. As expected, this table shows that the mean completed years of schooling decrease as we consider larger families. For example, first-, second- and third-order girls in families of four or more children had on average one fewer year of completed schooling as their first-born peers in families of two or more children. The Table also shows that there is a gender difference in favor of girls that increases in the samples of adolescents in larger family sizes—while among first-born adolescents in families of two or more children girls have 0.47 more year of schooling than boys, this difference reaches 0.59 year of schooling for the sample of adolescents in families of four or more children.

[3] Fertility treatments became generally accessible in Brazil in the late 1990s (Borlot and Trindade 2004). While it is impossible to be precise about the number of fertility clinics and procedures in Brazil, since there is no specific legislation regulating the practice, the Latin American Registry System (*Registro Latinoamericano de Reproducción Asistida)*— a surveillance system that currently covers more than 90% of the centers offering reproductive technologies in the Latin American region—estimates that the region as a whole has nearly 90 clinics (Zegers-Hochschild 2001). A 2002 report from the World Health Organization estimates that 6480 live births were produced via reproductive techniques in the region between 1990 and 1998 (Zegers-Hochschild 2001). It is estimated that Brazil shares 42.9% of these cases, which yields 308 cases per year in this 8-year period. Given that the 1996 DHS reports 3,495,249 live births in Brazil in 1996, we roughly estimate that 0.000088 of the live births in Brazil would have been produced through a fertility technology treatment, a small enough proportion to significantly affect our analysis.

Table 1 also shows that a similar proportion of first-born adolescent boys and girls are enrolled in school in all sub-samples. For example, 96% of girls and 94% of boys in families with two or more children are enrolled in school. While there are no marked gender differences on school enrollment among first-born adolescents, there are slight gender differences among adolescents of higher parity—88% of boys versus 92% of girls in families with four or more children were enrolled in school.

The results for work offer a different story with large gender and birth order differences. For example, among first-order adolescents in families with two or more children, 27% of boys and 15% of girls were in the labor force. The gender differences are similar among first-, second- and third-order adolescents—37% of boys and 21% of girls work. When we take hours worked into account, about half of the girls worked more than ten hours a week compared to their boy counterparts in all the samples. There are also large gender differences in the proportions of boys and girls performing household work. While 84% of first-born girls reported performing household work, this is true of only 51% of first-born boys. The gender differences in the chances of household work are at a similar magnitude for all samples of adolescents.

Table 2 provides the proportions of adolescents enrolled in school, in the labor market and performing household work by family size. As expected, the enrollment levels are lower among adolescents in larger families than among those in smaller families—95.32% of only-child adolescents were enrolled in school while only 86.11% of their counterparts in families of six or more children were enrolled in school. Enrollment levels are lower among boys vis-a-vis girls, and the gap favoring girls increases in larger families. The average years of completed education are higher for boys in smaller families than for girls. Here, boys also show lower levels of schooling than girls—in families of five or more siblings, for example, the average years of schooling is 4.09 for girls against 3.46 for boys.

Regarding the work-related variables, Table 2 shows that the larger the family, the greater the proportion of adolescents in the labor force— only 15.97% of only-children are in the labor force while this percentage is 35.21% for those in families of six or more children. The trend is similar for working more than 10 hours per week (10.62% against 27.77%). The gender difference in the

proportion of boys and girls working more than ten hours per week increases with larger family sizes—while 37.61% of boys in families with six or more children worked for more than 10 hours a week, this is true of only 16.91% of girls. As expected, we also see gender differences in the proportions performing household work—for example, while 81.23% of only-child girls performed some kind of household work, this is true of only 48.53% of boys. The gender differences remain in larger family sizes. Overall, girls are overrepresented in performing household work (88.56% of girls versus 47.10% of boys in families with six or more children) while boys present larger proportions in labor force participation (24.06% of girls versus 45.32% of boys in families with six or more children) and among those working more than 10 hours per week (16.91% of girls and 37.61% of boys in families of six or more children). It is worth noting that whereas the percentage of boys doing household tasks hardly varies as family sizes increase, the percentage of girls doing that—which is already high, reaching more than 80% even in smaller families—increases as family sizes increase.

Multivariate Results

Table 3 shows results for the first-stage 2SLS models. These results are interesting in that they show the implications of a multiple birth in increasing family size. The first-stage estimates using the twin instrument are strong and suggest that a multiple birth increases family sizes by about 0.6 to 0.8. This is in line with what past research has reported for other countries (0.7 to 0.9 for Norway in Black et al. 2010; a range of 0.4 to 0.7 for Israel in Angrist et al. 2010; 0.6 to 0.9 for China in Li et al. 2008). The first-stage estimates reflect the low fertility levels in Brazil of the late 1990s and 2000s (Potter et al. 2010), in that twins imply in a larger increase in family size when fertility levels—and therefore family sizes—are lower. The *t statistics* of the first stage are generally above 60, indicating that there are no concerns with weak instruments in the use of twins for our implementation.

Table 4 shows results for OLS and 2SLS regression models of school enrollment (Panel A) and enrollment in private school (Panel B) for adolescents ages 12 to 16 separately by gender and birth orders. Column 1 of Panel A shows results from the OLS models for school enrollment. Columns 2 and 3 report estimates of the 2SLS models and sample sizes respectively. We implement models for

both sexes (Columns 1-3) and for females (Columns 4-6) and males (Columns 7-9) separately within each sample set.

Results from OLS regression models in Column 1 of Table 4 confirm the general finding that the higher the number of siblings, the lower the probability of school enrollment for the combined samples. The OLS estimate for family size shows that the number of children has a negative impact on the probability of attending school of approximately 1.8 to 2.1 percentage points for the combined samples. The OLS estimates range from 1.6 to 1.9 percentage points for girls (Column 4) and 2.0 to 2.3 for boys (Column 7), suggesting a slightly higher association of family size and school enrollment for boys than for girls. The coefficients are negative and statistically significant at the 0.01 level for all samples.

The 2SLS estimates reported in Column 2 reflect the implications on school enrollment to an additional sibling for adolescents who were affected by an unexpected increase in family size of multiple instead of singleton siblings. Using twins as a source of variation, our results generally show no adverse effect of family size on adolescents' school enrollment. The coefficients are small and statistically significant at the 0.10 level only. For example, the 2SLS estimate of the effect on the first- and second-born adolescent of changes in family size induced by twin siblings of third-order is 0.019 (s.e.=0.011), statistically significant at the 0.10 level. The lower bound of the 95% confidence interval for this estimate is -0.002, suggesting no negative effects of family size on school enrollment. The corresponding estimate for our sub-sample of first-born adolescents is 0.013, with the lower bound of the 95% confidence intervals at -0.009. The estimates for the samples of first- and first- and second-order adolescents are positive, and one of them reaches significance, suggesting that family size has no adverse effect on adolescents' school enrollment and may indeed even benefit first- and second-order children.

Our separate analyses by gender shown in Columns 4-6 for girls and Columns 7-9 for boys confirm the results described above for all children in that there is no large negative effect of family size on school enrollment. Column 5 reports that adolescent girls with an additional sibling are statistically different from their counterparts with one fewer sibling. The estimate of 0.025 (s.e.=0.014) has a corresponding 95% confidence interval ranging from -0.003 to 0.052, confirming no adverse effects of

family size for first-born girls in families of two or more children. Similarly, the coefficient for the sub-sample of first- and second-order girls (0.024) and its corresponding lower-bound confidence interval (-0.001) confirm that an additional sibling may indeed benefit girls' school enrollment. These results imply in no large adverse effects of an additional sibling in girls' school enrollment. Not surprisingly, the estimates for boys presented in Columns 7-9 of Panel A confirm the results discussed for girls, except that none of the coefficients are statistically significant even at the 0.10 level.

Examining the coefficients representing birth order we find additional important considerations. While the coefficients on second-order children are not statistically significant, the coefficients representing third-order adolescents are positive for girls (0.025) and statistically significant at the 0.05 level. This suggests that later-born girls have an educational advantage over children who are born earlier, conditional on family size. This is also true in the models for completed years of schooling (not shown). While we do not report results for additional controls for space limitations, the control variables in these models have the expected signs. In general, rural children tend to have worse educational outcomes than their urban peers, as do those with lower-educated parents and lower levels of family income.

Panel B of Table 4 shows results from similar models to the ones discussed above for our second educational outcome, enrollment in private schools. Column 2 of Panel B shows that an additional sibling is related to 6.7 percentage points fewer chances of adolescents enrolling in private school (s.e.=0.017). The coefficient is significant at the 0.01 level and the 95% confidence interval is located only in negative values, reassuring that the effect is indeed negative. The coefficients for the two additional sub-samples are not statistically significant, however. The gender analysis presented in Columns 4-6 for girls and 7-9 for boys shows that this finding of first-born adolescents in larger families having fewer chances of enrolling in private school than their counterparts in smaller families reflects boys' disadvantages. The coefficient representing first-born boys is -0.083 (s.e.=0.019), significant at the 0.01 level.

We also examined an additional educational outcome, completed years of schooling. The results for completed years of schooling show no adverse effects of family size (not shown). However, similar to

school enrollment the results for completed years of schooling show that being a later-born children is advantageous in terms of educational outcomes.

Taken together, the results for educational outcomes show that the estimates of family size we examined in the 2SLS models become much smaller than the OLS estimates. With two exceptions, our findings suggest no large adverse effects of family size on adolescents' educational outcomes, a result that has been generally in line with past research that has used a twin strategy to estimate the implications of family size for children's education and also taking birth order into account. No adverse implications of family size for children's school enrollment were found in the U.S. (Caceres-Delpiano 2006) and in Israel (Angrist et al. 2010). Similarly, no adverse effects of family size on completed years of schooling were found in Norway (Black et al. 2005). In Brazil, while our own past work have shown positive effects of family size on schooling for early-born children in the 1970s and 1980s, these effects disappear in the late 1990s and 2000s, when fertility levels are lower and education had become a widespread value (Marteleto and Souza 2010).

On the other hand, the exceptions to these general findings are 1. Our results indicate that early-born girls slightly benefit from an additional sibling in terms of their overall school enrollment; and 2. First-born boys are negatively affected by an additional sibling in terms of having fewer chances of enrolling in private school. Within a family perspective, while it does not seem that parents overall invest differently in boys' and girls' education, first-born girls seem to slightly benefit (although we do not want to stress that finding since the level of significance is 0.10) from being in larger families. At the same time, boys in larger families seem to have smaller chances of enrolling in private schools than their peers in smaller families, a finding that is not true for girls.

In order to provide a complete picture of adolescents' well-being in terms of receiving and providing resources to the family unit, we next examine adolescents' work outcomes. Table 5 shows the results of models estimating adolescent work. Because of the large differences in work experiences of adolescent boys and girls, here we also estimated separate models by gender in addition to birth order. We therefore follow the same procedures as in the models for educational outcomes, using OLS and 2SLS models with twins as instruments.

Panel A of Table 5 shows results for labor force participation while Panel B shows results for working more than ten hours a week. Columns 1-3 of Table 5 show results for both girls and boys combined. The OLS estimates shown in Column 1 report positive coefficients ranging from 0.017 to 0.019 that are statistically significant at the 0.01 level, suggesting that an additional sibling implies in higher levels of labor force participation, even when accounting for birth order. The 2SLS estimates are reported in Column 2. The estimate for our sample of first-born adolescents in families of two or more children is positive and statistically significant at the 0.01 level (0.059, s.e.=0.023) , indicating that an additional sibling implies in larger chances of working outside the home for first-born children. The 95% confidence interval for this estimate ranges from 0.015 to 0.104, ruling out a negative effect and suggesting that an additional sibling implies in 5.9 points higher chances of adolescents working outside the home. The subsequent estimates for adolescents with at least two siblings is 0.000 (s.e.=0.020), and for adolescents with at least three siblings is 0.005 (s.e.=0.028). These results suggest that an additional sibling implies in more chances of participating in the labor market for first-born adolescents but not for later-born children.

The estimates for models stratified by gender are reported in Columns 4-6 for girls and 7-9 for boys. The 2SLS estimate shown in Column 5 indicates that an additional sibling implies in higher chances of girls' participation in the labor market for first-born girls (0.058 coefficient, s.e.=0.034) albeit significant only at the 0.10 level. The lower bound of the 95% confidence interval is -0.008, ruling out negative effects for first-born girls. The same is not true of the estimates for the additional sub-samples in that the lower bound of the 95% confidence intervals are -0.021 and -0.098, suggesting that negative estimates could potentially describe the association. However, this possibility only reassures that the adverse effect of an additional sibling in increasing labor market participation is indeed felt for first-born girls only.

Our results show a similar picture for boys, although the coefficient is significant at the 0.05 level—that is, an additional sibling is strongly associated with pushing first-born adolescent boys to participate in the labor market. The coefficient is 0.64 (s.e.=0.030) and statistically significant at the 0.05 level. The lower bound of the 95% confidence interval approaches zero, suggesting a precisely estimated positive effect of an additional sibling pushing first-born boys to participate in the labor market. The two additional analyses using other sub-samples generate estimates that are not

statistically significant. However, the coefficient representing second-order adolescents in families of three or more children is 0.017 (s.e.=0.007) and statistically significant at the 0.05 level, suggesting that second-born boys are also more likely to work. The coefficient representing third-order boys in families with four or more children reinforces the importance of birth order for the chances of boys in participating in the labor market. The coefficient is -0.043 (s.e.=0.019) and significant at the 0.05 level, suggesting that later-born boys have fewer chances of working vis-à-vis their first-born siblings. These coefficients show that later-born boys are less likely to work than their first- and second-born peers, controlling for family size.

The findings for working more than 10 hours outside the home presented on Panel B of Table 5 are very similar to the findings discussed above.

Table 6 shows results of our models of household work—whether adolescent provides any kind of household work and whether adolescents provide household work for more than 10 hours a week. The implementation strategy is the same as the one reported earlier for work outside the home. The very gender stratified nature of household work also justifies a separate analysis by gender. Column 1 of Panel A shows an OLS estimate indicating that an additional child increases the probability of performing household work among first-born children. While first-born children are more likely to perform household work, the coefficient is very small (0.003). The results for the other sub-samples show no association between family size and the probabilities of adolescents performing household work for adolescents of second- and third-orders.

Colum 2 in Panel A shows estimates from the 2SLS models. When we use multiple births as a source of variation in family size, we find that an additional child increases the probability of household work by a precisely estimated coefficient of 0.045 for the sample of first- and second-born adolescents with two or more siblings (s.e.=0.021). The lower bound of the 95% confidence interval is 0.005, suggesting that the effect is indeed positive, that is, an additional sibling increases the chances of adolescents performing household work. The estimates for the sub-samples for first-born adolescents in families of two or more children, and for first-, second- and third-order children in families with four or more children are not statistically significant.

On the other hand, the coefficient representing second- versus first-order children is -0.024 (s.e.=0.005) and statistically significant at the 0.01 level, suggesting that first-born adolescents have higher chances of performing household work than their second-born siblings. The coefficient representing second- and third-order adolescents in families of four or more children confirms this birth order effect. The coefficients are -0.022 and -0.046, statistically significant at the 0.01 level, confirming that first-born children have higher chances of participating in the labor market than their later-born siblings.

The results for the gender-stratified analysis are reported in Columns 4-6 for girls and 7-9 for boys. None of the coefficients representing family size are statistically significant, and not surprisingly the 95% confidence intervals are wider than the non-stratified analysis and range from negative to positive values for most sub-samples.

We next show results of models of adolescents performing household work for more than 10 hours a week. Panel B of Table 6 shows similar analysis as the ones discussed above. The OLS estimate shown in Column 1 of Panel B suggests a positive association between an additional child and the probability of performing household work for more than 10 hours a week independently of birth order, although the coefficients are very small (between 0.005 and 0.007).

Colum 2 of Panel B shows estimates from the 2SLS models. As with the probability of performing household work, we also find a higher probability of performing domestic tasks for more than 10 hours/week due to an additional child. This coefficient was precisely estimated (0.047) for the sample of first- and second-born adolescents with two or more siblings (s.e.=0.023). The lower bound of the 95% confidence interval is 0.002, suggesting that an additional sibling increases the chances of adolescents performing household work for more than 10 hours. Again, the estimates for the sub-samples of first-born in families of two or more children, and first-, second- and third-order children in families with four or more children are not statistically significant. Additionally, the coefficient representing second- versus first-order children in families of tree or more (-0.018) and the coefficient representing second- and third-order adolescents in families of four or more children (-0.020 and -0.072, respectively) suggests that first-born adolescents have higher chances of performing household work at, least, ten or more hours a week than their later- born siblings.

The estimates of the gender-stratified analysis are reported in Columns 4-6 for girls and 7-9 for boys and are not statistically significant. These coefficients are not estimated precisely to rule out negative effects, since the 95% confidence intervals ranges from negative to positive values for most sub-samples.

Combined, our results suggest that—with the exception of first-born boys enrolling in private school—an additional sibling in the family does not lead to adverse implications for the educational outcomes of Brazilian adolescents. On the other hand, our findings suggest that an additional child in the family is associated with higher chances of adolescents providing resources to the family. Brazilian adolescents in larger families are more likely to participate in the labor force, and this is particularly true for first-born boys. At the same time, larger families are associated with higher chances of performing household work, a result that is stronger for early-born girls.

Work and Family Socio-economic Status

A last stratification of the sample we examined is whether the results for work and household work hold for adolescents in families with low versus high socio-economic status. Here we are interested in examining whether a poverty explanation could account for our earlier findings on work and household work. Given that adolescents in high socio-economic status families have more resources, having an additional child in the family may result in a smaller adverse impact on adolescents' work statuses among those families than among those in low-SES families. To examine the disparity in the effect of family size between adolescents in low- versus high-SES families, we next present results of the same models as before but stratified by adolescents in low- versus high-ses families.

Results from Table 7 generally show that an additional sibling leads to an increase in labor force participation for first-born adolescents in low-ses families of two or more children (0.071, s.e.=0.032). The same is not true of first-born adolescents in high-ses families of two ore more children. Similarly, first- and second-born adolescents in low-ses families of three or more children have higher chances of performing household work (0.058, s.e.=0.025), while their peers in larger high-ses families are not different from their peers in smaller high-ses families.

We estimated models stratified by family socio-economic status and gender, but the standard errors were large and we do not trust such estimates.

Sensitivity tests

In this section, we test the sensitivity of our estimates to more stratification of the sample. We estimated models for additional age groups of adolescents and single ages similar to the models for age group 12 to 16 we discussed above. Our results do not change qualitatively for different age groups, but the smaller sample sizes for models estimated for single ages lead to lower-precision estimates. Another possibility we investigated was examining older adolescents up to age 18. However, because of the nature of our data collection, we can only examine satisfactorily adolescent girls up to the age of 16. This is so because we only have information on parental education and family size for children of the head of the family, and girls marry younger than boys. The majority of the adolescents up to 16 we examine are living with at least one of their parents. Starting at age 17 however, a non-trivial proportion of girls leave the parental home—16% percent are heads or spouses of the head of the family.

Conclusions and Discussion

This paper uses nationally representative data from Brazil to show the implications of family size on adolescents' outcomes of well-being. Our first set of outcomes encompasses educational indicators—school enrollment, enrollment in private school and completed years of schooling—reflecting the implications of an additional sibling on parental investments in their adolescent children. The second set of outcomes we examined—labor force participation and household work—reflect resources going from adolescents to the family unit. This paper expands previous analysis by considering that adolescents not only receive but also provide resources to the family unit. We use a twin approach to examine these effects, arguably purging the endogeneity between family size and children's well-being outcomes.

Within a family perspective, our results suggest that Brazilian families do not seem to generally distribute resources unequally among boys and girls. We found no strong adverse effects of family

size on the educational outcomes we examined—school enrollment and completed years of schooling. The exception is first-born boys, who are adversely affected in their chances to enroll in private schools by an additional sibling in the family. On the other hand, we generally found direct implications of larger family sizes in pushing first-born adolescents to participate in the labor market. Not only birth order matters, but the work implications of an additional sibling have a very different nature for boys and girls. While there is a strong tendency for first-born boys to work outside the home given an additional sibling, the estimate for girls is only significant at the 10% level. On the other hand, we find signs that larger families lead to higher chances of household work, and that such effect comes from girls only, particularly early-born. While an additional sibling entails a higher tendency for girls to perform work for more than 10 hours in the household, this is not true of boys. In that sense, our findings suggest gender differences in adolescents' providing to the family unit.

Results from this research also reinforce to some extent findings from a body of research pointing that there are no strong family size effects on children's educational outcomes once birth order is taken into account (Black et al. 2005; Caceres-Delpiano 2006). While positive effects were found in earlier periods, Brazil is now an emerging economy and its demographic profile resembles more and more that of developed countries, with fertility rates below replacement levels, for example.

Our findings also suggest important birth order effects on both educational and work outcomes—later-born children have greater chances of school enrollment vis-à-vis their first- and second-born counterparts. The results for labor force participation also confirm that later-born adolescents have lower chances of working outside the home and performing household work than first-born adolescents. Combined, our findings indicate that first-born children, boys in particular, seem to take the burden of working outside the home and dropping out of school, a result that is in sharp contrast to a well-established literature indicating son preference coming from Asian societies. Our findings are consistent, however, with previous research on adolescent work in Brazil in that boys suffer more directly the consequences of an unexpected household shock by working outside the family (Dureya et al. 2007).

REFERENCES

Angrist, J., V. Lavy and A. Schlosser. 2009. "Multiple Experiments for the Causal Link between the Quantity and Quality of Children." MIT Department of Economics.

Anh, T., J. Knodel, D. Lam and J. Friedman 1998. "Family Size and Children's Education in Vietnam." *Demography* Vol. 35:57-70.

Barros, R. and D. Lam. 1996. "Income and Educational Inequality and Children's Schooling Attainment." *Opportunity Foregone: Education in Brazil*, N. Birdsall and R. Sabot (eds.). Washington: Inter-American Development Bank.

Becker, G. 1981. *A treatise on the family*. Cambridge: Harvard University Press.

Behrman, J., M. Rosenzweig and P. Taubman. 1994. "Endowments and the Allocation of Schooling in the Family and in the Marriage Market: The Twins Experiment." *The Journal of Political Economy* 102:1131-1174.

Black, S., P. Devereux, and K. Salvanes. 2005. "The More the Merrier? The Effect of Family Size and Birth Order on Children's Education." *The Quarterly Journal of Economics* 120:669-700.

Black, S., P. Devereux, and K. Salvanes. 2010. "Small Family, Smart Family? Family Size and the IQ Score of Young Men." *The Journal of Human Resources* 45:33-58.

Blake, J. 1981. *Family size and achievement*. Berkeley : University of California Press.

Blake, J. 1985. **"**Number of siblings and educational mobility." *American Sociological Review* 50:84-94.

Cáceres-Delpiano, J. 2006. "The Impacts of Family Size on Investment in Child Quality." *Journal of Human Resources* 41(4): 738–754.

Chernichovsky, D. 1985. "Socioeconomic and demographic aspects of school enrollment and attendance in rural Botswana." *Economic Development and Cultural Change* 33(2):319-32.

Conley, D. 2000. "Sibship Sex Composition and the Educational Attainment of Men and Women." *Social Science Research*. 29:441-457.

Conley, D. and R. Glauber. 2006. "Parental Educational Investment and Children's Academic Risk: Estimates of the Impact of Sibship Size and Birth Order from Exogenous Variation in Fertility " *The Journal of Human Resources* 41:722-737.

Conley, D. and R. Glauber. 2008. "All in the Family? Family Composition, Resources, and Sibling Similarity in Socioeconomic Status." *Research in Social Stratification and Mobility* 26:297-306.

Corseuil, C. and M. Foguel. 2002. *Uma sugestão de deflatores para rendas obtidas a partir de algumas pesquisas domiciliares do IBGE*. Discussion Paper 897. Rio de Janeiro: IPEA.

Guo, G. and L. VanWey. 1999. "Sibship Size and Intellectual Development: Is the Relationship Causal?" *American Sociological Review* 64:169-87.

Hauser, R. and W. Sewell. 1985. "Birth order and educational attainment in full sibships." *American Educational Research Journal*. 22(1):1-23.

Kelley, A. 1996. "The consequences of rapid population growth on human resource development: The case of education." Pp. 67-137 in *The Impact of Population Growth on Well-Being in Developing Countries*, D.A.K.A.C.M.K.O. Berlin: Springer-Verlag.

Knodel, J. and M. Wongsith. 1991. "Family Size and Children's Education in Thailand: Evidence From a National Sample." *Demography* 28:119-31.

Knodel, John, N. Havanon and W. Sittitrai. 1990. "Family size and the education of children in the context of rapid fertility decline." *Population and Development Review* 16(1).

Lam, D. and S. Duryea. 1999. "The Effects of Education on Fertility, Labor Supply, and Investments in Children, with Evidence from Brazil." *Journal of Human Resources* 34(1): 160-192.

Lam, D. and L. Marteleto. 2006. “Small Families and Large Cohorts: The Impact of the Demographic Transition on Schooling in Brazil,” in C. Lloyd, J. Behrman, N. Stromquist, and B., Editors, *The Changing Transitions to Adulthood in Developing Countries: Selected Studies.* Washington DC*:* National Academies Press.

Lam, D. and L. Marteleto. 2008. “Stages of the Demographic Transition from a Child’s Perspective: Family Size, Cohort Size, and Children’s Resources.” *Population and Development Review* 34(2): 225-252.

Lloyd, C. 1994. “Investing in the next generation: The implications of high fertility at the level of the family.” in *Population and Development: Old Debates, New Conclusions*, edited by R. Cassen. Washington: Overseas Development Council.

Li, H., J. Zhang and Y. Zhu. “The Quantity-Quality Trade-off of Children in a Developing Country: Identification Using Chinese Twins.” *Demography* Vol. 45(1): 223-243.

Lu, Y. and D. Treiman. 2008. “The Effect of Sibship Size on Educational Attainment in China: Period Variations.” *American Sociological Review*, Vol. 73(5): 813-834.

Maralani, V. 2008. “The Changing relationship between family size and educational attainment over the course of socioeconomic development: Evidence from Indonesia.” *Demography* 45(3):693–717.

Martine, G. 1996. "Brazil's Fertility Decline, 1965-95: A Fresh Look at Key Factors." *Population and Development Review* 22(1): 47-75.

Parish, W. L. and R. Willis. 1993. Daughters, education, and family budgets: Taiwan experiences. *The Journal of Human Resources* 28:863-98.

Patrinos H. and G. Psacharopoulos. 1997. “Family size, schooling and child labor in Peru - an empirical analysis**.”** *Journal of Population Economics* 10(4):387-405.

Potter, J, C. Schmertmann, S. Cavenaghi. 2002. “Fertility and Development: Evidence from Brazil.” *Demography* 39(4): 739-761

Powell, B. and L. Steelman. 1993. "The Educational Benefits of Being Spaced Out: Sibship Density and Educational Progress” *American Sociological Review* 58: 367-381.

Pong, S. 1997. "Sibship Size and Educational Attainment in Peninsular Malaysia: Do Policies Matter?" *Sociological Perspectives* 40(2): 227-242.

Post, D. and S. Pong. 1998. "Intra-Family Educational Inequality in Hong Kong: The Waning Effect of Sibship Composition." *Comparative Education Review* 42(2): 99-117.

Psacharopoulos, G. and A. Arriagada. 1989. “The determinants of early age human capital formation: Evidence from Brazil.” *Economic Development and Cultural Change* 37:683-708.

Shavit, Y. and J. Pierce. 1991. “Sibship size and educational attainment in nuclear and extended families: Arabs and Jews in Israel.” *American Sociological Review* 56:321-30.

Steelman, L, B. Powell, R. Werum and S. Cater. 2002. “Reconsidering the Effects of Sibling Configuration” *Annual Review of Sociology* 23: 243-270.

Veloso, F. 2009. “15 Anos de Avanços na Educação no Brasil: Onde Estamos?” In F. Veloso, S. Pessôa, R. Henriques and F. Giambiagi (editors). *Educação Básica no Brasil: Construindo o País do Futuro.* Rio de Janeiro: Elsevier.

Yu, W-h. and K-H. Su. 2006. Gender, Sibship Structure, and Educational Inequality in Taiwan: Son Preference Revisited. *Journal of Marriage and Family* 68:1057-1068.

Zajonc, R. and G. Markus. 1975. “Birth Order and Intellectual Development”. *Psychological Review* 82:74-88.

Tables and Figures

Table 1. Summary Statistics of Adolescents Ages 12-16 - Twins as instruments: Brazil, 1997 to 2009

Variable	First-born in families 2+		First- and second-born in families 3+		First- second- and third-born in families 4+	
	Girl	Boy	Girl	Boy	Girl	Boy
Education	5.78 (2.00)	5.31 (2.09)	5.39 (2.06)	4.86 (2.14)	4.84 (2.08)	4.25 (2.15)
School enrollment	0.96 (0.20)	0.94 (0.24)	0.94 (0.23)	0.92 (0.28)	0.92 (0.27)	0.88 (0.32)
Labor force participation	0.15 (0.36)	0.27 (0.44)	0.18 (0.39)	0.32 (0.47)	0.21 (0.41)	0.37 (0.48)
Worked more than 10 hours per week	0.09 (0.29)	0.20 (0.40)	0.12 (0.32)	0.24 (0.43)	0.14 (0.35)	0.29 (0.46)
Household work	0.84 (0.36)	0.51 (0.50)	0.87 (0.34)	0.51 (0.50)	0.88 (0.32)	0.50 (0.50)
Age	13.88 (1.39)	13.93 (1.40)	13.86 (1.39)	13.92 (1.40)	13.83 (1.38)	13.90 (1.39)
Mother's education	6.47 (4.00)	6.39 (4.01)	5.38 (3.80)	5.34 (3.82)	4.13 (3.33)	4.06 (3.33)
Father's education	6.13 (4.18)	6.02 (4.20)	5.10 (4.01)	5.05 (4.05)	3.88 (3.56)	3.80 (3.56)
Race	0.52 (0.50)	0.55 (0.50)	0.59 (0.49)	0.62 (0.49)	0.67 (0.47)	0.69 (0.46)
Number of siblings	1.85 (1.13)	1.86 (1.15)	2.76 (2.76)	1.25 (3.89)	3.86 (1.21)	1.38 (1.23)
Twins in the family	0.01 (0.12)	0.01 (0.11)	0.02 (0.14)	0.02 (0.14)	0.03 (0.18)	0.04 (0.19)
Twins at second birth	0.01 (0.08)	0.01 (0.08)	0.01 (0.09)	0.01 (0.08)	0.00 (0.06)	0.00 (0.07)
Twins at third birth	0.00 (0.06)	0.00 (0.06)	0.01 (0.08)	0.01 (0.09)	0.01 (0.11)	0.01 (0.12)
Twins at fourth birth	0.00 (0.04)	0.00 (0.04)	0.00 (0.06)	0.00 (0.06)	0.01 (0.09)	0.01 (0.09)
First two children are same sex	0.49 (0.50)	0.51 (0.50)	0.49 (0.50)	0.55 (0.50)	0.49 (0.50)	0.55 (0.50)
Urban	0.82 (0.39)	0.81 (0.39)	0.77 (0.42)	0.76 (0.43)	0.69 (0.46)	0.69 (0.46)
North	0.13 (0.33)	0.13 (0.33)	0.15 (0.36)	0.15 (0.36)	0.18 (0.38)	0.18 (0.38)
Northwest	0.30 (0.46)	0.31 (0.46)	0.34 (0.47)	0.35 (0.48)	0.40 (0.49)	0.40 (0.49)
South	0.16 (0.37)	0.16 (0.37)	0.14 (0.34)	0.13 (0.34)	0.12 (0.32)	0.11 (0.31)
Southwest	0.29 (0.45)	0.28 (0.45)	0.26 (0.44)	0.26 (0.44)	0.23 (0.42)	0.22 (0.42)
Center-west	0.12 (0.33)	0.12 (0.33)	0.11 (0.32)	0.11 (0.32)	0.08 (0.28)	0.08 (0.28)
[N]	40,843	44,656	37,571	40,574	21,008	22,615

Source: 1997-2009 PNAD data. IBGE (National Household Sample Survey). Notes: Standard deviation in parenthesis.

Table 2. Means of Sibship Size by Adolescents' Outcome Variables (Ages 12-16): Brazil, 1997 to 2009

Sibship Size	School Enrollment			Years of schooling			Labor force participation			Worked more than 10 hours per week			Household work			[N]
	All	Girls	Boys	All	Girls	Boys	All	Girls	Boys	All	Girls	Boys	All	Girls	Boys	
0	95.32	96.30	94.43	5.65	5.88	5.45	15.97	11.76	19.80	10.62	6.61	14.27	64.11	81.23	48.52	23,009
	(21.12)	(18.87)	(22.94)	(1.94)	(1.87)	(1.97)	(36.63)	(32.22)	(39.85)	(30.81)	(24.84)	(34.98)	(47.97)	(39.05)	(49.98)	
1	96.75	97.43	96.13	5.76	5.97	5.56	16.76	11.90	21.26	11.16	6.90	15.10	64.89	82.06	48.98	94,637
	(17.73)	(15.83)	(19.30)	(1.90)	(1.85)	(1.93)	(37.35)	(32.38)	(40.91)	(31.49)	(25.35)	(35.81)	(47.73)	(38.37)	(49.99)	
2	95.51	96.57	94.54	5.45	5.70	5.21	20.57	14.84	25.88	14.39	9.38	19.03	67.17	85.47	50.20	78,375
	(20.70)	(18.20)	(22.73)	(1.98)	(1.92)	(2.01)	(40.42)	(35.55)	(43.80)	(35.10)	(29.16)	(39.25)	(46.96)	(35.24)	(50.00)	
3	92.93	94.33	91.62	4.90	5.18	4.63	24.74	17.89	31.22	17.96	11.78	23.81	68.20	87.59	49.85	37,092
	(25.63)	(23.14)	(27.72)	(2.04)	(1.98)	(2.05)	(43.15)	(38.33)	(46.34)	(38.39)	(32.23)	(42.60)	(46.57)	(32.97)	(50.00)	
4	90.70	92.24	89.24	4.38	4.69	4.09	28.69	20.27	36.73	21.32	13.64	28.66	68.61	87.82	50.27	18,010
	(29.04)	(26.75)	(31.00)	(2.09)	(2.04)	(2.10)	(45.23)	(40.20)	(48.21)	(40.96)	(34.32)	(45.22)	(46.41)	(32.71)	(50.00)	
5+	86.11	89.17	83.34	3.76	4.09	3.46	35.21	24.06	45.32	27.77	16.91	37.61	66.81	88.56	47.10	18,325
	(34.59)	(31.08)	(37.27)	(2.11)	(2.04)	(2.12)	(47.77)	(42.75)	(49.78)	(44.79)	(37.49)	(48.44)	(47.09)	(31.83)	(49.92)	

Source: 1997-2009 PNAD data. IBGE (National Household Sample Survey). Notes: Standard deviation in parenthesis.

Table 3. First Stage of Two-Stage Least Squares (2SLS) Estimates of the Effect of a Twin Birth on Family Size (Ages 12-16): Brazil, 1997 to 2009

Birthorder and Sex	All			Girls			Boys		
	Coef.		[N]	Coef.		[N]	Coef.		[N]
Sample: First child in families of 2+ children	0.693	**	85,499	0.634	**	40,843	0.751	**	44,656
(Instrument: twin at second order)	(0.034)			(0.047)			(0.048)		
Sample: First & second children in families 3+	0.852	**	78,145	0.869	**	37,571	0.837	**	40,574
(Instrument: twin at third order)	(0.043)			(0.062)			(0.060)		
Sample: First, second & third children in families 4+	0.794	**	43,623	0.819	**	21,008	0.775	**	22,615
(Instrument: twin at fourth order)	(0.056)			(0.073)			(0.084)		

Source: 1997-2009 PNAD data. IBGE (National Household Sample Survey). Notes: ** p<0.01, * p<0.05, + p<0.1. Robust Standard Errors in parentheses.

Table 4. Ordinary Least Square (OLS) and Two-Stage Least Squares (2SLS) Estimates of the Effect of Family Size on Adolescents' Educational Outcomes (Ages 12-16): Brazil, 1997 to 2009

Birthorder and Sex	All				Girls				Boys			
	OLS	2SLS		[N]	OLS	2SLS		[N]	OLS	2SLS		[N]
	(1)	(2)		(3)	(4)	(5)		(6)	(7)	(8)		(9)
Panel A: School Enrollment												
First in families of 2+	-0.018 **	0.013			-0.016 **	0.025 +			-0.020 **	0.003		
(Instrument: twin at 2nd)	(0.001)	(0.011)		85,499	(0.001)	(0.014)		40,843	(0.001)	(0.017)		44,656
		[-.009 .035]				[-.003 .052]				[-.030 .036]		
First & second in families of 3+	-0.021 **	0.019 +			-0.019 **	0.024 +			-0.023 **	0.014		
(Instrument: twin at 3rd)	(0.001)	(0.011)			(0.001)	(0.013)			(0.002)	(0.017)		
		[-.002 .041]		78,145		[-.001 .050]		37,571		[-.020 .047]		40,574
Second	0.004 *	-0.004			0.007 **	0.000			0.000	-0.007		
	(0.002)	(0.003)			(0.002)	(0.003)			(0.003)	(0.004)		
First, second & third in families of 4+	-0.019 **	-0.020			-0.017 **	-0.014			-0.021 **	-0.024		
(Instrument: twin at 4th)	(0.001)	(0.020)			(0.002)	(0.027)			(0.002)	(0.030)		
		[-.060 .019]				[-.067 .039]				[-.083 .034]		
Second	0.005	0.005		43,623	0.011 **	0.011 +		21,008	-0.001	0.000		22,615
	(0.003)	(0.005)			(0.004)	(0.006)			(0.005)	(0.007)		
Third	0.020 **	0.021 *			0.026 **	0.025 *			0.015 **	0.016		
	(0.003)	(0.009)			(0.005)	(0.012)			(0.005)	(0.013)		
Panel B: Enrollment in Private School												
First in families of 2+	-0.006 **	-0.067 **			-0.007 **	-0.047			-0.005 **	-0.083 **		
(Instrument: twin at 2nd)	(0.001)	(0.017)		61,507	(0.001)	(0.030)		29,661	(0.001)	(0.020)		31,846
		[-.101 -.033]				[-.106 .012]				[-.122 -.044]		
First & second in families of 3+	-0.002 **	0.022			-0.003 **	0.016			-0.001	0.028		
(Instrument: twin at 3rd)	(0.001)	(0.015)			(0.001)	(0.019)			(0.001)	(0.023)		
		[-.007 .051]		53,159		[-.021 .054]		25,865		[-.016 .072]		27,294
Second	0.000	-0.004				-0.003			0.000	-0.005		
	(0.002)	(0.003)				(0.004)			(0.003)	(0.005)		
First, second & third in families of 4+	-0.001 *	-0.001			-0.001	-0.008			-0.001 *	0.006		
(Instrument: twin at 4th)	(0.001)	(0.010)			(0.001)	(0.011)			(0.001)	(0.015)		
		[-.020 .019]				[-.030 .014]						
Second	0.004 +	0.004		28,115	0.003	0.004		13,723	0.004	0.003		14,392
	(0.002)	(0.003)			(0.003)	(0.003)			(0.003)	(0.004)		
Third	0.003	0.003			0.006 +	0.009			0.001	-0.002		
	(0.002)	(0.004)			(0.003)	(0.005)			(0.003)	(0.006)		

Source: 1997-2009 PNAD data. IBGE (National Household Sample Survey). Notes: ** p<0.01, * p<0.05, + p<0.1. Robust Standard Errors in parenthesis. 2SLS coefficient 95% Confidence Interval in brackets.

Table 5. Ordinary Least Square (OLS) and Two-Stage Least Squares (2SLS) Estimates of the Effect of Family Size on Adolescents' Work (Ages 12-16): Brazil, 1997 to 2009

Birthorder and Sex	All				Girls				Boys			
	OLS	2SLS		[N]	OLS	2SLS		[N]	OLS	2SLS		[N]
	(1)	(2)		(3)	(4)	(5)		(6)	(7)	(8)		(9)
Panel A: Labor force participation												
First in families of 2+	0.019 **	0.059 **			0.016 **	0.058 +			0.022 **	0.064 *		
(Instrument: twin at 2nd)	(0.001)	(0.023)		85,499	(0.002)	(0.034)		40,843	(0.002)	(0.030)		44,656
		[.015 .104]				[-.008 .125]				[.005 .122]		
First & second in families of 3+	0.017 **	0.000			0.011 **	0.032			0.023 **	-0.030		
(Instrument: twin at 3rd)	(0.001)	(0.020)			(0.002)	(0.027)			(0.002)	(0.028)		
		[-.039 .038]		78,145		[-.021 .085]		37,571		[-.084 .025]		40,574
Second	0.006 *	0.009 *			0.006 +	0.003			0.006	0.017 *		
	(0.003)	(0.005)			(0.004)	(0.006)			(0.004)	(0.007)		
First, second & third in families of 4+	0.018 **	0.005			0.011 **	-0.032			0.023 **	0.049		
(Instrument: twin at 4th)	(0.002)	(0.028)			(0.002)	(0.034)			(0.003)	(0.046)		
		[-.050 .061]				[-.098 .034]				[-.042 .139]		
Second	0.007	0.009		43,623	0.007	0.014 +		21,008	0.009	0.004		22,615
	(0.005)	(0.007)			(0.006)	(0.008)			(0.007)	(0.011)		
Third	-0.022 **	-0.017			-0.008	0.010			-0.033 **	-0.043 *		
	(0.005)	(0.013)			(0.007)	(0.016)			(0.008)	(0.019)		
Panel B: Worked more than 10 hours per week												
First in families of 2+	0.017 **	0.047 *			0.013 **	0.052 +			0.021 **	0.048 +		
(Instrument: twin at 2nd)	(0.001)	(0.020)		85,499	(0.002)	(0.029)		40,843	(0.002)	(0.028)		44,656
		[.008 .087]				[-.005 .108]				[-.007 .103]		
First & second in families of 3+	0.016 **	0.029			0.008 **	0.034			0.023 **	0.024		
(Instrument: twin at 3rd)	(0.001)	(0.018)			(0.002)	(0.024)			(0.002)	(0.027)		
		[-.007 .064]		78,145		[-.013 .081]		37,571		[-.029 .076]		40,574
Second	0.010 **	0.008 +			0.009 **	0.005			0.012 **	0.012 +		
	(0.003)	(0.004)			(0.003)	(0.005)			(0.004)	(0.007)		
First, second & third in families of 4+	0.017 **	-0.008			0.009 **	-0.011			0.022 **	0.002		
(Instrument: twin at 4th)	(0.002)	(0.026)			(0.002)	(0.031)			(0.003)	(0.042)		
		[-.059 .044]				[-.071 .049]				[-.081 .084]		
Second	0.009 *	0.014 *		43,623	0.011 *	0.015 *		21,008	0.010	0.014		22,615
	(0.004)	(0.006)			(0.005)	(0.007)			(0.006)	(0.010)		
Third	-0.016 **	-0.007			0.000	0.008			-0.030 **	-0.022		
	(0.005)	(0.012)			(0.006)	(0.014)			(0.007)	(0.018)		

Source: 1997-2009 PNAD data. IBGE (National Household Sample Survey). Notes: ** p<0.01, * p<0.05, + p<0.1. Robust Standard Errors in parenthesis. 2SLS coefficient 95% Confidence Interval in brackets.

Table 6. Ordinary Least Square (OLS) and Two-Stage Least Squares (2SLS) Estimates of the Effect of Family Size on Adolescents' Household Work (Ages 12-16): Brazil, 1997 to 2009

Birthorder and Sex	All				Girls				Boys			
	OLS		2SLS	[N]	OLS		2SLS	[N]	OLS		2SLS	[N]
	(1)		(2)	(3)	(4)		(5)	(6)	(7)		(8)	(9)
Panel A: Household work												
First in families of 2+	0.003	*	0.030		0.000		0.004		0.006	*	0.052	
(Intrument: twin at 2nd)	(0.001)		(0.026)	85,499	(0.002)		(0.033)	40,843	(0.002)		(0.039)	44,656
			[-.021 .081]				[-.062 .069]				[-.023 .128]	
First & second in families of 3+	-0.002		0.045	*	-0.002		0.020		-0.001		0.062	+
(Instrument: twin at 3rd)	(0.001)		(0.021)		(0.001)		(0.023)		(0.002)		(0.034)	
			[.005 .086]	78,145			[-.025 .065]	37,571			[-.004 .128]	40,574
Second	-0.015	**	-0.024	**	0.001		-0.003		-0.030	**	-0.043	**
	(0.003)		(0.005)		(0.003)		(0.005)		(0.005)		(0.008)	
First, second & third in families of 4+	-0.001		-0.024		0.001		0.018		-0.003		-0.060	
(Instrument: twin at 4th)	(0.002)		(0.029)		(0.002)		(0.029)		(0.003)		(0.050)	
			[-.080 .032]				[-.040 .075]				[-.158 .037]	
Second	-0.026	**	-0.022	**	-0.007		-0.009		-0.045	**	-0.035	**
	(0.005)		(0.007)	43,623	(0.005)		(0.007)	21,008	(0.008)		(0.012)	22,615
Third	-0.055	**	-0.046	**	-0.025	**	-0.032	*	-0.084	**	-0.062	**
	(0.005)		(0.013)		(0.006)		(0.014)		(0.009)		(0.021)	
Panel B: Worked in household more than 10 hours per week												
First in families of 2+	0.007	**	0.031		0.013	**	0.029		0.003	*	0.031	
(Instrument: twin at 2nd)	(0.001)		(0.027)	70,824	(0.003)		(0.050)	32,060	(0.002)		(0.028)	38,764
			[-.023 .084]				[-.069 .127]				[-.023 .086]	
First & second in families of 3+	0.005	**	0.047	*	0.009	**	0.084	*	0.002		0.011	
(Instrument: twin at 3rd)	(0.002)		(0.023)		(0.003)		(0.041)		(0.002)		(0.024)	
			[.002 .091]	62,862			[.004 .164]	28,300			[-.036 .058]	34,562
Second	-0.010	**	-0.018		-0.009		-0.021	*	-0.010	**	-0.012	*
	(0.003)		(0.005)	**	(0.006)		(0.009)		(0.003)		(0.006)	
First, second & third in families of 4+	0.006	**	0.027		0.010	**	0.030		0.003	+	0.023	
(Instrument: twin at 4th)	(0.002)		(0.032)		(0.004)		(0.057)		(0.002)		(0.035)	
			[-.036 .089]				[-.081 .141]				[-.045 .092]	
Second	-0.017	**	-0.020	**	-0.023	*	-0.026	*	-0.013	*	-0.017	*
	(0.005)		(0.007)	34,368	(0.009)		(0.012)	15,295	(0.005)		(0.008)	19,073
Third	-0.063	**	-0.072	**	-0.094	**	-0.102	**	-0.041	**	-0.048	**
	(0.006)		(0.014)		(0.011)		(0.026)		(0.006)		(0.015)	

Source: 1997-2009 PNAD data. IBGE (National Household Sample Survey). Notes: ** p<0.01, * p<0.05, + p<0.1. Robust Standard Errors in parenthesis. 2SLS coefficient 95% Confidence Interval in brackets.

Table 7. Ordinary Least Square (OLS) and Two-Stage Least Squares (2SLS) Estimates of the Effect of Family Size on Adolescents' Work (Ages 12-16): Brazil, 1997 to 2009

Birthorder and Mother Education	Low Mother's Education			High Mother's Education			Low Mother's Education			High Mother's Education		
	OLS	2SLS	[N]	OLS	2SLS	[N]	OLS	2SLS	[N]	OLS	2SLS	[N]
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)
	Panel A: Labor force participation						**Panel C: Household Work**					
First in families of 2+	0.021 **	0.071 *		0.015 **	0.031		0.003 *	0.021		0.020 **	0.042	
(Instrument: twin at 2nd)	(0.001)	(0.032)	60,209	(0.003)	(0.029)	25,290	(0.001)	(0.033)	60,209	(0.004)	(0.042)	25,290
		[.009 .134]			[-.027 .088]			[-.045 .086]			[-.040 .125]	
First & second in families of 3+	0.019 **	0.001		0.011 *	-0.009		-0.001	0.058 *		0.006	0.012	
(Instrument: twin at 3rd)	(0.001)	(0.025)		(0.005)	(0.026)		(0.001)	(0.025)		(0.005)	(0.038)	
		[-.048 .049]	62,543		[-.061 .042]	15,602		[.010 .107]	62,543		[-.063 .087]	15,602
Second	0.009 **	0.013 *		-0.004	-0.002		-0.017 **	-0.030 *		-0.004	-0.005	
	(0.003)	(0.006)		(0.005)	(0.006)		(0.003)	(0.006)		(0.007)	(0.008)	
First, second & third in families of 4+	0.019 **	0.003		0.014 +	0.019		-0.001	-0.033		0.004	0.072	
(Instrument: twin at 4th)	(0.002)	(0.032)		(0.008)	(0.054)		(0.002)	(0.032)		(0.009)	(0.062)	
		[-.059 .066]			[-.086 .125]			[-.096 .029]			[-.050 .194]	
Second	0.010 *	0.013 +	39,191	-0.018	-0.018	4,432	-0.026 **	-0.021 **	39,191	-0.020	-0.026 +	4,432
	(0.005)	(0.008)		(0.012)	(0.013)		(0.005)	(0.007)		(0.015)	(0.016)	
Third	-0.023 **	-0.017		-0.007	-0.009		-0.058 **	-0.045 **		-0.027	-0.041 +	
	(0.006)	(0.015)		(0.014)	(0.018)		(0.006)	(0.015)		(0.018)	(0.022)	
	Panel B: Worked more than 10 hours per week						**Panel D: Worked in household more than 10 hours per week**					
First in families of 2+	0.019 **	0.049 +		0.008 **	0.039		0.008 **	0.042		0.021 **	0.002	
(Instrument: twin at 2nd)	(0.001)	(0.028)	60,209	(0.003)	(0.026)	25,290	(0.002)	(0.037)	48,696	(0.004)	(0.038)	22,128
		[-.007 .104]			[-.013 .090]			[-.031 .114]			[-.073 .077]	
First & second in families of 3+	0.017 **	0.035		0.007 +	0.003		0.007 **	0.047 +		0.009 +	0.039	
(Instrument: twin at 3rd)	(0.001)	(0.023)		(0.004)	(0.022)		(0.002)	(0.028)		(0.006)	(0.036)	
		[-.010 .081]	62,543		[-.040 .047]	15,602		[-.009 .102]	49,572		[-.031 .108]	13,290
Second	0.012 **	0.008		0.006	0.006		-0.013 **	-0.021 **		0.007	0.004	
	(0.003)	(0.006)		(0.005)	(0.005)		(0.004)	(0.007)		(0.007)	(0.008)	
First, second & third in families of 4+	0.018 **	-0.015		0.008	0.033		0.007 **	0.034		0.009	-0.040	
(Instrument: twin at 4th)	(0.002)	(0.030)		(0.006)	(0.050)		(0.002)	(0.037)		(0.009)	(0.050)	
		[-.072 .043]			[-.065 .131]			[-.039 .107]			[-.137 .058]	
Second	0.011 *	0.017 *	39,191	-0.003	-0.005	4,432	-0.017 **	-0.022 **	30,585	0.001	0.005	3,783
	(0.005)	(0.007)		(0.011)	(0.012)		(0.005)	(0.008)		(0.015)	(0.016)	
Third	-0.018 **	-0.005		0.003	-0.003		-0.061 **	-0.073 **		-0.055 **	-0.045 *	
	(0.005)	(0.014)		(0.012)	(0.016)		(0.006)	(0.017)		(0.017)	(0.020)	

Source: 1997-2009 PNAD data. IBGE (National Household Sample Survey). Notes: ** p<0.01, * p<0.05, + p<0.1. Robust Standard Errors in parenthesis. 2SLS coeficient 95% Confidence Interval in brackets.