Paper prepared for presentation at IUSSP Meeting
August 2001, Salvador Brazil
Letícia Marteleto

S53 Demography and Education

Title: Children's Schooling in Brazil: Do Number and Composition of Siblings Matter?

Author: Letícia Marteleto
Population Studies Center, The University of Michigan, 426 Thompson St. Ann Arbor MI 48106 USA. leticiam@umich.edu

Abstract: The structure of Brazilian families has been changing over the past three decades. Children are sharing family resources with fewer siblings and spending more time in intergenerational households. For example, the 1963 cohort of 14 year-olds on average had 5.4 siblings, while the 1983 cohort had 2.3 siblings. In this paper, the consequences of such significant changes from the perspective of 14 year-olds are examined. The purpose of this paper is to examine the effects of smaller family sizes and their gender and age composition on schooling and school enrollment of cohorts of children born pre- and post- demographic transition. Using nationally representative data of the PNADs, regressions for cohorts of 14 year-olds born in 1963 and 1983 are estimated. Results show that children benefit from small family sizes in both cohorts, even after controlling for socio-economic characteristics. Findings from decompositions show that such improvements come from the higher proportions of children in smaller families in the younger cohorts, not from a decrease in the negative effect of number of siblings. Further, the investigation of siblings' gender and age composition reveals that siblings of different ages and genders affect children's schooling differently. The analysis suggests that fertility decline has benefited children's education through changes in children's distribution across family sizes.

Children's Schooling in Brazil: Do Number and Composition of Siblings Matter?*

Letícia Marteleto

Population Studies Center and Dept. of Sociology
University of Michigan
Leticiam@umich.edu

June 2001

*Paper prepared for presentation at the 2001 IUSSP Meeting, August 2001, Salvador, Brazil. During the different stages of this research, support was provided by CAPES Foundation, the Population Council, Ford and Mellon Foundations. I would like to thank Heather Branton, John Knodel, David Lam, Rachel Lucas, Pam Smock and Yu Xie for helpful comments. Please send correspondence to leticiam@umich.edu.

Introduction

The structure of Brazilian families has changed over the past three decades. As a consequence of the demographic transition, children are sharing family resources with fewer siblings and spending more time in intergenerational households. The purpose of this paper is to address the effects of the changing family sizes and their gender and age compositions on children's schooling and school enrollment for cohorts of children born in pre- and post-demographic transition.

The first analytical question addressed in this paper is whether children with fewer siblings are better off in terms of educational attainment than children with more siblings. While past research has primarily emphasized the role of parents in their children's schooling (McLanahan 1994; Featherman and Hauser 1976; Blau and Duncan 1967) there has been relatively little exploration on how the number, and particularly, the age and gender compositions of siblings influence children's education in developing countries. The traditional view is that children compete for, but do not contribute to familial resources (Blake 1981, 1985; Becker and Lewis 1973; Becker 1981). The number of siblings is likely to influence investments in children, which in turn affect educational outcomes.

The second goal of this paper is to examine how Brazil's rapid fertility transition, and its resulting smaller families, affected children's schooling and school enrollment. That is, as Brazil underwent demographic and family structure changes, are children from the post fertility decline cohort better off in terms of schooling and school enrollment than children from the pre-fertility decline cohort? Is the cohort difference in each of these educational outcomes due to different effects of number of siblings on education, or due to simple variation in the proportions of children in smaller and larger families? Fertility decline has potentially affected children's educational outcomes. Variation in patterns of educational attainment is the joint outcome of demographic processes, intergenerational transmission of human capital, and opportunities.

The third analytical goal of this paper is to examine whether number of siblings affects boys and girls differently in the two cohorts of study. The effects of number of siblings on children's education may not be gender neutral. Most societies, although to different degrees, maintain different gender roles and sexual division of labor, resulting in sex differentials in life opportunities and outcomes, such as education. Although Brazil is seen as a less traditional

society, it is a patriarchal country with strong gender roles, which makes it relevant to consider gender distinctions when examining children's schooling.

Lastly, siblings' composition, that is, whether the gender and age of siblings affect children's schooling and school enrollment is examined. Are higher schooling levels associated with having a younger or older sister or a younger or older brother? Are the patterns of age and gender composition consistent across cohorts?

Understanding the determinants of children's education is a critical concern in developing countries, particularly because investments in children's education produce a skilled stock of human capital that contributes to eliminating constraints towards development (Becker 1995). Knowledge on whether siblings' number and composition affect children's education in different ways before and after fertility decline may enlighten policies designed to promote universal primary school enrollment and better rates of educational attainment, goals of most developing countries. This study also informs targeting policies that aim at addressing specific children's needs, such as *bolsa-escola*[1], by identifying how siblings' number, gender and age composition play a role on children's schooling and school enrollment. Further, this work informs social policies by clarifying whether and how children's gender is associated with educational outcomes.

The structure of this paper is as follows: In the first section, a theoretical framework on the ways in which number and gender composition of siblings affects children's education is laid out, then the theoretical reasons for the impact of the changing demographic trends on children's education are discussed. Next, research questions are presented, followed by the methods and data used in this paper. Finally results, discussion, and conclusions are presented.

Theoretical Framework

There are theoretical reasons to believe that number of siblings may affect children's schooling and school enrollment. In this section, the siblings' rivalry and dilution of resources theories are addressed because they offer insights on how children's educational attainment relates to their number of siblings.

[1] *Bolsa-escola* is a program that started in some Brazilian states in 1994. It consists of providing poor families with children at school age with a minimum-wage so that the child enrolls in school.

According to the siblings' rivalry and the dilution of resources hypotheses, children with many siblings are generally worse off in terms of several outcomes related to chances in life, such as educational attainment, mortality and nutrition (Becker 1981; Blake 1985). These theories explain the negative impact of number of siblings on schooling and school enrollment.

Under the dilution hypothesis developed by Blake (1985), a large number of siblings or close spacing between siblings decreases parental resources of time - parental help in learning, companionship, relief from family and work obligations - and money placed to each child. The smaller financial and interpersonal resources available to each child may negatively influence several children's outcomes, including educational attainment (Blau and Duncan 1967; Blake 1985, 1989). Children whose parents value education and spend time to teach and supervise them are more likely to have tools to acquire greater social capital than children who do not have these types of support. Nonetheless, the sociological and demographic literature consider that socialization, levels of intimacy and communication vary by group size. If "the resources that emerge from one's social ties," that is, one's social capital, produce systematic differences on educational attainment (Coleman 1988), why would we not believe that educational opportunities do not also vary by family size? According to the dilution of resources framework, not only financial but also interpersonal resources are considered relevant for children's education and they are diluted among children in an equal way.

In contrast to the dilution of resources framework where parents invest equally among their children, under the siblings' rivalry hypothesis parents may or may not invest equally among their children. Siblings are pitted against each other for resources because family members maximize family utility: Parents invest in their children in an efficient manner because they seek to maximize the expected wealth of the entire family, including future returns (Becker 1981). This means that parents invest more on children who are perceived to produce higher expected returns later in life. Children's prospects in life are respectively the so-called quality of children while the number of children is the quantity. The interaction between quantity and quality of children explains why education per child tends to be lower in families having more

children. Given a set pool of family resources, more children mean fewer resources to each child and therefore lower prospects in life (Becker 1981)[2].

Much of the empirical work in both developed and developing countries that has examined the effects of family size on schooling attainment confirms the siblings rivalry and dilution hypotheses, i.e., that children from larger families present educational disadvantages compared to children from smaller families. This negative effect persists after socio-economic variables are controlled for (Shavit and Pierce 1991; Knodel and Wongsith 1991; Ahn, Knodel, Lam, and Friedman 1998; Parish and Willis 1993, 1989; Gomes 1984; Patrinos and Psacharopoulos 1997). Empirical research from developing countries consistently shows that there is a negative effect of family size on children's schooling.

Research from developed countries, mainly from the United States, also confirms a quantity-quality framework for the association between number of siblings and their educational attainment (Blake 1985, Blake 1989; Hauser and Kuo 1998; Kuo and Hauser 1997; Hauser and Sewell 1985; Mare and Chen 1986). The effect of number of siblings has been found to be greater for the transition from primary to secondary school than for later educational transitions in the United States (Blake 1985; Mare and Chen 1986).

Contrary to the empirical evidence of a negative relationship between family size and several schooling outcomes in both developing and developed countries, few studies have found a positive association between family size and education (Chernichovsky 1985; Mueller 1984; Zajonc 1976) or have produced mixed results (Psacharopoulos and Arriagada 1989).

These findings provoke questions as to whether the dominant quantity-quality framework for explaining the relationship between family size and schooling holds for Brazil. The siblings rivalry and dilution of resources hypotheses were developed in the West, which raises a question as to whether these dominant frameworks conform to the Brazilian case. The specialization of roles framework is an alternative notion for whether and how siblings affect children's schooling and school enrollment in developing countries. This paper's research questions emerge from this framework.

[2] The function is defined by the quantity of children, n; the expenditure on each child, called the quality of children,

In developing countries, the positive association between number of siblings and schooling found in some studies has been attributed to the specialization of roles in the family. In these settings, "a large number of children in the family may lead not to a universal resource dilution but to improved opportunities for the late born" (Parish and Willis 1993, pp. 868). Children in larger families may specialize in different activities as much as several siblings may actually free late-born children for school. This is particularly true in countries like Brazil, where children work commonly outside the home also going to school or not (Levison, Duryea, Hoek and Lam 2000). Indeed, having older siblings that work and provide financial and interpersonal resources may in fact enhance children's educational attainment. It therefore may be that when children draw on the support of older siblings, the negative effect of a larger family size on schooling and school enrollment may be less pronounced and even become positive. Another more plausible hypothesis is that older siblings may improve the educational outcomes of 14 year-olds by providing interpersonal and financial resources.

In societies with strong gender roles, there may also be a differentiation on the effect of not only siblings' ages but also their genders. Previous research on the determinants of school and work have indirectly suggested that parents of many children may diversify investments in their children, such that some specialize in home production, some work, and others focus on education (Levison 1991). Chernichovsky attributes such a positive association in Botswana to diminishing returns to child labor, which leads to role assignment within the family, with some children working in and outside the household, and others concentrating on their schooling. In the case of Brazil, Psacharopoulos and Arriagada (1989) found a negative effect of number of younger siblings on educational attainment but found a positive association between number of siblings at school age and schooling. This more refined way of looking at siblings' age and gender composition is necessary in order to disentangle the effects on children's schooling and schooling work in Brazil. Despite the significance of number and composition of siblings on education demonstrated in the literature, the majority of empirical studies on educational attainment still do not examine family size, and the ones that do rarely account for the differentiating effects of siblings' age and gender. Indeed, there has been relatively little empirical research on how number and composition of siblings affect children's schooling in Latin America.

---

q; and the quantities of commodities, as follows U = U (n, q, Z1,…, Zn) (Becker 1971, 1981).

This way, a sibling aged 0-6 may require care from 14 year-olds while siblings at the school ages 7-14 may compete with 14 year-olds for school resources. These effects are not expected to be different by the gender of the siblings. On the other hand, the mechanisms for the effects of older sisters versus older brothers may be different. Older sisters may help younger siblings because they may be more committed to late-born siblings even when they leave the household. On the other hand, older brothers may help by working and providing financial resources to support the schooling of 14 year-olds but they may not be highly committed to their previous household after they leave home. Indeed, Parish and Willis (1993) found this to be the case in Taiwan. Ofstedal, Knodel and Chayovan (1999) found that non-coresident females commonly provide material support to parents than males in the Philippines, Singapore, Thailand and Singapore, although the gender difference is modest.

In developed countries some argue that children can also benefit from larger family sizes, even though there is much controversy on this issue in developed countries (Zajonc 1976). According to Zajonc, older children benefit from teaching their siblings, which reinforces their own abilities (1976). However, there is a debate on whether siblings' age and gender affect children's education in the United States. Sewell and Hauser (1980) found no significant difference on the impact of siblings according to their ages and genders. This may be because they examine the educational attainment of adults or high school graduates, particularly in developed countries (Sewell and Hauser 1980). The importance of number of siblings to postsecondary education will appear relatively small compared with other variables because of the selection process by sibsize that has already taken place (Blake 1989, pp. 50). Many children from larger families have already dropped out or been held back, leaving a selected group of survivors from these families.

In addition to siblings' genders and ages, in this paper the different investments in boys and girls education are also examined. This can result from a variety of factors, including, but not limited to gender gap in returns to education and segregated labor markets. In most societies, women disproportionately carry the burden associated with childbearing and household tasks, which can produce sex preferences in educational investments, particularly in families with limited resources. Nonetheless, limited or non-existent access to training, decision-making and economic resources has also historically produced different gender roles. Some studies in several countries, particularly Taiwan have found that girls have an educational disadvantage in

relation to boys and can be related to this notion (Parish and Willis 1993). Thus, even though gender roles are prevalent in most societies and previous studies have shown their implication for children's schooling outcomes, the importance of gender context on children's education has not been examined in Brazil.

To summarize, according to the siblings' rivalry and dilution of resources hypotheses a larger number of siblings is associated with worse life outcomes, such as lower schooling levels and poorer nutrition. This is a result of a smaller share of financial and interpersonal resources for each child in larger families. Among the studies that examined such an effect, the majority has found such effect to be negative. Nonetheless, previous studies in developing countries have found conflicting results, and some studies have shown that the relationship is positive. This research conflicts with quantity-quality hypotheses. It is therefore unclear whether a quality-quantity framework fits the Brazilian case and whether and how siblings' age and gender interact with number of siblings. It may be that siblings' composition and number interact in developing countries, resulting in benefits for some children's schooling in larger family size. Indeed, if it is true that some sort of specialization mechanism operates within the family, previous research has not disentangled which specific age groups and genders are associated with schooling benefit and harm. It is not evident which children focus on studying and which children do not and how these decisions are made. Without a systematic investigation of siblings' age and gender, it is not clear whether the process of siblings schooling conforms to classic quality-quantity frameworks and/or to the idea of specialization within the family. I hypothesize that one of the reasons why previous research has found conflicting results on the effects of number of siblings on children's schooling is that previous researchers have solely examined number of siblings and have not looked at their genders and ages. Siblings' gender and birth order may interact with number of siblings in a way that may ameliorate the negative effect of larger family sizes. Nonetheless, these effects could differ according to demographic and social contexts.

Cohort Analysis for the Study of Educational and Demographic Change

Socio-economic and demographic trends shape the macro conditions in which the educational attainment process takes place. Brazil underwent a demographic transition in the 1970s, as discussed in detail in Paper 2. Decreasing rates of population growth and in relative cohort sizes resulting from secular declines in birth rates are factors that have potentially affected

children's schooling. At the elementary and secondary levels, school enrollment rates increase with lower rates of population growth, so that demand for education at these levels closely parallels future trends in the population aged 6-17 (Serow and Espenshade 1978). An additional consequence of slowing population growth is that the quality of education can rise – quality as measured by constant resources invested per student (Serow and Espenshade 1978).

The resulting smaller proportions of primary school age groups relative to the total population may create favorable demographic conditions, a "window of opportunity", for improving countries with poor basic educational systems such as Brazil (Carvalho and Wong 1995). Conceptualizing birth cohort as an important determinant of educational well-being (Easterlin 1980), this paper addresses the question of whether the advantageous demographic conditions for children born after the Demographic Transition, as opposed to those born prior to the transition, have contributed to improvements in children's schooling. Comprehensive analysis based on this framework in order to examine macro changes in educational structure will inform policy makers to better serve their communities as they face unprecedented smaller demands of students in primary school, a "window of opportunity" for alleviating educational inequality (Carvalho and Wong 1995).

The major recent shifts in the Brazilian demographic patterns have also affected the micro conditions in which children's schooling takes place by changing family size and composition. As a result of fertility decline, the distribution of family sizes within the Brazilian population has changed considerably. Increasing proportions of children are coming from smaller families. For example, 2% of 14 year-olds born in 1963 came from families of one or two living children; 33% came from families of seven or more. In contrast, 5% of 14 year-olds born in 1983, after the fertility decline, come from families with one or two children and only 12% from families with seven or more.

Does the negative association between number of siblings and schooling still hold with the smaller family sizes resulting from the demographic transition, and for all ages and gender compositions of siblings? Few studies have examined the effect of family size on educational attainment over time. One exception is the work of Parish and Willis (1993) who found an increasing role in the effect of family size on educational attainment in Taiwan, despite the declining average number of siblings and increasing average income. Parish and Willis attribute the unexpected increasing effect of family size on educational attainment to the rising

opportunity cost of school in recent decades. While past work has examined the effects of family size on children's schooling in developing countries at one point in time - and a few over time - there has not been research on whether these effects differ for cohorts of children separated by fertility decline.

Research Questions

In combination with the current literature and theoretical frameworks, the figures of family size and demographic change provoke empirical questions related to the determinants of basic education that are relevant for other countries with high levels of educational inequality and low levels of education such as Brazil. In this paper the educational attainment and school enrollment of cohorts of 14 year olds born in 1963 and 1983 are investigated in order to address the following research questions:

1. What is the effect of number of siblings in determining children's schooling and school enrollment? Are Brazilian children with fewer siblings better off in terms of educational attainment than children with a large number of siblings? Does the Brazilian pattern conform to the dominant quantity-quality framework? Is this true for cohorts born before and after the fertility decline?
2. As Brazil underwent major demographic and family changes, are children from the younger cohort better off in terms of schooling and school enrollment than children from the older cohort? If yes, is this true because the relationships between number of siblings and schooling and enrollment have changed or because of a simple change in the distribution of children across family sizes?
3. Are the effects of number of siblings age and gender sensitive?
4. What are the effects of gender and age of siblings on children's schooling and school enrollment? Does the specialization hypothesis fit the Brazilian case, that is, do children have higher schooling levels because of having an older sister, or an older brother? Are they better off having younger brothers or younger sisters? Are the patterns of age and gender composition consistent across cohorts born before and after fertility decline or has the pattern changed?

In a country where school enrollment is not the norm, the investigation of fertility factors associated with attendance is an essential area of knowledge for the promotion of higher school attendance and subsequent greater levels of educational attainment.

Methods

In order to assess the impact of composition and number of siblings on children's educational attainment in Brazil, models of schooling and school enrollment for children in the 1963 and 1983 cohorts are estimated.

First the relationship between number of siblings and the two educational outcomes – schooling and school enrollment – is established for each single cohort in two ways: Unadjusted and adjusted means of schooling and school enrollment. The unadjusted means are simple cross-tabulations of number of siblings by each of the two educational outcomes. The adjusted means of schooling and school enrollment are calculated as predicted schooling and predicted probabilities of enrollment through regression techniques.

I model years of school attainment by estimating equation (1) using ordinary least square regressions:

$$(1) \qquad S_i = a + bF_i + cD_i + e_i$$

where S_i equals the years of schooling for 14 year-old *i*; F_i is a vector of a set of dummy variables indicating number and gender composition of siblings, and their interactions; D_i is a vector of demographic, residence, and socio-economic characteristics, and e_i is a normally distributed error term.

I then model the probability of children's school enrollment by estimating equation (2) using logistic regression:

$$(2) \qquad W_i = a + bD_i + cM_i$$

where W_i equals the probability of school enrollment for 14 year-old *i*; D_i is a vector of demographic and residence characteristics; M_i is a set of dummy variables indicating number and composition of siblings. The results will be shown on figures presenting predicted probabilities of school enrollment by cohort and region of residence, as well as tables with odds ratios of school enrollment.

Both sets of regressions – ordinary least square regressions for years of schooling and logistic regressions for school enrollment – consist of separate models for the cohorts of 1963 and 1983 for the whole country. The standard controls used in models of children's educational outcomes such as sex, rural versus urban location, family income, mother's education and region of residence are included in the models. An indicator of the number of younger – both school age of 7 to 14 and 0 to 6 years of age - and older sisters and brothers is also included. In order to calculate the adjusted means of schooling and school enrollment the values of the covariates for each child were set as each children's own value. The value for number of siblings is then forced to range from 0 to 7 for every child.

The second step in assessing whether the effects of number of siblings and educational outcomes have changed across cohorts is to determine whether differences between each regression coefficient are statistically significant. The purpose of this paper's third analytical step is to determine whether such differences are due to a change in the distribution of children across family sizes or to a change in the effect of number of siblings on educational outcomes. To do so, the total explained change on schooling of cohorts to the differences accounted for by effects and distribution of number of siblings was decomposed. The results will indicate, for example, the extent to which a decline in the number of siblings in the youngest cohort explains improvements in educational attainment across cohorts of 14 year-olds.

A caveat should be made. It is possible that parents may jointly decide their number of children and the "quality" of their children with regards to education (Becker 1981; Blake 1981). If there is simultaneity between the decisions on number of siblings and desired educational attainment for those children, then neither additive nor interactive models of school attainment are correct as they assume that sibship size is determined prior to schooling. Family size is correlated with unmeasured determinants of children's schooling as parents may choose a combination of low fertility and high schooling for their children. This contributes to a negative cross-family correlation between family size and schooling that tends to overstate the extent to which schooling would increase if parents were required to limit their number of children. However, this is true only if one believes that parents are rational in their fertility decisions and educational expectations for their children, even in developing countries. Arguing the contrary, Knodel and colleagues have pointed out that in some societies, such as Thailand, fertility decisions and educational attainment of children are not calculated in a quality-quantity manner

(Knodel et al. 1990). It is true however that the way fertility decisions are made may change over time.

Past work has dealt with the endogeneity of family size in several ways. In a study of the effect of family size on children's schooling in Vietnam, Anh and colleagues recognized the effects of the potential bias from the endogeneity of family size in their results, although they have not used specific tools for solving this problem (Anh et al. 1998). A standard solution for such an identification problem is to use instrumental variables that are correlated with family size, but not with the demand for schooling. Due to the unavailability of useful instrumental variables in most surveys, past research has rarely employed this method. The prevailing approach found in the literature has been to identify how the effects of fertility on education could have been overestimated if it is true that parents decide for number of children and their education at once.

The third step in assessing the impact of fertility decline on children's education is to perform decomposition of the cohort difference in mean schooling. Decompositions of the cohort gain is done only for schooling because this educational outcome reflects current and past educational decisions. Enrollment in school enrollment on the other hand is solely a current decision.

The general regression form expressed in equations 1 and 2 can be simplified when family size is the sole independent variable. Two separate regressions are then estimated, one for each cohort defined in equations 3 and 4:

$$Y_{1963} = a_{1963} + b_{f1963} X_{f1963} \quad (3)$$

$$Y_{1983} = a_{1983} + b_{f1983} X_{f1983} \quad (4)$$

As equations 3 and 4 make clear, mean schooling (Y) in each cohort is now specified as a function of b_i (coefficient) and X_i (mean) of family size. Y_{cohort} equals the years of schooling for 14 year-old *i* in cohorts 1963 and 1983. b_{cohort} is the coefficient of family size on each cohort, and X_{cohort} is the distribution of family size in each cohort. Schooling changes when there is a change in b_{cohort} or X_{cohort} or both. The regression equations of family size on children's schooling are assumed to accurately represent the relationship between these variables in each

cohort. The idea is to express the cohort difference in average schooling, which is the gap to be explained, in terms of the difference in predicted schooling from equations 3 and 4:

$$(Y_{1983} - Y_{1963}) = (a_{1963} + b_{f1963} X_{f1963)} - (a_{1983} + b_{f1983} X_{f1983}) \quad (5)$$

Equation 5 can be expanded in several ways to obtain decompositions of the schooling difference. There are several decomposition strategies in the literature (Bound and Holzer 1993; Jones and Kelley 1984; Oaxaca and Ransom 1994; Preston 1975). The basic difference on decomposition approaches is how the interaction term and the part due to membership are defined. Table 1 in the Appendix provides a comparison of decomposition procedures, their formulas and the meaning of each part decomposed, as well as estimates from all decomposition procedures in order to elucidate their differences.

In this paper Preston's model of decomposition is used (Preston 1975). This method is appropriate because it allows for separation of the part of the schooling change due to shifts in the relationship between family size and schooling versus the distribution of family size. Furthermore, this strategy is suitable for this analysis because it does not separate the amount of the change in schooling due to intercept differences. In regressions that have dummy variables, as equations 3 and 4, the intercept is arbitrary and changes according to the way the dummy variables are coded.

According to Preston's decomposition model, equation 5 is expanded in the following way:

Change attributable to change in distribution = $((\Sigma b_{f1963} X_{f1983}) + a_{1963}) - Y_{1963}) / Y_{1983} - Y_{1963}$ (6)

Change attributable to change in coefficient = $((\Sigma b_{f1983} X_{f1963}) + a_{1983}) - Y_{1963}) / Y_{1983} - Y_{1963}$ (7)

Where $((\Sigma b_{f1963} X_{f1983}) + a_{1963})$ is the mean schooling children in the 1963 cohort would attain if they had the family sizes of the 1983 cohort. This estimate minus the actual 1963 cohort mean schooling is equal to the numerator of equation 6. In order to calculate the change predicted by a change in the distribution of family size, this last estimate is divided by the cohort

difference in mean schooling. Equation 7 is similar to equation 6. The term $((\Sigma b_{f1983} X_{f1963})+ a_{1983})$ is equal to the mean schooling children in the 1963 cohort would attain if they experienced the relationship between family size and schooling that children in the 1983 cohort experienced. This last estimate minus the actual 1963 cohort mean schooling is equal to the numerator of equation 6. In order to calculate the change predicted by a shift in the family size coefficient, this last estimate is divided by the true cohort difference in mean schooling.

As defined in equations 6 and 7, children's schooling for the 1963 cohort is calculated using the 1963 coefficient and mean estimates of family size of the younger cohort. An estimate of what schooling in the younger cohort would have been if the older cohort's relationship between family size and schooling still in effect is then produced. The difference between this last estimate and the older cohort's schooling indicates the gain in education attributable to declines in family size per se between the 1963 and 1983 cohorts. I repeat the procedure using the older cohort's family size but the younger cohort's relationship. The difference between this estimate and older cohort's schooling evidences the gain in schooling attributable to shifts in the curve or to factors exogenous to family size. The two differences when added to the initial estimate should come close to the actual schooling for the younger cohort.

Description of Data and Analytical Sample

In this paper data from the 1977 and 1997 *Pesquisa Nacional por Amostra de Domicílios*/PNAD (National Research of Household Sample), annual household surveys conducted by the *Instituto Brasileiro de Geografia e Estatística* (IBGE), the Brazilian statistical bureau is used. The PNAD is comparable with the U.S. Current Population Survey (CPS), and is carried out in September of each year.

The PNAD is appropriate for this study because it contains standard demographic and socio-economic variables such as sex, age, income, and schooling for all members of the household. Another feature of the PNAD that makes it suitable for this study is that the repeated cross-sections allow for the construction of true cohort histories for schooling and other social, economic and demographic variables. Data from 1977 and 1997 are comparable, with the exception of a few discrepancies. The 1977 PNAD does not contain information on race and ethnicity, making it impossible to compare cohort ethnic distributions. Also, the PNAD does not

cover the rural part of the northern region in 1977 or in 1997. This probably results in overestimates of the educational and socio-economic statistics of the northern region.

The PNAD is a nationally representative survey of extremely good quality. For 1977, the PNAD contains 498,679 individuals in 100,039 households, compared to 365,870 individuals in 89,939 households in 1997. The large sample permits sufficient sub-sample sizes for analysis of specific groups, such as 14 year-olds. For 1977, there are 12,834 14 year-olds in the sample, compared to 7,861 14-year-olds in 1997. Children's educational experiences at different ages are sufficiently diverse that it is sensible that they are analyzed separately. Fourteen year-olds were chosen to be the unit of analysis because this is the eldest age for school enrollment legally required in Brazil. This is an ideal age for this analysis also because children who have been successful in school should be making a transition from primary to secondary education at 14 years of age. Because the substantive aim is to compare the experience of different cohorts born before and after fundamental demographic changes, throughout the analysis reference to cohorts of children will be made, and not to the years of the survey. Data from 14 year-olds in the 1963 cohort come from the 1977 PNAD, while data from 14 year-olds in the 1983 cohort come from the 1997 PNAD.

A methodological problem arises from the analysis of educational attainment of 14 year-olds, as their final completed levels of education are not known. It can be that the ones who have low levels of schooling at age 14 will achieve high educational levels later on. Children who are in school may catch up if they continue uninterruptedly, for example. The ones who are not in school may enroll later and still get levels of educational attainment similar to the ones of children who were ahead at age 14. Censoring is a problem for the analysis of levels of schooling that current school enrollment measures are not affected by.

Accurate determination of the percentage of children who achieve a particular level of schooling can only be made for those who are above the age at which the level in question would be completed. There is enormous variation in the levels of schooling of 14 year-olds in Brazil, therefore making it unsuitable to set particular levels of schooling achieved at specific age groups. For this reason, number of years of schooling is the outcome variable in this study rather than percentage of children who completed specific levels. The huge variation on schooling levels of children provides evidence that there are specific factors playing important roles in determining selection to school enrollment and high levels of educational attainment already in

early ages in the Brazilian society. As a consequence, it becomes rather crucial to disentangle the components that establish strong inequalities early in the educational careers of Brazilian children.

The PNAD is household data and, as such, permits the account of all family and non-family members who live in the household, but cannot account for family members outside the household. It can be therefore, that there are other family members outside the household, particularly siblings, who influence children's school enrollment and schooling but are not accounted for. Nonetheless, the 1977 and 1997 PNADs provide complete numbers of children for each woman over 15 years of age therefore providing complete information on siblings. In terms of the dilution of resources available to children, it is reasonable to believe that family resources will more likely be divided among children who are in the household. An exception is college students away from home, which is not common in Brazil. Nonetheless, in terms of socialization effects on children's education, it is reasonable to believe that resident family and non-family members have strong influences in terms of schooling decisions of children. However, depending on class, it is common in Brazilian society that siblings living outside the household send resources.

Because I want to look at the effects of number and composition of siblings and family structure on children's education, the analytical sample had to be limited to children who are daughters or sons of the head of the family, i.e., children whose mothers and therefore their complete parity can be identified. This creates a selection bias. Children who are not daughters or sons of the head of the family may be significantly different from the full sample of 14 year-olds.

Most empirical studies on educational attainment are based on information of adults' complete education, and recollection of siblings' information. Because individuals can catch up on their schooling later in life, and data on children do not take this into account, the analysis of children's educational attainment have problems of selectivity. On the other hand, the analysis of the influence of siblings on adults' educational outcomes has two limitations. One such difficulty is that siblings' characteristics are most likely unavailable or inaccurate later in life. In fact, they are usually retrospective information based on individuals' recollection and therefore susceptible to mistakes. This is particularly true for the analysis of siblings' age in developing countries where individuals may not know the ages of all their siblings.

This study overcomes these limitations by accounting for both school enrollment and schooling achievement. In a country where school enrollment is not the norm, disentangling of the fertility factors associated with school attendance is an essential area of knowledge for the promotion of higher school attendance and subsequent greater levels of educational attainment. In addition, this study also accounts for siblings' composition, that is, the age and genders of siblings.

Table 1 shows the socio-economic and family characteristics used in the analytical models for the full sample, and for children of the head of the family in the 1963 and 1983 cohorts. This provides evidence on the extent of selection bias. About 9 in 10 children in both cohorts live with at least one of their parents. Children of the head of the family are not significantly different from the full sample of children on their distribution across rural/urban location, family income, region or gender. School enrollment rates and years of education of these groups by selected characteristics were compared (results are not provided here). There are no notable differences in enrollment rates nor in educational attainment among the full and restricted samples. Because the majority of 14 years-olds live with at least one of their parents, and because children of the head of the family are not different from all children, there does not appear to be a severe selectivity bias. In order to further ensure that the sample of 14 year-old children of the head of the family does not have selectivity bias, models of schooling and school enrollment for all 14 year-olds in the 1989 PNAD are estimated, as this particular year of the PNAD has supplementary information on parents' education of all individuals.

Further descriptions of the analytical sample provided in Table 1 are noteworthy. Columns 2 and 4 provide comparisons of the distribution of 1963 and 1983 cohorts across socio-economic and family characteristics. The general life conditions of these cohorts are somewhat different. Almost two-thirds of 14 year-olds born in 1963 live in urban areas (67%) compared to nearly four-fifths of 14 year-olds born in 1983 (78%). Brazil's increased urbanization across the 1960s and 1970s suggests changes in the overall value of children and therefore on their educational outcomes. With regard to regional distribution, about 3 in 4 children in both cohorts were living in the southeast and northeast together. The majority of Brazilian children live in these regions, reinforcing the importance of studying Brazil's northeast and southeast separately.

The distribution of children by mother's education has changed dramatically across cohorts. Nearly seven times more children have mothers who attended at least one year of university in the youngest than in the oldest cohort.

Table 2 provides means and standard deviations for the analytical sample by cohort. The proportion of 14 year-olds enrolled in school is higher for the youngest than for the older cohorts. Similarly, educational attainment of young people in Brazil has increased dramatically in the last twenty years. The average education of 14 year-olds grew from 3.4 for the cohort born in 1963 to 4.7 for the youngest cohort. It is likely that the magnitude of these improvements in educational outcomes has been different according to for children's family sizes. In order to elucidate this, in the next section results of cross-tabulations and regressions on educational outcomes by selected family and socio-economic variables are provided.

Results

Table 3 provides overall enrollment rates and schooling attainment, as well as the distribution of these educational measures by family and socio-economic characteristics separately by cohort. First the distribution of enrollment rates and schooling attainment of 14 year-olds across their socio-economic characteristics is discussed and next these distributions are compared for each birth cohort, 1963 versus 1983.

Table 3 provides evidence for gender differences in levels of school enrollment and attainment across and within cohorts. This table shows that among the oldest cohort 78% of boys are enrolled in school compared to 72% of girls. The trend of higher school enrollment for boys is reversed in the youngest cohort: 90% of girls are enrolled in school compared with 81% of boys. It is worthy to note that in the oldest cohort even though boys are enrolled in school at higher rates than girls, on average girls have more years of schooling than boys. This may mean that girls go through school much faster than boys do. The trend of girls' higher levels of schooling remains in the youngest cohort. The recent pattern of girls' higher levels of both educational attainment and school enrollment to the detriment of boys is remarkably different from findings in other developing countries (Knodel and Jones 1996; 1994).

The proportion of 14 year-olds living in female-headed families has doubled from the oldest to the youngest cohort (10.1 percent versus 20.1 for oldest and youngest cohorts, respectively). The proportion of children enrolled in school in female-headed and male-headed families is

nearly the same for both cohorts. However, children in male-headed families have on average more years of schooling than children in female-headed families have.

The consequences of the profound demographic change Brazil has experienced in the period that separates this study's cohorts are evident through 14 year-olds' average number of siblings and their distribution across family sizes. The average number of siblings went from 4.3 in the older cohort to 3.3 in the younger cohort. Figure 4.1 provides further support that the distribution of children across family sizes has changed considerably across the 1963 and 1983 cohorts. In the older cohort, more than two-thirds of children had four or more siblings while only one third of children had four or more siblings in the younger cohort. This dramatic change is evident as nearly one-third of 14 year-olds in the older cohort had 7 or more siblings. In the younger cohort the portion of children with 7 or more siblings drops to 12%.

Throughout the century and in most places there has been an inverse relationship between sibship size and children's educational attainment, often attributed to a reduction in the availability of resources per child (Blake 1989; Duncan 1974). In some countries research has showed a positive relationship, often attributed to role specialization within the family. Is this true for Brazil? Do brothers affect their siblings' school enrollment and schooling differently than sisters, relating to specialization? The distribution of children according to their number of siblings has changed. Has this change, which resulted from fertility decline, contributed to better educational outcomes of younger cohorts?

Is there an effect of total number of siblings on school enrollment in both 1963 and 1983 cohorts? Has this effect changed?

Figure 4.3 presents the percentages of children enrolled in school for the 1963 and 1983 cohorts by family size. These unadjusted proportions of school enrollment are compared with adjusted values in Figures 4.4 and 4.5, separately by cohort. Adjusted enrollment rates come from results of logistic regressions that include other socio-economic and demographic covariates, as discussed in the methods section. Results are translated into predicted probabilities in order to make cohort comparisons and interpretations easier. Figure 4.6 provides comparisons of adjusted school enrollment rates for both cohorts.

Figure 4.3 shows that the vast majority of 14 year-olds with one sibling in the older cohort - 91% - were enrolled in school, while 68% of the ones who had 7 or more siblings were attending school. Children in larger families have significantly lower school enrollment levels than children in smaller families. This finding generally conforms with quantity-quality frameworks within the family. This is true for all family sizes except those with only one child. Only children are enrolled in school at lower rates than children with one or two siblings. Compared with children with one or two siblings only children are in disadvantage. This suggests that a specialization mechanism may be operating in families with more than one child. This exception may also be related to specific characteristics of only children that make them different from children who have siblings. One such difference is that only children are more likely to be born out of wedlock, which may be confounding the effects of number of siblings with other factors. Another specific characteristic of only children may be related to parents' fecundity problems that operate independently on the determinants of family size that relate to education. Other variables may distort the effects of number of siblings on school enrollment. In order to eliminate the effects of these potential confounding factors, the adjusted probabilities of school enrollment derived from multivariate analyses are estimated when other predictors of school attendance are controlled for. The adjustment is done so that independent variables are set to the mean.

Figures 4.4 and 4.5 provide evidence that children with one sibling remain at an enrollment advantage or at the same level of only children. Children with one sibling are better off than only children thus suggesting that specialization within siblings may be freeing some children for school. However, family size becomes negatively associated with educational outcomes in families larger than two, conforming to a quantity-quality framework. Indeed, Figures 4.4 and 4.5 confirm that the associations between school enrollment and number of siblings are still strongly negative even when socio-economic and demographic variables are controlled. Results from adjusted probabilities show that this is true for both cohorts: In the 1963 cohort the probability of school attendance is 75 percent for children with seven or more siblings and 88 percent for children with one sibling. These results make clear that number of siblings is an important determinant of the cumulative probability of school enrollment in and of itself for cohorts born pre- and post-fertility decline.

Figure 4.6 shows a comparison of the curve of adjusted enrollment by family size by cohort. Overall, children in the 1963 cohort are enrolled in school at higher levels than children in the 1983 cohort, at all family sizes. For children born in 1963, the relative advantage of coming from a smaller family compared with a larger family is substantial. More pronounced differentials of school attendance related to number of siblings are evident for children born pre-demographic transition. Figure 4.6 shows that 90% or more of children born in 1983 and with three or less siblings are in school. This result is beneficial for education as two-thirds of children in this younger cohort post- demographic transition are in families with three or less siblings.

Is there an effect of total number of siblings on schooling in both 1963 and 1983 cohorts? Has this effect changed?

The story for schooling is somewhat similar to that of school enrollment. Figure 4.7 shows levels of schooling according to family size separately by cohort. It is worth noting that if a 14 year-old had started school at the mandatory age of 7, and had not dropped out of school or repeated a grade, s/he would have 6 or 7 years of schooling. Figure 4.7 indicates that 14 year-olds in both cohorts and in all family sizes are substantially behind in terms of their educational attainment. Nonetheless, children have lower levels of schooling as their number of siblings increases.

Figures 4.8 and 4.9 provide unadjusted and adjusted schooling of 14 year-olds born in 1963 and 1983, respectively. Figure 4.8 indicates that the difference in adjusted schooling between children with 7 or more and no siblings is .9 years of schooling in the older cohort while such difference is 1.6. The schooling penalty for being in larger families is smaller when other covariates are controlled for. Even though the curve of schooling by family size shifts upward from 1963 to 1983, the disadvantage of being in larger families still holds in the younger cohort. In fact, Figure 4.9 indicates that the difference in schooling between children with 7 or more siblings versus no siblings is 1.0 year of schooling, a small increase over the 1963 difference

Figure 4.10 shows adjusted schooling for children born in 1963 and 1983 in order to demonstrate whether and how the curve of the relationship between number of siblings and schooling has changed across cohorts. This figure indicates that children in larger families are slightly more disadvantaged in the younger than in the older cohort. This finding shows that the

slope of the coefficient between number of siblings and schooling has not changed. Under high and low fertility regimes, the effect of family size on children's schooling has remained negative.

Decompositions

I decompose the increase in schooling across cohorts in order to elucidate how much of such a change is attributed to a change in the slope and how much is due to a change in the distribution of children across family sizes. The goal of this analysis is to address whether the contribution of reduced family size to education is substantial.

Table 8 reports estimates from the decomposition of the cohort difference in schooling with family size as sole predictor. The change to be explained is the total increase of 1.32 years of schooling across cohorts. The 1963 and 1983 regression coefficients used in the estimations of mean schooling in Table 8 are presented in Table 9. These coefficients are different from the coefficients presented in the earlier section in that they have family size as sole predictor of schooling.

The estimates presented in the first row of Table 8 are the mean schooling calculated by using the 1963 cohort coefficient. The first estimate uses the coefficient and children's mean schooling of the older cohort, which produces the actual 3.43 years of schooling of the 1963 cohort. Repeating the procedure but using mean family size of the 1983 cohort, the second estimate indicates the level of schooling children in the older cohort would have if the family size distribution of the younger cohort were in effect. The observed decline in family size would have produced a direct gain in schooling of 4.10 across the two cohorts. The difference of 0.67 of the two estimates of the first row indicates the reduction in the cohort difference resulted from giving the older cohort the same distribution of family size of the younger cohort. The means schooling of the second row of Table 8 are calculated in a similar way as those in the first row, except for the use of the 1983 cohort regression coefficients. The first mean of the second row is the product of the 1983 cohort coefficient times the mean family size of the 1963 cohort. The second mean is the actual mean family size of the younger cohort, 4.75 years of schooling. Subtracting these two estimates yields a schooling gain of 0.79. The average of 0.79 and 0.67, that is 0.73 represents the schooling children in the older cohort would gain if they had the number of siblings of the younger cohort, that is, the proportion of the schooling difference explained by a change in the distribution of family size. The change in family size accounts for

nearly 55% of the schooling difference, the portion of the schooling difference that has been explained.

The procedure described above but is repeated now subtracting the means across columns. The contribution estimate indicates that differences in the family size coefficient and exogenous factors account for 0.59 of a year of schooling. The estimate of the total contribution using the younger cohort's coefficients is slightly smaller (45%) than the estimate of the shift due to a change in the distribution of family size (55%).

The decomposition exercise implies that around 55 percent of the increase in schooling between cohorts is attributable to the decline in family size per se. Changes in the curve and to factors exogenous to family size are responsible for 45 percent of the increase in schooling across cohorts. The change in the effect of family size on children's schooling and factors exogenous to family size suggests that the opportunity cost of education has increased in the period that separates this study's cohorts. On the other hand, the schooling gain is explained mostly by the pronounced growth in the proportion of children coming from small families. These findings confirm that fertility decline has had a direct impact on increasing children's schooling.

Gender Component

Figures 4.11 to 4.20 provide results of analogous models to the ones presented in the previous section separately for boys and girls. The adjusted and unadjusted school enrollment and school attainment of boys and girls born in 1963 and 1983 were examined.

Figures 4.11 and 4.12 provide cohort comparisons of unadjusted school enrollment by family sizes of boys and girls. Levels of enrollment increased across cohorts of both boys and girls at all family sizes. Figure 4.12 shows that enrollment levels of girls increased more in larger family sizes, which is not true for boys. Graphs 4.13 and 4.14 show the same curves as graphs 4.11 and 4.12, but emphasize gender differences. These figures provide evidence that girls are behind boys in the older cohort, but are ahead in the younger cohort. Indeed, enrollment levels of girls in the younger cohort are higher than that of boys at all family sizes. Girls in the older cohort, particularly in larger families, were penalized, while girls in smaller families had levels of enrollment that were similar to boys. The benefit of girls in the younger cohort suggests that a change in gender roles in the allocation of education might have happened in the

20-year period of demographic change that separates these cohorts. Since girls are responsible for household tasks such as taking care of younger siblings more than boys (Connelly, Levison and DeGraff 1997), the smaller family sizes of younger cohorts may have disproportionately benefited girls' school enrollment levels. A smaller number of siblings may have freed girls to attend school while boys may have been drawn into the labor force at higher rates (cite Lam, Levison, Dureya papers). It may also be that other conditions that affect girls' school attendance differently from boys' have changed. A possible reason could be an increase in the availability of schools closer to home, which would make it safer for girls to attend school

Figures 4.15 and 4.16 show adjusted school enrollment and confirm these results. Figures 4.17 and 4.18 present adjusted schooling of 1963 and 1983 cohorts by gender. They demonstrate that the educational attainment of boys and girls in the older cohort are similar, with boys presenting a small disadvantage over girls at all family sizes. This last set of figures shows that even though girls had lower levels of school enrollment than boys in the 1963 cohort, they have higher schooling attainment. This finding demonstrates that girls seem to go through school faster than boys, a finding that has been demonstrated in other countries such as Thailand (Knodel and Jones 1996).

The curves of school attainment for boys and girls in the younger cohort present a different picture from the older cohort's. Girls in the post fertility decline cohort have substantially higher levels of schooling than boys at all family sizes. This gender gap in educational attainment reaches nearly a year of advantage of girls over boys, among only-children.

The finding that girls have higher schooling attainment and school enrollment rates at all levels of family size suggests that some sort of specialization within the family is going on in the younger cohort. Even though the effect of family size on schooling outcomes is negative, it seems that there is some sort of allocation of specialization within the family. This allocation may happen for several reasons: girls may demonstrate a taste for school, and boys do not; girls may be more studious than boys and more reliable in school.

Does the specialization hypothesis hold in Brazil? Siblings' Composition: Do age and gender matter?

In order to elucidate whether there is to be some sort of allocation of specialization towards girls, I now turn to the examination of whether and how siblings' genders are associated with schooling and school enrollment. Table 9 shows the coefficients and standard deviations of OLS regressions with schooling as outcome variable. Table 10 presents odds ratios and standard deviations of logistic regressions with school enrollment as dependent variable. Figures 4.21 to 4.28 present predicted schooling and school enrollment by combinations of siblings of given ages and genders estimated from regression results presented on Tables 9 and 10. Figures 4.21 to 4.24 present the difference on predicted schooling of 14 year-olds with no siblings versus 14 year-olds that with various combinations of siblings. Similarly, Figures 4.25 to 4.28 show the difference on predicted enrollment of 14 year-olds with no versus a combination of siblings. These combinations of siblings are one sibling aged 0-6, two siblings aged 0-6, one sibling aged 7-14, and two siblings aged 7-14.

As discussed in the theoretical framework section, there are reasons to believe that a younger as opposed to an older sibling may impact 14 year-olds' schooling and school enrollment differently. Nonetheless, older sisters and older brothers are likely to affect children's schooling through different mechanisms even though the final positive outcome may be equal.

Figures 4.21 and 4.22 show the schooling difference of 14 year-olds with no siblings versus various combinations of younger siblings for the older and younger cohorts respectively. Figure 4.21 shows that the presence of younger siblings at any age decreases the schooling of both boys and girls. However, the schooling penalty of having a younger sibling aged 0 to 6 is higher than the schooling penalty of having a younger sibling at the school ages of 7 to14. For example, girls from the older cohort lose about one-third of a schooling year for having a sibling aged 0 to 6 and about one-tenth of a schooling year for having a sibling aged 7 to14. Boys also lose from having younger siblings. However, the penalty for having a sibling 0 to 6 years of age is higher for girls than it is for boys. It seems that girls carry the burden of child care more than boys do.

Figure 4.22 shows that there was a surprising increase in the negative effect of younger siblings. As shown earlier, the average number of siblings per family declined dramatically over these decades. Instead of declining, the negative effect of each extra younger sibling increased. Figure 4.22 shows that the threat to schooling is particularly high for both boys and girls having

younger siblings 0 to 6 years of age. As in the older cohort, siblings at child care ages present higher penalties for children's schooling than siblings at school ages of 7 to 14. Girls lose almost a year of schooling by having two siblings in this age group and nearly 4 months of schooling from having two siblings 7 to 14. Boys' schooling is also more threatened by siblings aged 0 to 6 than siblings aged 7 to 14. It is better to have a sibling at the school ages of 7 to 14 than a sibling at the child care ages of 0 to 6. The mechanism through which younger siblings harm children's education is different according to their ages. This result provides support to the notion that some sort of role specialization may be going on within families, as opposed to direct competition for resources by siblings at school age. Figures 4.21 and 4.22 also suggest that the burden of child care in larger families seems to be shared by both boys and girls.

Figures 4.23 and 4.24 provide differences in predicted schooling of boys and girls with no siblings versus a combination of older sisters and brothers. Figure 4.23 shows that older brothers hurt a child's schooling in both cohorts. The negative impact of older brothers is higher in the younger cohort, which is not true for older sisters. Older sisters threaten children's schooling at higher rates in the older than in the younger cohort. Indeed, older sisters have no significant effect on declining boys' schooling in the younger cohort and a very small effect for girls. Older sisters and boys affect their siblings' schooling at different levels, particularly in the younger cohort.

Figures 4.25 to 4.28 show figures similar to those discussed above but for school enrollment. They provide the difference on school enrollment for 14 year-olds with none versus given combinations of siblings. Results are similar to the ones for schooling. Younger siblings aged 0 to 6 threaten children's school participation more than younger siblings aged 7 to 14. The difference is that this negative impact does not increase in the younger cohort. This may be because school enrollment reached an almost universal level in the decades that separate these studies' cohorts. Nonetheless, Figures 4.27 and 4.28 show that older sisters in fact help one's school enrollment, although the impact is small. The positive effect of older sisters has been found in Taiwan and is attributed to older sisters' marriage (Parish and Willis 1993). According to Parish and Willis (1993), these sisters marry and are more likely to still care for their late born siblings than older brothers. The same effect seems to occur in Brazil.

To summarize, two important findings emerge from these section's analyses. The effect of siblings on one's educational attainment differs according to siblings' age and gender in

Brazil. Indeed, siblings may even help and not hurt one's school enrollment and schooling as older sisters do in some cases. Siblings aged 0 to 6 threatens the most, and both boys and girls are hurt. Although girls are penalized most by having siblings at child care ages, boys are also substantially hurt by their presence. This suggests that in Brazil the negative impact of number of siblings seems to work through higher child care demands rather than competition for school with siblings at schooling ages.

Conclusion and Discussion

This paper provides evidence of the importance of number of siblings on schooling and school enrollment. Children in larger families from both pre- and post-fertility decline cohorts are disadvantaged compared with children in smaller families, supporting the dominant quantity-quality explanations for the association of family size and education. This negative impact of larger families on children's schooling and school enrollment persists in the post-demographic transition cohort. Findings from the decomposition of the difference in schooling of cohorts born pre- and post- demographic transition show that children in the younger cohort have benefited from the higher proportions of smaller families resulted from the fertility decline. However, the negative effect of family size on children's education has not declined. A change in the curve of family size and schooling and factors exogenous to family size have also contributed to the schooling gain, though not as much as a change in the distribution. The demographic transition has benefited children's schooling through smaller number of siblings. This finding provides support for a window of opportunity framework: the smaller family sizes of post-fertility decline benefit children's schooling.

The investigation of gender differentials on the effect of family size on schooling and school enrollment shows that girls in the older cohort have lower levels of school enrollment than boys, irrespective of family size. Girls' lower level of school enrollment is especially greater in larger family sizes. The story changes for the younger cohort born after the fertility decline. Boys in the younger cohort not only have lower levels of school enrollment and schooling than girls, but they also are more penalized for being in larger families. In the post-fertility decline cohort, not only are girls ahead of boys, but also girls are not as penalized as boys for being in larger families. This finding suggests that a level of specialization where girls are being selected for schooling may be happening within families.

The investigation of the effect of siblings' composition on children's schooling and school enrollment provides further evidence that a process of siblings' specialization is taking place within families. Children in both cohorts are penalized for having younger siblings, irrespective of being at school or child care ages. This finding provides further support to the specialization hypothesis, that is, larger families require that some siblings specialize in housework and work outside the household. Somewhat surprisingly, both boys and girls are making sacrifices. Males are just as threatened as females by having younger siblings at child care age. In addition to that, girls are ahead of boys and are not penalized as boys are for being in larger families. These results suggest that boys are fulfilling the specialization role of working while girls, now free from taking care of larger number of siblings, are gaining on schooling careers. There are several reasons why this school specialization towards girls may be occurring. Girls may be more studious and therefore less unreliable in school. Boys may gain higher wages than girls and therefore are concentrating on work, freeing girls for school. More research on the intersections between children's work, school and gender of siblings will further elucidate the patterns found in this paper.

Older sisters marginally benefit while older brothers definitely hurt children. Parish and Willis (1993) found that marriage is the mechanism through which older sisters benefit the education of late-born siblings. They may marry and send back resources to the family. This may be the case in Brazil because family ties are strong. That is not the case in younger cohorts, as 14 year-olds do not benefit from having older sisters. Thus, the effect of older sisters on siblings' schooling and school enrollment has changed.

The negative relationship between family size and children's educational outcomes in Brazil suggests that a quantity-quality process for schooling allocation is occurring within families. Nonetheless, the gender differentials in such effects and the change in the impact of older sisters on children's schooling indicate that a process of role specialization among siblings is occurring within families. If, in older cohorts, boys were selected within families for schooling, in younger cohorts, girls seem to specialize more in education. This study provides evidence for quantity-quality frameworks and specialization of roles within the family.

The persistence of the negative effect of family size after fertility decline suggests that children in larger families in the younger cohort are seriously disadvantaged. Children in the post-fertility decline cohorts who are in larger families should be targeted in policies that aim at

increasing levels of schooling and enrollment rates. In order to implement targeting policies that focus on these children's educational attainment, it is therefore important to account for number and composition of siblings. Research that focuses on children's work and school should examine children's siblings' characteristics and activities in order to expand this paper's findings on how school decisions are played out among siblings within families.

Table 1. Socio-Economic and Family Characteristics of 14 Year-Olds [%] Cohorts of 1963 and 1983, Brazil

	Cohort of 1963		Cohort of 1983	
	Other Children	Children of the Head	Other Children	Children of the Head
Family Headship				
Female	17.96	9.16	36.38	18.42
Male	82.04	90.84	62.62	81.58
Relationship with the Head of the Family				
Child of the Head	-	100.00	-	100.00
Other Relative of the Head		-	82.44	-
Other		-	17.56	-
Total Number of Siblings				
0	N/A	0.07	N/A	2.40
1	N/A	2.68	N/A	3.89
2	N/A	6.91	N/A	21.02
3	N/A	10.92	N/A	24.98
4	N/A	13.24	N/A	14.63
5	N/A	11.66	N/A	8.77
6	N/A	11.98	N/A	6.89
7+	N/A	42.54	N/A	16.84
Rural/Urban Location				
Urban	70.72	62.71	78.13	77.76
Rural	29.28	37.29	21.87	22.24
Region				
Southeast = 0	36.77	42.79	32.86	40.96
North = 1	4.06	2.01	7.78	5.51
Northeast = 2	40.42	31.40	41.93	32.13
South = 3	13.83	20.38	11.15	14.61
Central = 4	4.91	3.42	6.28	6.78
Gender				
Male	38.13	50.77	41.45	50.60
Female	61.87	49.23	58.55	49.40
Mother's Education				
No Education (0)	N/A	36.94	N/A	19.43
Attended First Primary (1-4)	N/A	47.08	N/A	38.72
Attended Second Primary (5-8)	N/A	11.33	N/A	22.81
Attended High School (9-11)	N/A	3.26	N/A	11.72
Attended University or more (12+)	N/A	1.37	N/A	7.30
[N]	1,565	11,269	652	7,131

Source: PNADs 1977, 1997.

Table 3. School Enrollment and Schooling by Family and Socio-Economic Characteristics of 14 Year-olds Children of the Head of the Family, 1963 and 1983 Cohorts, Brazil

	Mean Years of Schooling		Enrollment Rates [%]	
	Cohort of 1963	Cohort of 1983	Cohort of 1963	Cohort of 1983
Family Headship				
Female	3.25	4.76	74.64	86.32
Male	3.43	4.52	75.61	89.21
Total Number of Siblings				
0	3.71	5.88	74.16	75.57
1	4.81	5.52	81.60	94.76
2	3.66	5.78	89.55	95.81
3	4.07	5.40	87.23	92.74
4	3.61	4.61	81.66	88.62
5	3.16	4.15	76.32	86.34
6	2.67	3.62	72.73	79.32
7+	2.58	3.42	67.57	82.24
Rural/Urban Location				
Urban	4.16	5.09	83.59	90.98
Rural	2.14	3.44	75.75	80.66
Region				
Southeast	4.14	5.41	75.96	90.68
North	3.42	4.03	94.97	89.69
Northeast	1.98	3.49	83.59	86.12
South	4.01	5.64	58.91	88.45
Central	3.81	4.96	87.80	88.47
Gender				
Male	3.19	4.39	77.67	86.96
Female	3.62	5.05	72.38	90.45
Mother's Education				
No Education (0)	2.13	2.91	66.19	76.35
Attended First Primary (1-4)	3.80	4.55	75.29	87.01
Attended Second Primary (5-8)	5.00	5.31	89.91	94.88
Attended High School (9-11)	5.81	6.13	97.69	98.23
Attended University or more	6.37	6.58	100.00	99.40
Family Income (Quintiles)				
First Quintile	1.86	3.24	68.96	81.83
Second Quintile	2.47	3.98	68.05	83.32
Third Quintile	3.28	4.74	70.57	87.59
Fourth Quintile	4.02	5.52	75.65	93.42
Fifth Quintile	5.09	6.20	88.83	97.52
[N]	7,162	6,672	7,162	6,672

Source: PNADs 1977, 1997

Table 4. Coefficients and Standard Deviations of Logistic Regressions of School Enrollment 14 Year-olds Children of the Head of the Family, 1963 and 1983 Cohorts, Brazil

	Cohort of 1963						Cohort of 1983					
	All		Boys		Girls		All		Boys		Girls	
	Coeff	SD	Coeff.	SD	Coeff	SD	Coeff	SD	Coeff	SD	Coeff	SD
Family Headship (Omitted=female)	0.095	0.17	-0.332	0.12	-0.148	0.12	-0.273	0.16	-0.382	0.14	-0.461	0.16
Number Siblings (Omitted=7+)												
0	0.866	0.46	0.515	0.43	1.291	0.49	1.032	0.47	1.065	0.43	1.062	0.52
1	0.907	0.26	1.333	0.28	0.842	0.21	1.103	0.25	1.102	0.24	0.898	0.27
2	0.844	0.16	0.659	0.16	0.805	0.17	1.011	0.21	0.690	0.19	0.597	0.22
3	0.589	0.14	0.440	0.14	0.760	0.14	0.707	0.21	0.350	0.18	0.525	0.23
4	0.424	0.13	0.272	0.13	0.260	0.13	0.577	0.23	0.375	0.20	0.302	0.24
5	0.179	0.13	0.250	0.13	-0.015	0.12	0.186	0.21	0.175	0.20	-0.285	0.22
6	0.184	0.12	-0.081	0.13	-0.069	0.12	0.172	0.28	0.092	0.22	0.850	0.30
Rural/Urban (Omitted=rural)	-0.985	0.09	-1.029	0.09	-1.092	0.09	-0.404	0.15	-0.178	0.13	-0.480	0.15
Region (Omitted=Southeast)												
North	-0.817	0.35	1.464	0.3526	1.866	0.35	-0.829	0.28	0.452	0.27	0.124	0.30
Northeast	-1.057	0.11	1.072	0.127	1.450	0.10	-0.927	0.17	0.348	0.15	0.651	0.18
South	0.372	0.11	-0.349	0.11	-0.556	0.10	0.265	0.19	-0.046	0.18	-0.417	0.19
Central	-0.505	0.17	0.929	0.17	1.380	0.18	-0.289	0.25	0.011	0.23	-0.169	0.27
Gender	0.388						0.638					
Mother's Education	0.201	0.02	0.185	0.02	0.220	0.02	0.119	0.03	0.185	0.02	0.204	0.03
Log Family Income	0.454	0.05	0.244	0.05	0.273	0.05	0.387	0.07	0.261	0.07	0.340	0.08
Constant	-0.594	0.46	-1.052	0.48	-1.702	0.44	1.175	0.53	-0.747	0.48	-0.761	0.56
[N]	9,423		4,461		4,615		6,408		3,250		3,158	

Source: PNADs 1977 & 1997

Table 5. Predicted School Enrollment
14 Year-olds Children of the Head of the Family, 1963 and 1983 Cohorts, Brazil

	Cohort of 1963			Cohort of 1983		
	All	**Boys**	**Girls**	**All**	**Boys**	**Girls**
Total Number of Siblings						
0	86%	84%	89%	94%	93%	95%
1	88%	92%	84%	94%	93%	94%
2	85%	85%	84%	91%	90%	92%
3	83%	83%	83%	89%	87%	92%
4	79%	81%	77%	89%	87%	90%
5	77%	80%	73%	85%	85%	84%
6	74%	76%	72%	89%	84%	94%
7+	75%	77%	73%	85%	83%	88%
[N]						

Source: PNADs 1977 & 1997

Table 6. Coefficients and Standard Deviations of OLS Regressions of Years of Schooling 14 Year-olds Children of the Head of the Family, 1963 and 1983 Cohorts, Brazil

	Cohort of 1963						Cohort of 1983					
	All		Boys		Girls		All		Boys		Girls	
	Coeff	SD	Coeff	SD	Coeff	SD	Coeff	SD	Coeff	SD	Coeff	SD
Family Headship (Omitted=female)	0.093	0.052	0.137	0.07	0.054	0.07	-0.274	0.05	-0.247	0.08	-0.293	0.07
Number Siblings (Omitted=7+)												
0	0.043	0.160	1.028	0.20	0.673	0.22	0.071	0.11	0.852	0.18	1.211	0.16
1	-0.021	0.155	1.048	0.11	0.769	0.11	-0.021	0.11	1.140	0.11	1.076	0.10
2	-0.275	0.153	0.958	0.09	0.713	0.09	-0.325	0.11	0.986	0.11	1.042	0.10
3	-0.440	0.154	0.587	0.08	0.574	0.08	-0.456	0.12	0.656	0.11	0.770	0.10
4	-0.685	0.154	0.564	0.08	0.279	0.08	-0.846	0.12	0.453	0.12	0.728	0.12
5	-0.680	0.155	0.170	0.08	0.191	0.08	-0.860	0.13	0.145	0.13	0.236	0.12
6	-0.865	0.150	0.160	0.08	0.203	0.08	-1.033	0.12	0.014	0.14	0.347	0.13
Rural/Urban (Omitted=rural)	-0.985	0.040	-0.894	0.06	-1.087	0.06	-0.404	0.05	-0.358	0.08	-0.463	0.07
Region (Omitted=Southeast)												
North	-0.817	0.123	-1.003	0.17	-0.635	0.17	-0.830	0.09	-0.905	0.13	-0.755	0.12
Northeast	-1.057	0.044	-1.107	0.06	-0.998	0.06	-0.928	0.05	-1.002	0.07	-0.848	0.07
South	0.372	0.046	0.398	0.06	0.353	0.07	0.265	0.06	0.397	0.09	0.136	0.08
Central	-0.505	0.095	-0.394	0.13	-0.612	0.13	-0.289	0.08	-0.291	0.12	-0.282	0.11
Gender	0.389	0.033	-	-	-	--	0.638	0.03	-	-	-	-
Mother's Education	0.201	0.007	0.199	0.01	0.203	0.01	0.120	0.00	0.125	0.01	0.113	0.01
Log Family Income	0.454	0.022	0.498	0.03	0.411	0.03	0.387	0.02	0.425	0.04	0.344	0.04
Constant	0.271	0.225	-1.013	0.26	0.202	0.26	2.212	0.18	0.949	0.24	2.078	0.24
R Squared	0.455		0.468		0.435		0.452		0.461		0.417	
[N]	10,417		5,270		5,147		6,408		3,250		3,158	

Source: PNADs 1977 & 1997

Table 7. Predicted Number of Years of Schooling
14 Year-olds Children of the Head of the Family, 1963 and 1983 Cohorts, Brazil

	Cohort of 1963			Cohort of 1983		
	All	**Boys**	**Girls**	**All**	**Boys**	**Girls**
Total Number of Siblings						
0	4.0	3.9	4.0	5.0	4.6	5.5
1	4.0	3.9	4.1	5.1	4.9	5.4
2	3.9	3.8	3.9	5.0	4.7	5.4
3	3.7	3.4	3.9	4.7	4.4	5.1
4	3.5	3.4	3.6	4.6	4.2	5.0
5	3.3	3.0	3.5	4.2	3.9	4.6
6	3.3	3.0	3.5	4.2	3.7	4.7
7+	3.1	2.8	3.3	4.0	3.7	4.3
[N]						

Source: PNADs 1977 & 1997

Table 8. Decomposition Results of Difference on Children's Schooling for 14 Year-olds of 1963 and 1983 Cohorts (Family Size as Sole Predictor)

Relationship between family size and schooling as observed in cohort:	Family Size in:		Estimated Change due to decline in family	
	1963	1983		
1963	3.43 (actual mean)	4.10 (numerator of equation 4)	0.67 (equation 4)	
1983	3.96 (numerator of equation 5)	4.75 (actual mean)	0.79 (equation 5)	Average 0.73
Estimated change due to shift in relationship	0.53 (equation 5)	0.65 (equation 4)	Total Change 1.32 (denominator of equations 4 & 5)	
	Average 0.59			
Percent of the increase in schooling attributable to decrease in distribution of family size *per se*	55%			
Percent of the increase in schooling attributable to change in the coefficient and factors exogenous to family size	45%			

Table 9. Coefficients of OLS Regressions of Years of Schooling 14 Year-olds Children of the Head of the Family, 1963 and 1983 Cohorts, Brazil (Family Size as Sole Predictor)

	Cohort of 1963	**Cohort of 1983**
Family Size (7=omitted)		
0	1.6087	2.5000
1	2.3614	2.7412
2	2.0298	2.3766
3	1.4754	1.5593
4	0.9625	1.1161
5	0.5167	0.5588
6	0.2496	0.3541
Constant	2.6515	3.0699
[N]	10,417	6,408

Source: PNADs 1977 & 1997

Figure 5.1
Proportion of 14 Year-olds with x Siblings or More - Cummulative: Brazil, 1963 & 1983 Cohorts

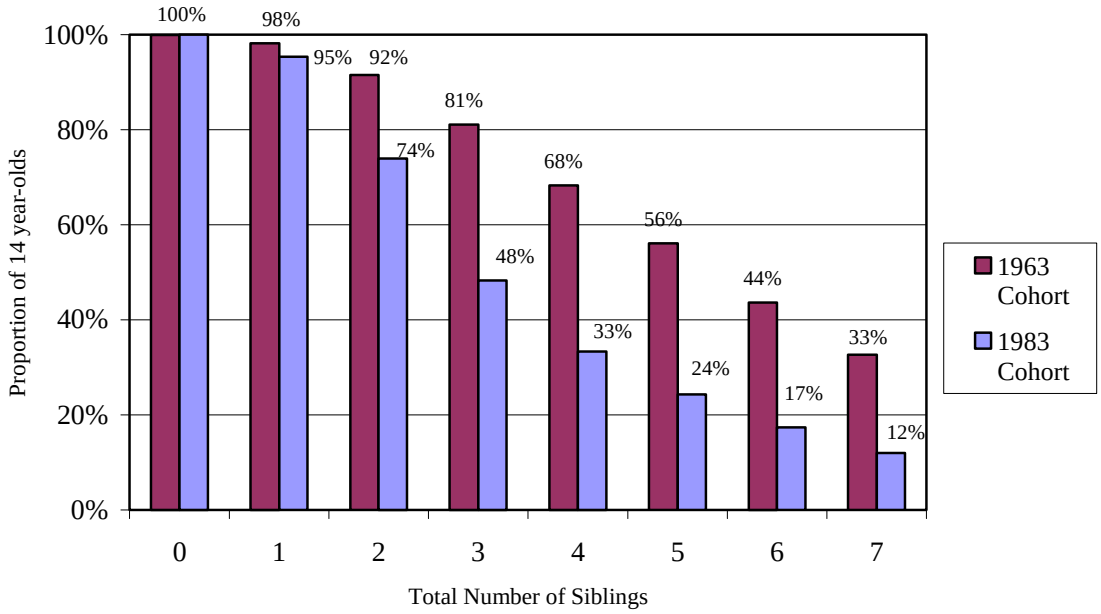


Figure 5.2
Proportion of 14 Year-olds with at Least X Siblings - Cummulative: Brazil, 1963 & 1983 Cohorts

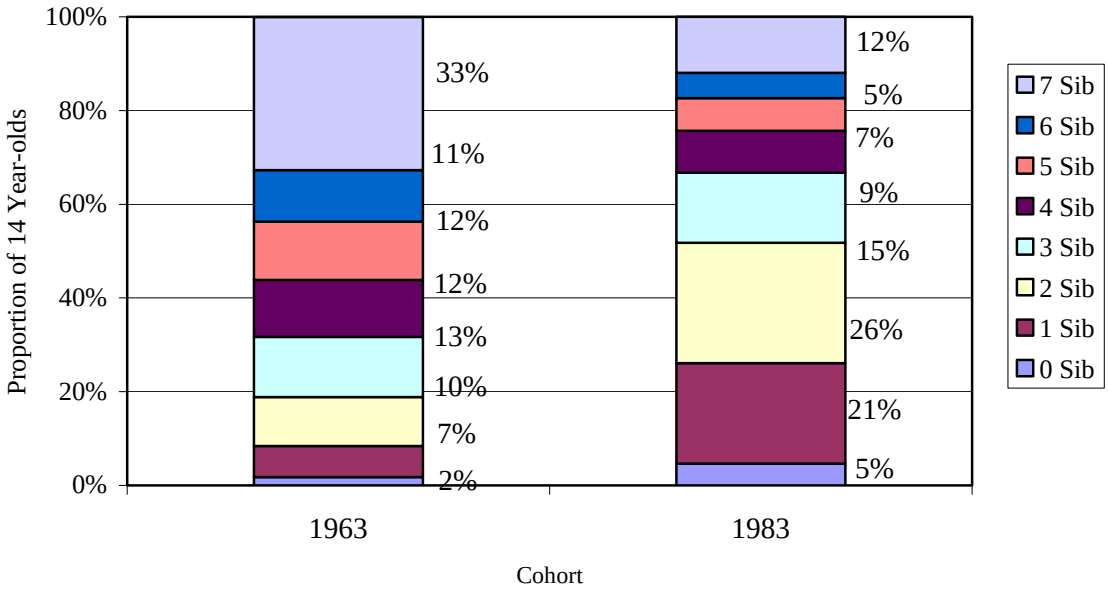


Figure 5.3
Unadjusted Proportion of 14 Year-olds Enrolled in School by Family Size: Brazil, 1963 & 1983 Cohorts

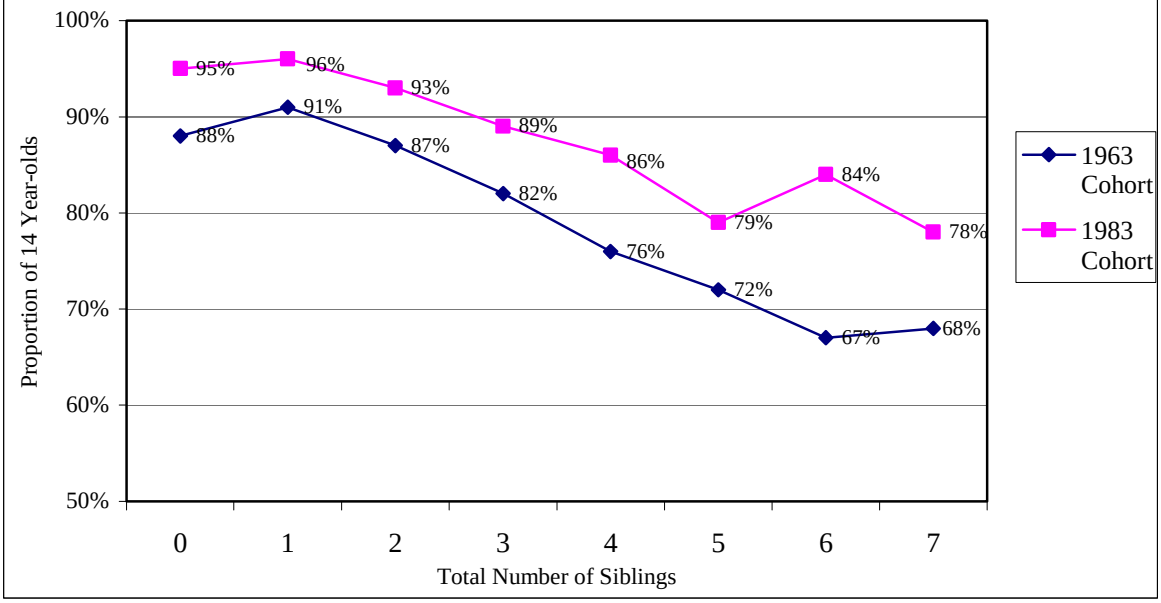


Figure 5.4
Proportion of 14 Year-olds Enrolled in School by Family Size: Brazil, 1963 Cohort

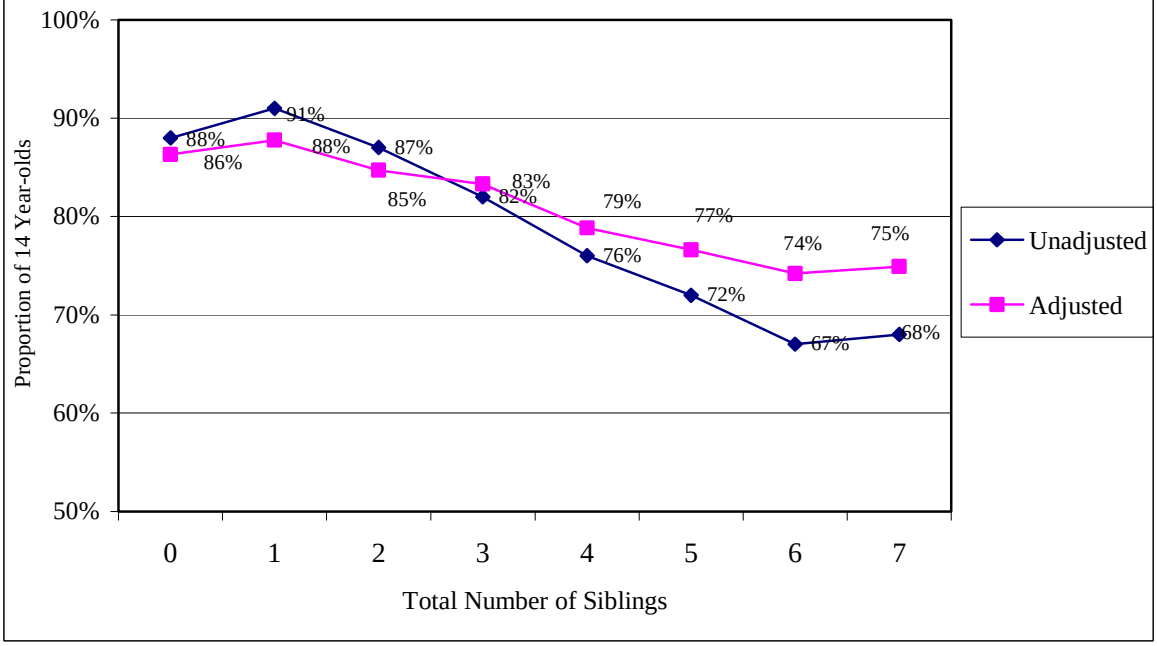


Figure 5.5
Proportion of 14 Year-olds Enrolled in School by Family Size: Brazil, 1983 Cohort

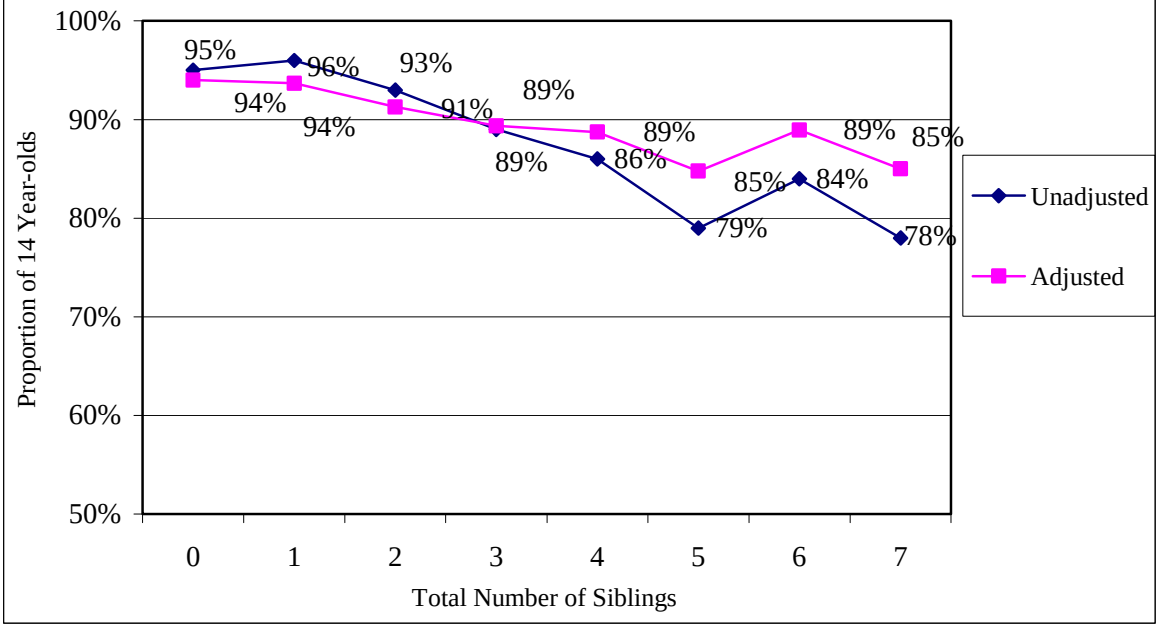


Figure 5.6
Adjusted Proportion of 14 Year-olds Enrolled in School by Family Size, Brazil, 1963 & 1983 Cohorts

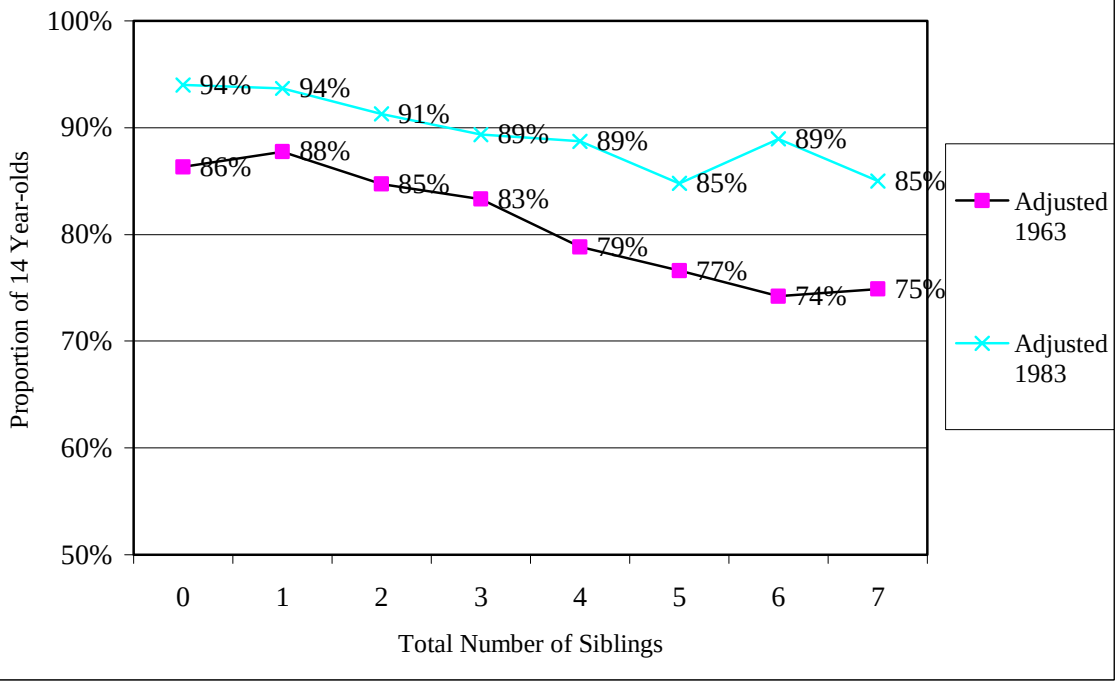


Figure 5.7
Schooling of 14 Year-olds by Family Size:
Brazil, 1963 & 1983 Cohorts

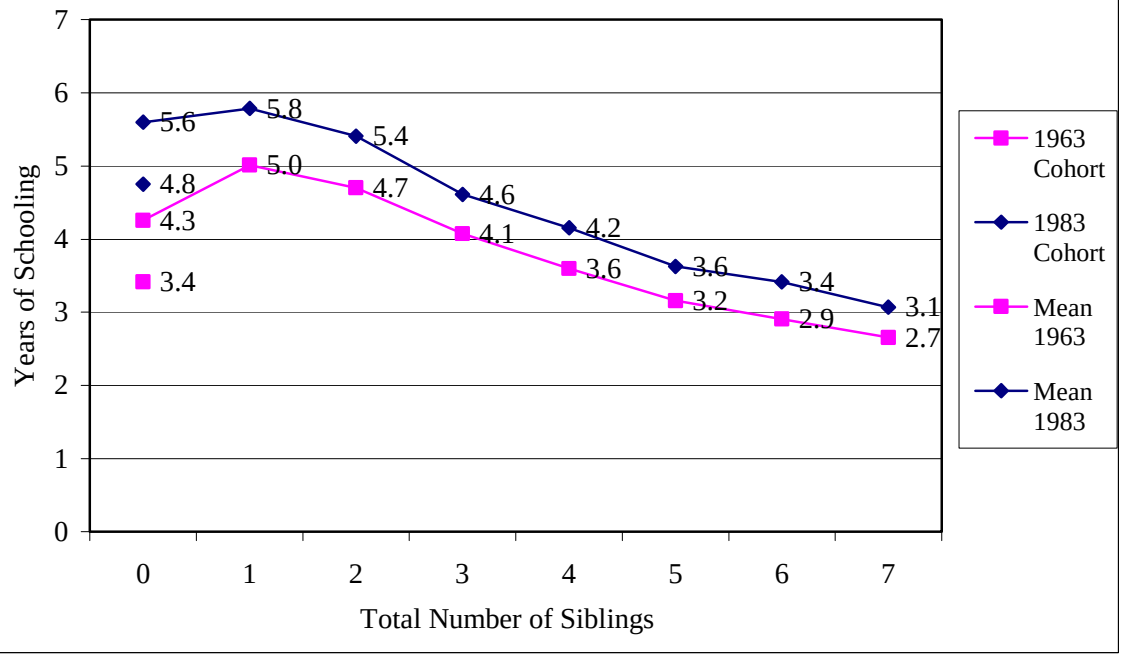


Figure 5.8
Adjusted and Unadjusted Schooling of 14 Year-olds by Family Size:
Brazil, 1963 Cohort

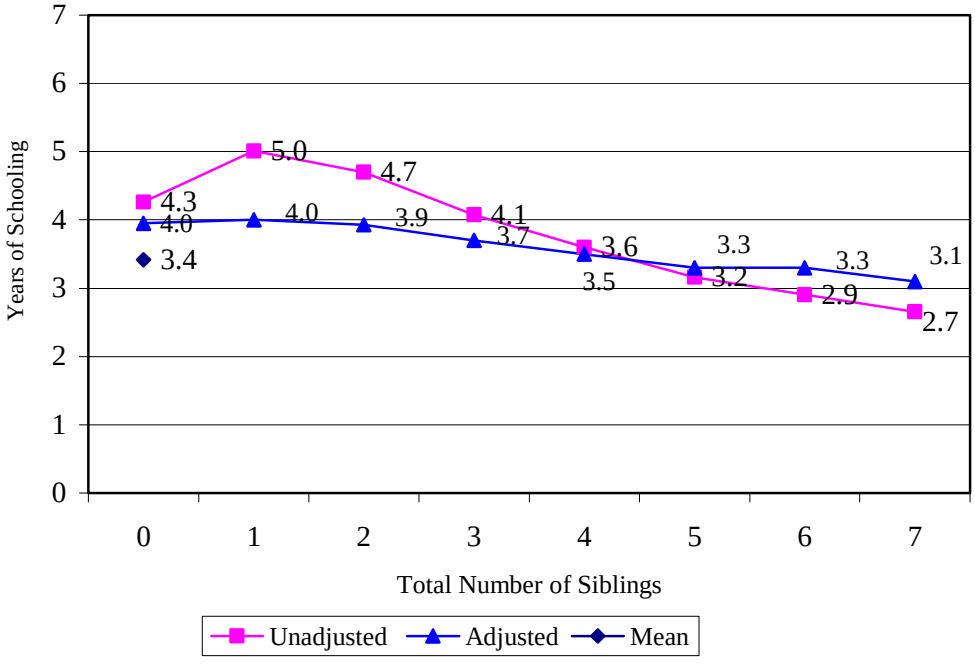


Figure 5.9
Adjusted and Unadjusted Schooling of 14 Year-olds by Family Size: Brazil, 1983 Cohort

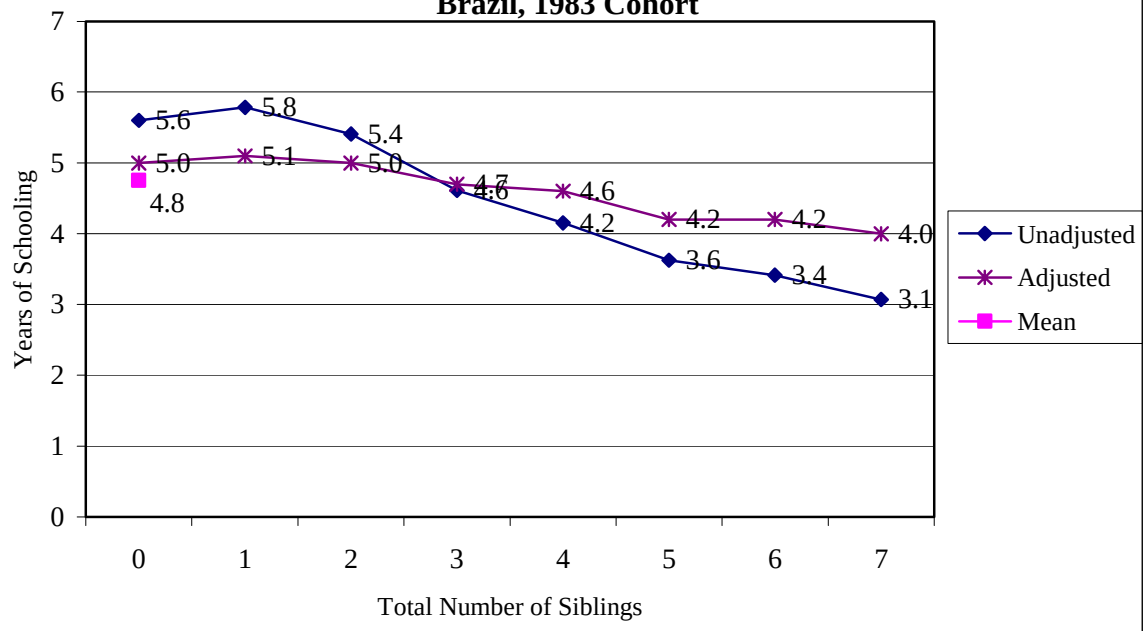


Figure 5.10
Adjusted Schooling of 14 Year-olds by Family Size Brazil, 1963 & 1983 Cohorts

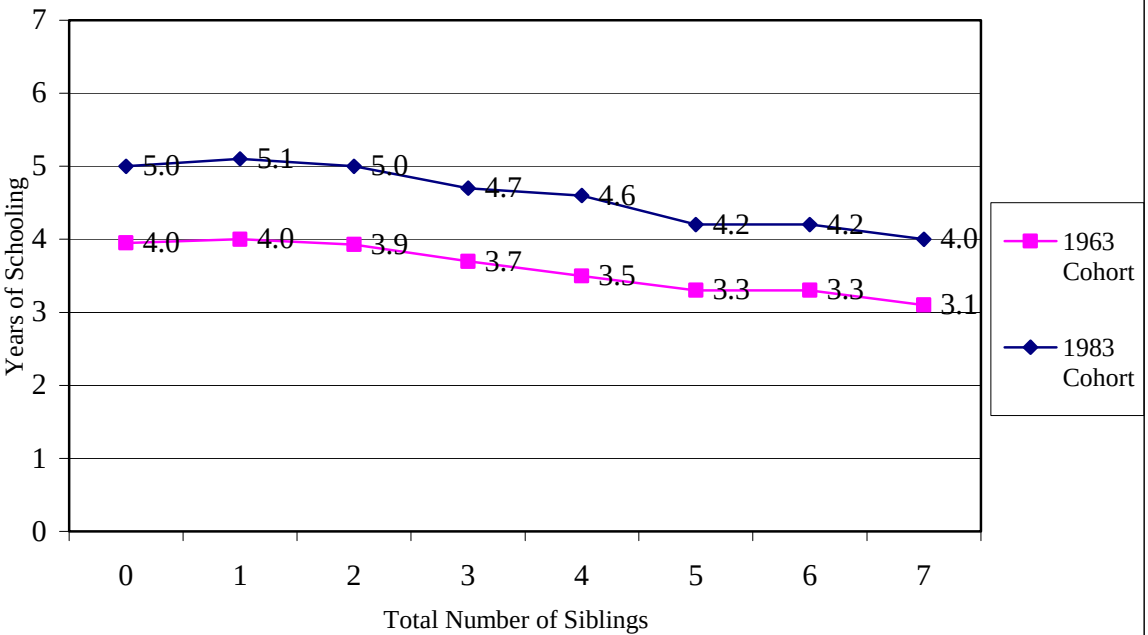


Figure 5.11
Unadjusted Proportion of 14 Year-old Boys Enrolled in School by Family Size: Brazil, 1963 & 1983 Cohorts

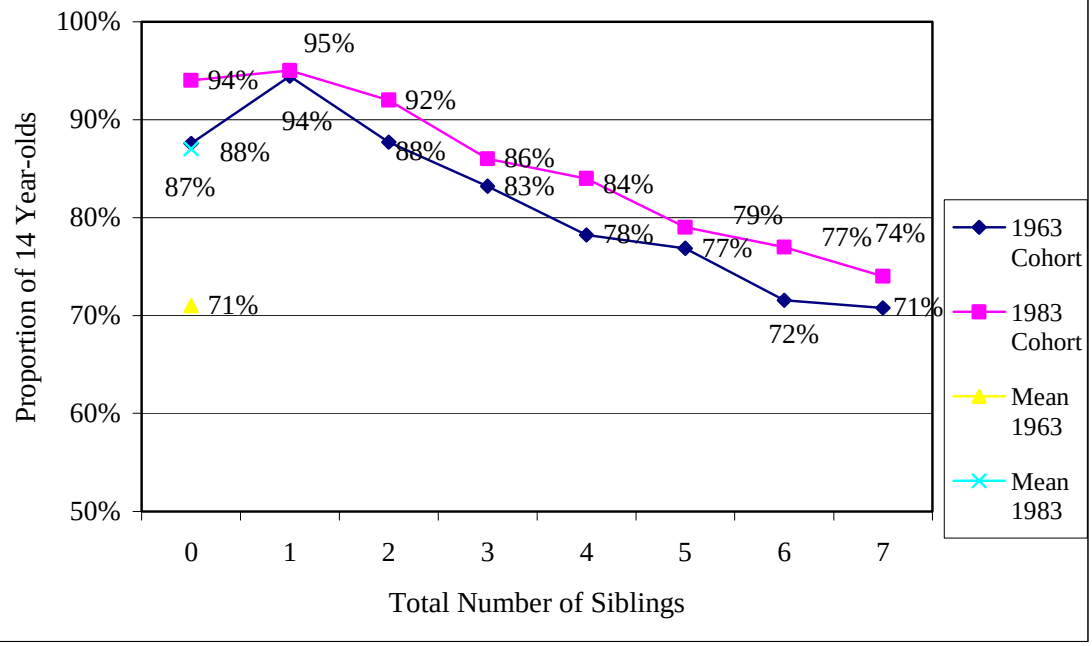


Figure 5.12
Unadjusted Proportion of 14 Year-old Girls Enrolled in School by Family Size: Brazil, 1963 & 1983 Cohorts

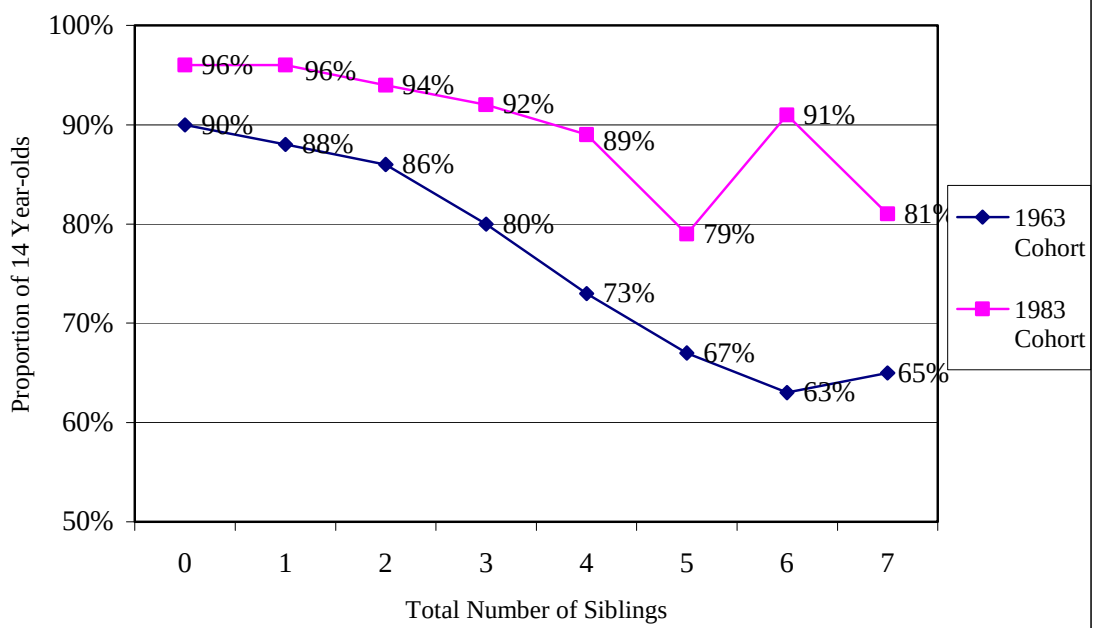


Figure 5.13
Unadjusted Proportion of 14 Year-old Boys & Girls Enrolled in School by Family Size: Brazil, 1963 Cohort

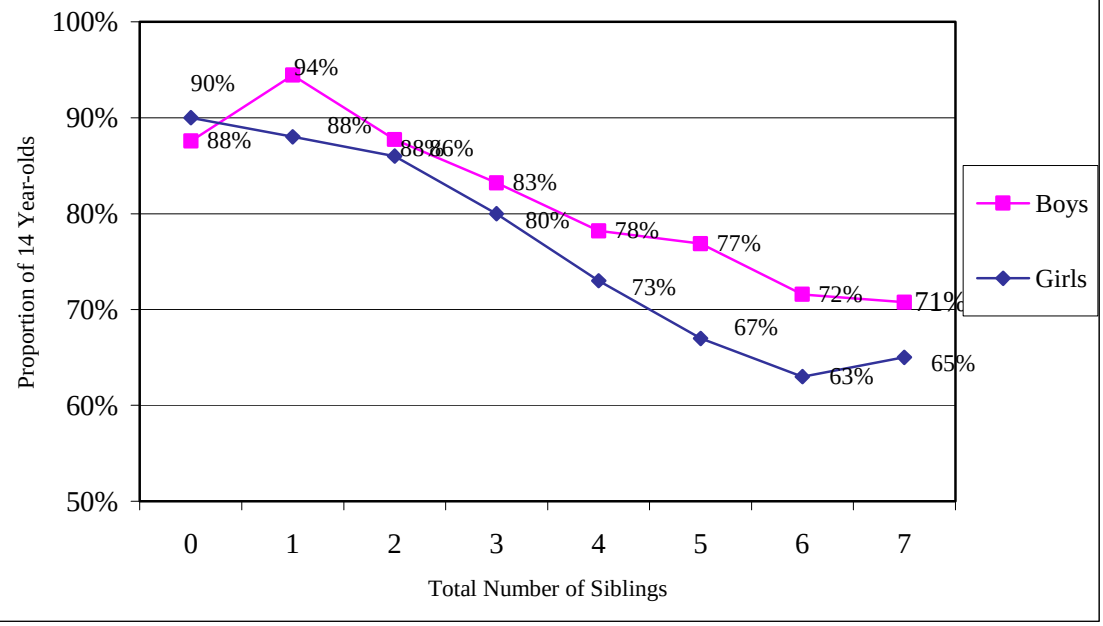


Figure 5.14
Unadjusted Proportion of 14 Year-old Boys & Girls Enrolled in School by Family Size: Brazil, 1983 Cohort

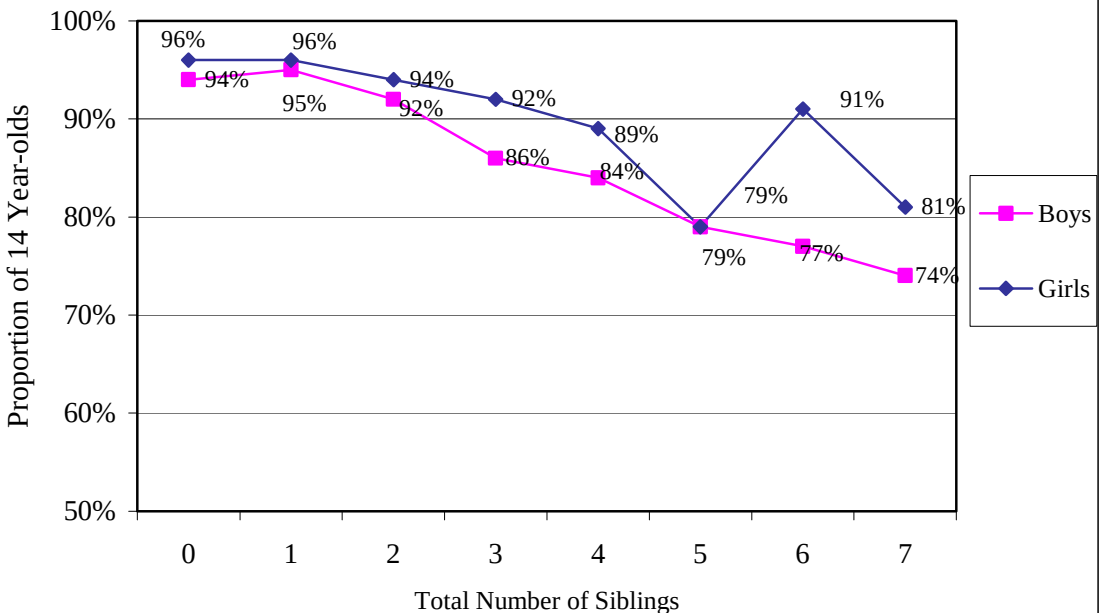


Figure 5.15
Adjusted Proportion of 14 Year-old Boys and Girls Enrolled in School by Family Size: Brazil, 1963 Cohort

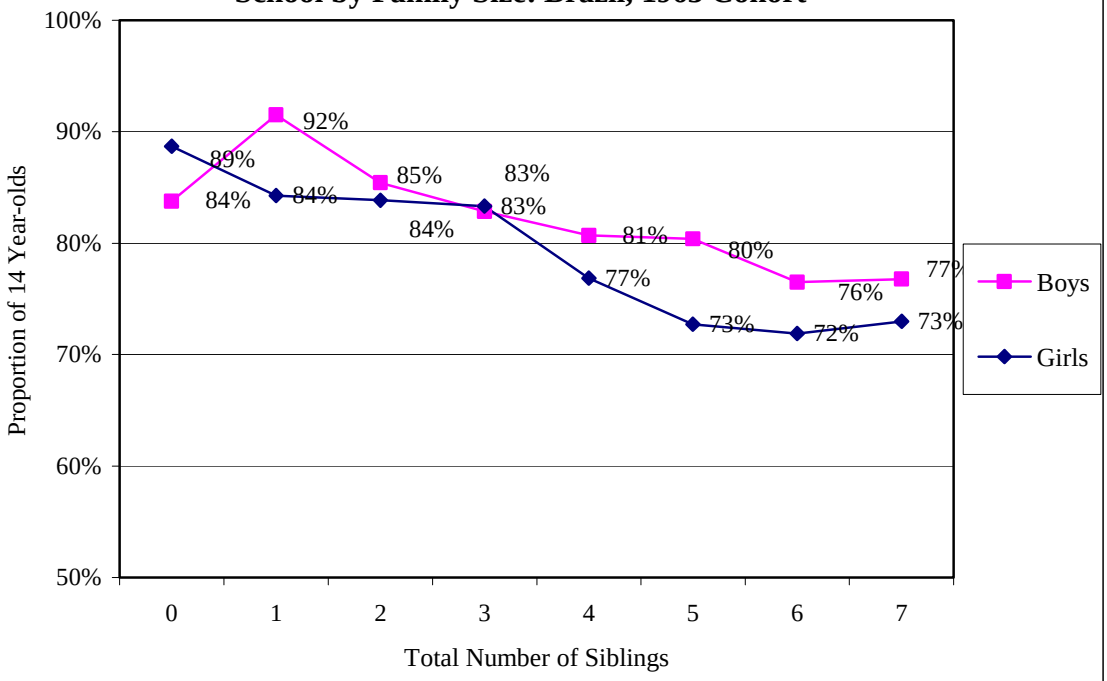


Figure 5.16
Adjusted Proportion of 14 Year-old Boys and Girls Enrolled in School by Family Size: Brazil, 1983 Cohort

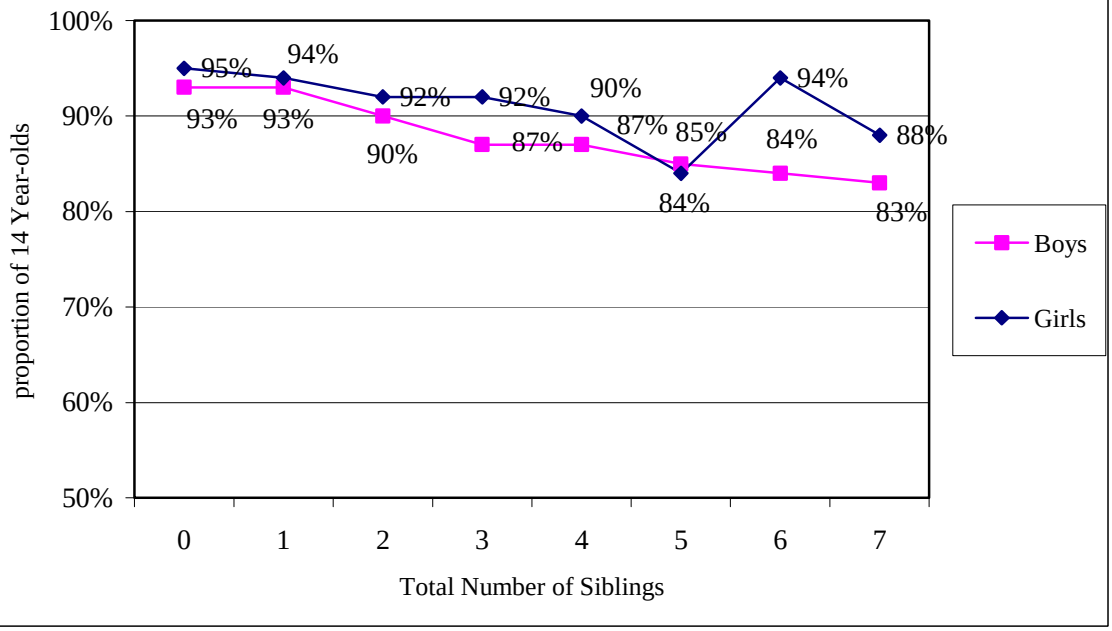


Figure 5.17
Unadjusted Schooling of 14 Year-old Boys & Girls by Family Size: Brazil, 1963 Cohort

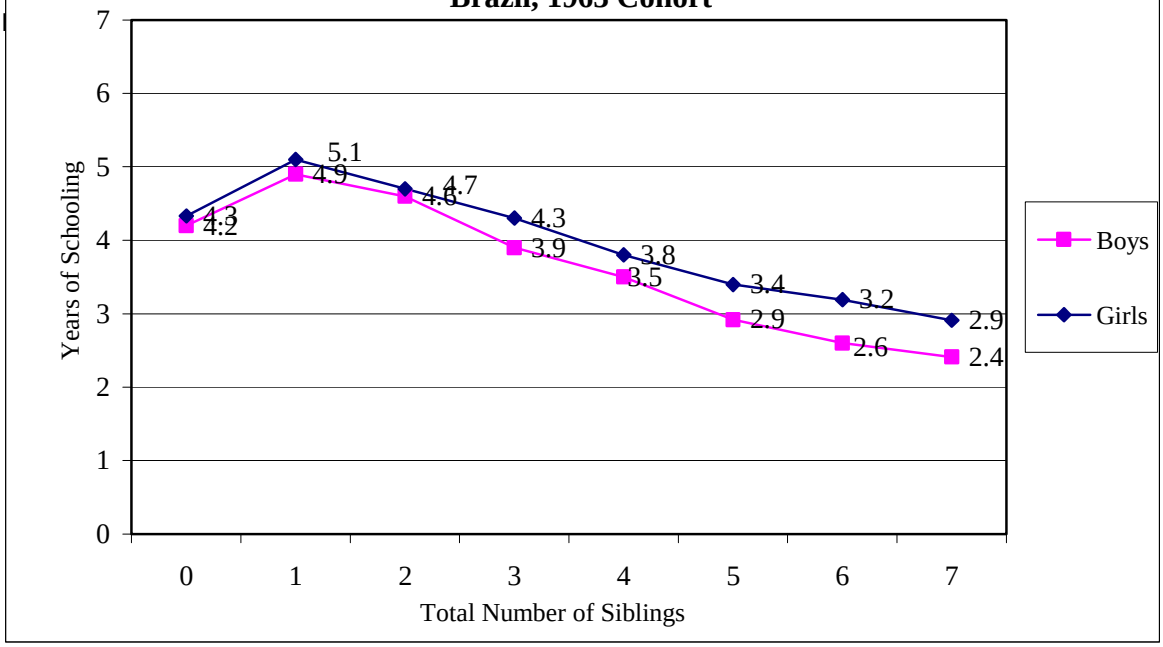


Figure 5.18
Unadjusted Schooling of 14 Year-old Boys & Girls by Family Size: Brazil, 1983 Cohort

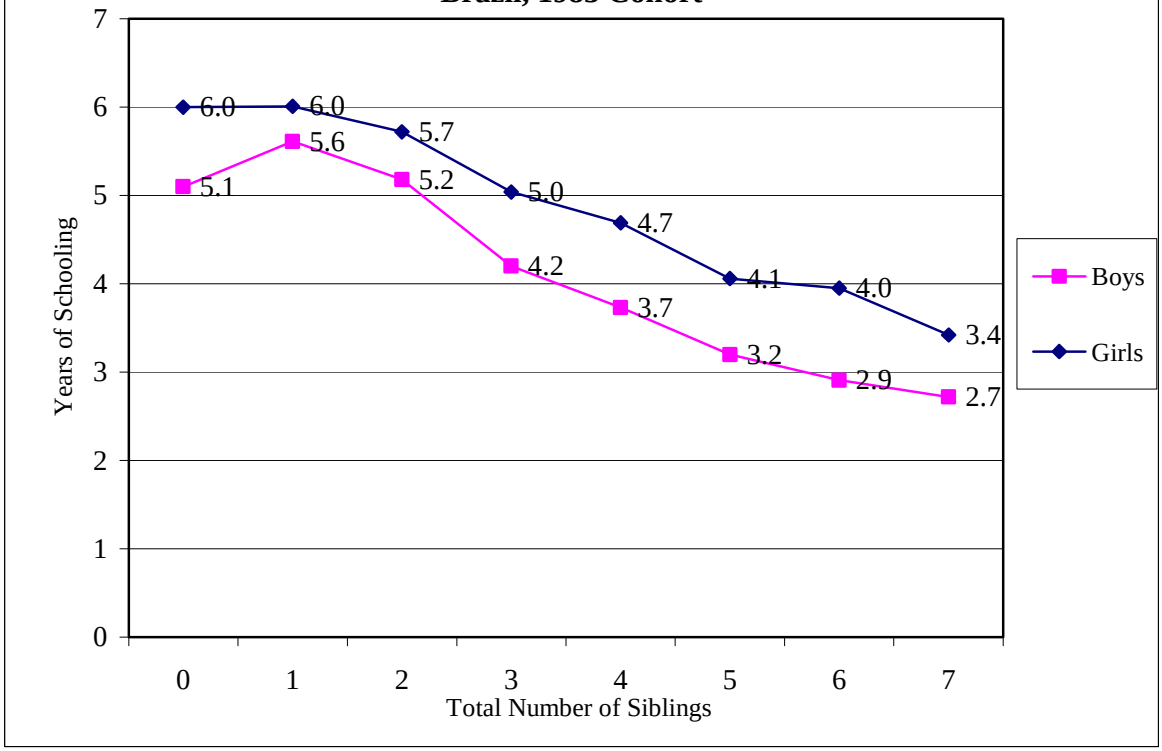


Figure 5.19
Adjusted Schooling of 14 Year-old Boys & Girls by Family Size: Brazil, 1963 Cohort

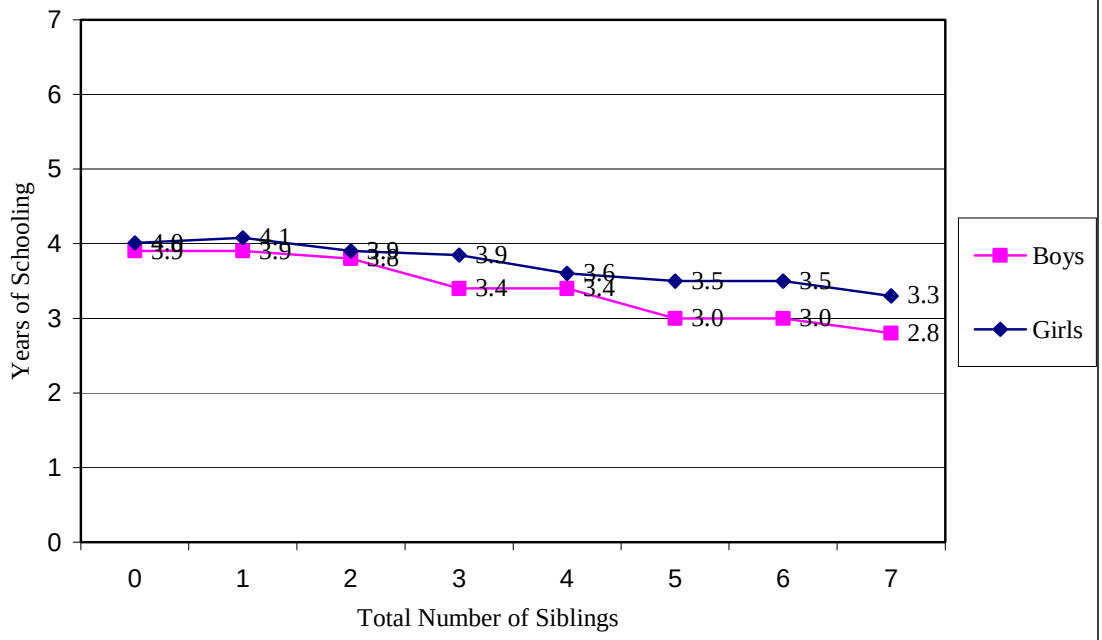


Figure 5.20
Adjusted Schooling of 14 Year-old Boys & Girls by Family Size: Brazil, 1983 Cohort

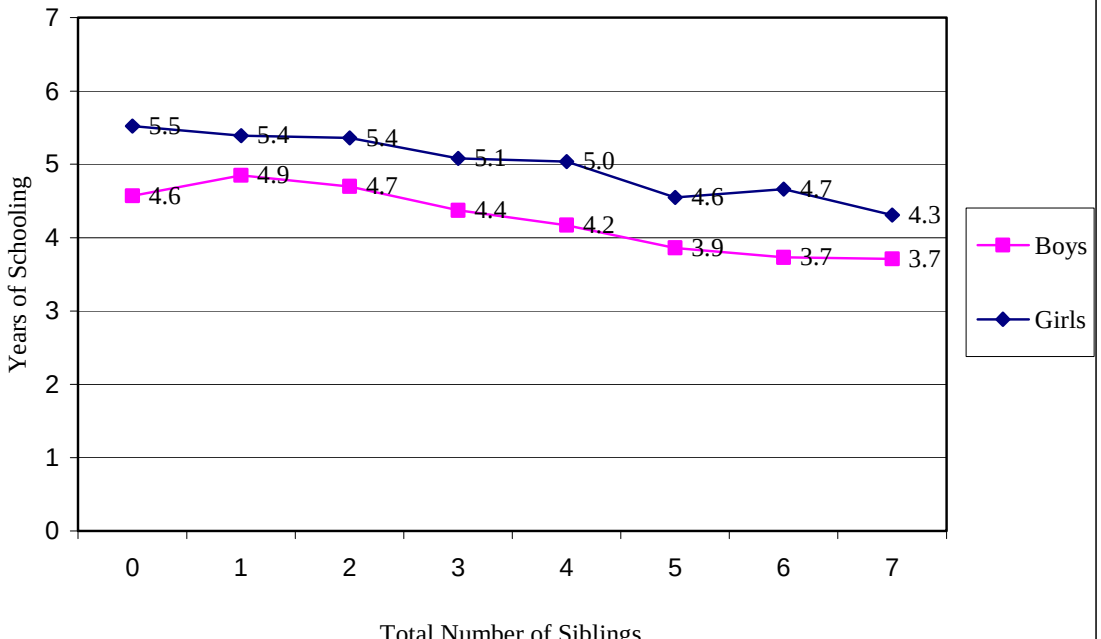


Figure 4.21
Predicted Schooling of 14 Year-Olds by Composition of Younger Siblings, Cohort of 1963: Brazil

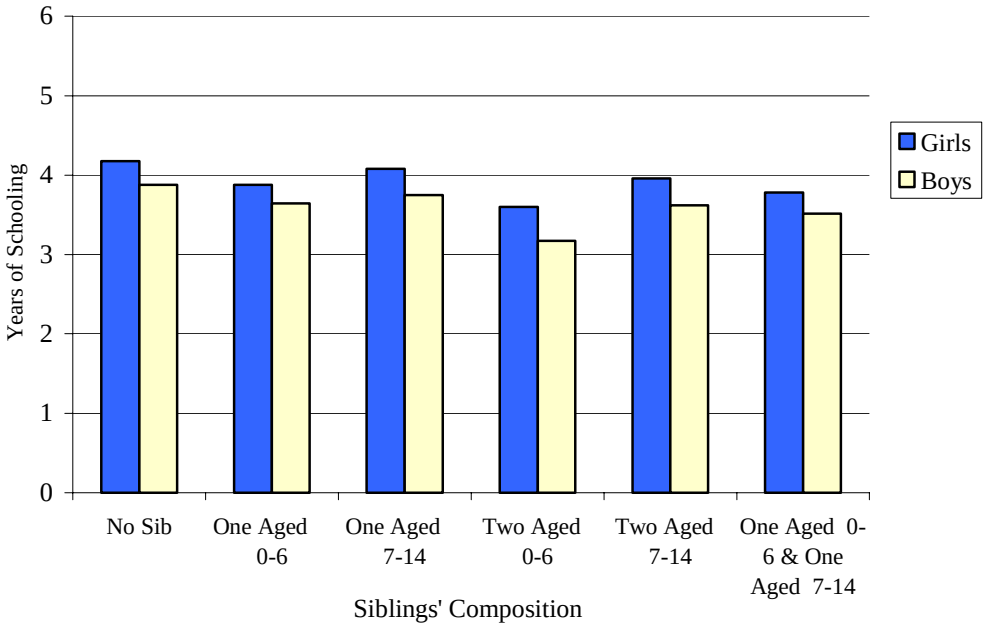


Figure 4.22
Predicted Schooling of 14 Year-Olds by Composition of Younger Siblings, Cohort of 1983: Brazil

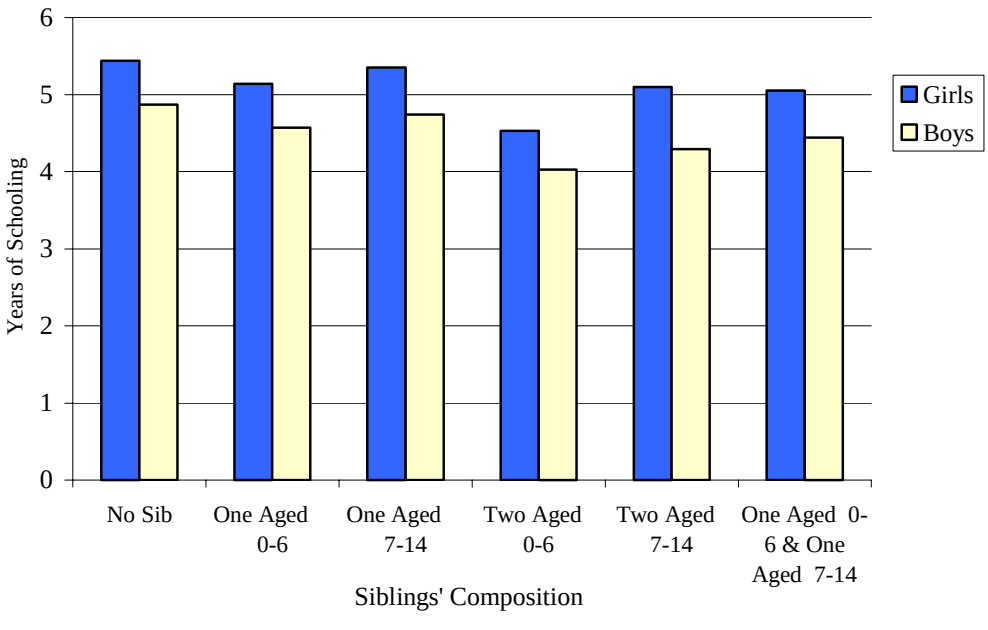


Figure 4.23
Predicted Schooling of 14 Year-Olds by Composition of Older Siblings, Cohort of 1963: Brazil

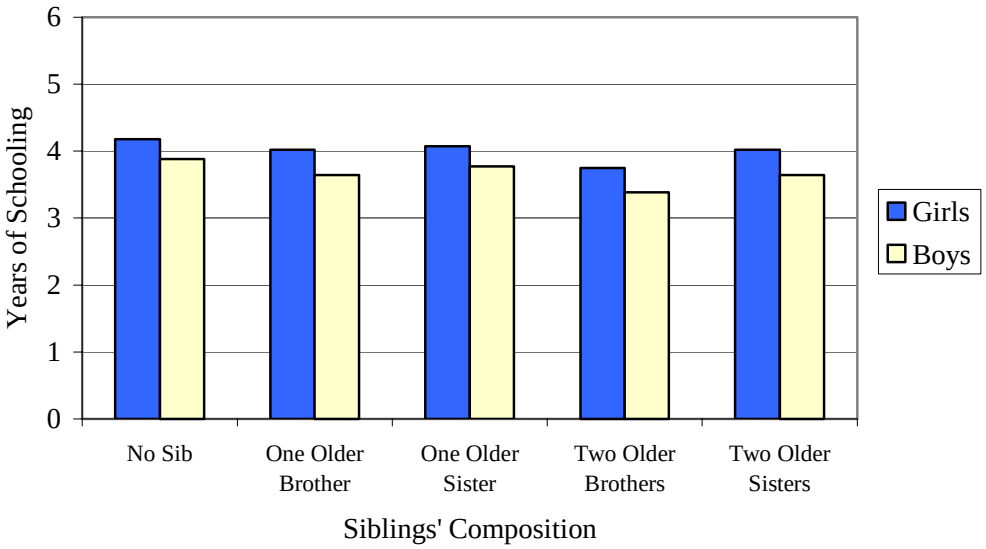


Figure 4.24
Predicted Schooling of 14 Year-Olds by Composition of Older Siblings, Cohort of 1983: Brazil

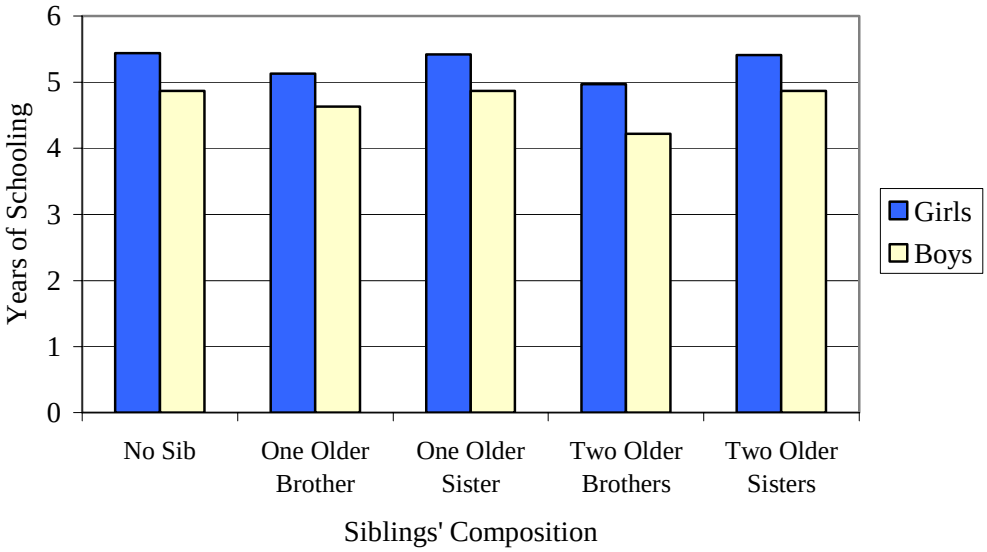


Figure 4.25
Predicted School Enrollment of 14 Year-Olds by Composition of Younger Siblings, Cohort of 1963: Brazil

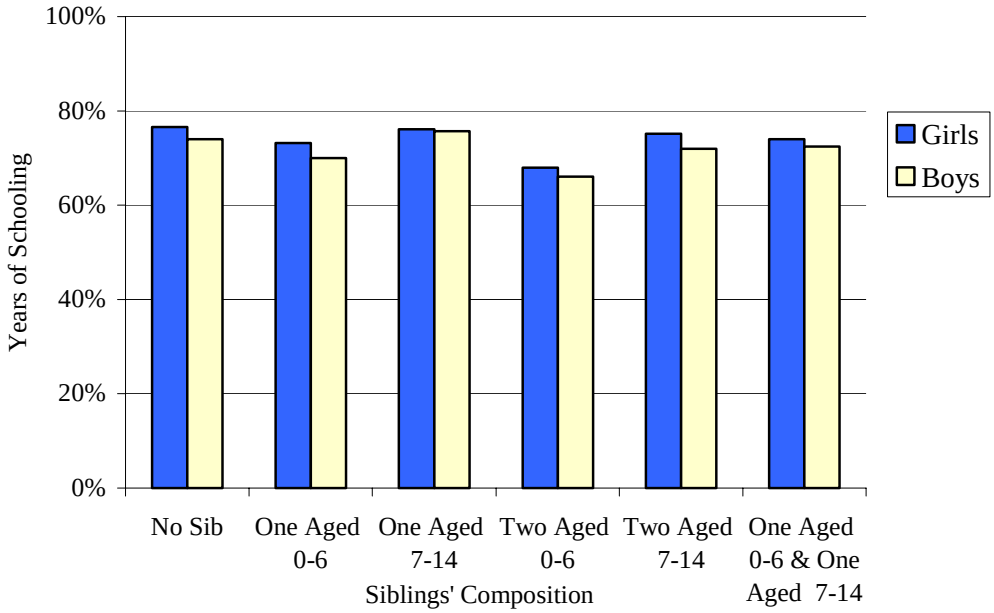


Figure 4.26
Predicted School Enrollment of 14 Year-Olds by Composition of Younger Siblings, Cohort of 1983: Brazil

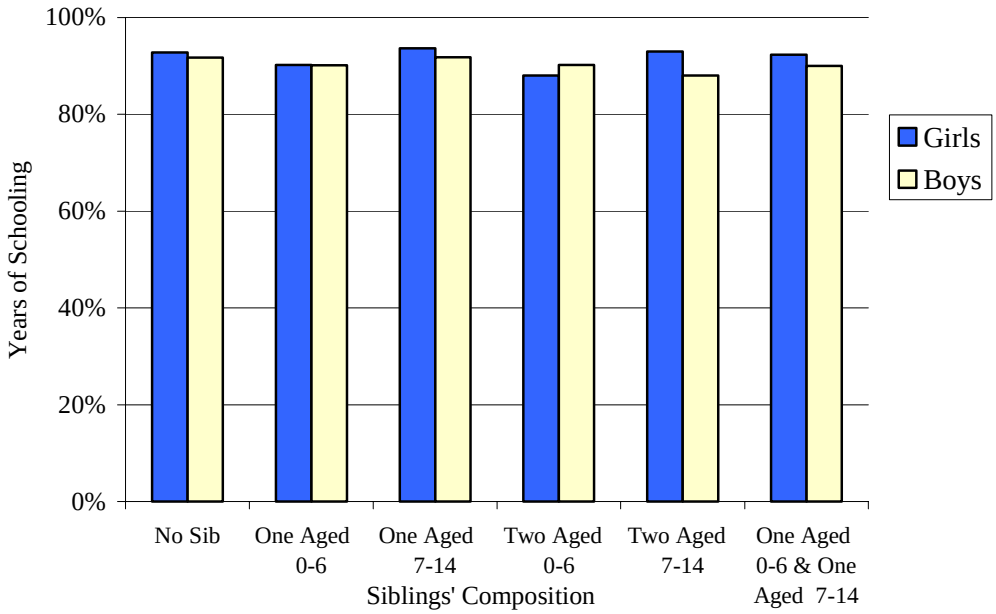


Figure 4.27
Predicted School Enrollment of 14 Year-Olds by Composition of Older Siblings, Cohort of 1963: Brazil

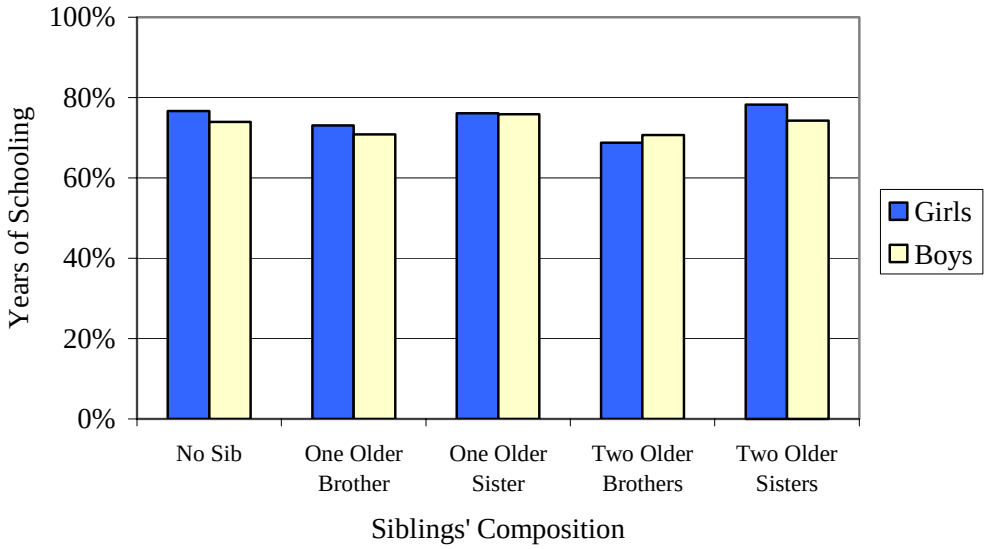
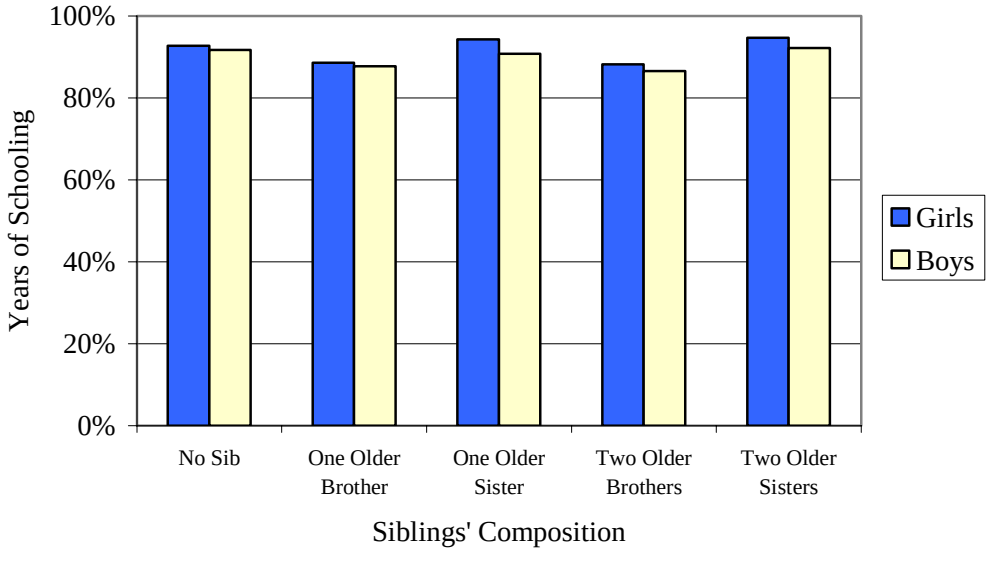


Figure 4.28
Predicted School Enrollment of 14 Year-Olds by Composition of Older Siblings, Cohort of 1983: Brazil



Reference List

Anh, Truong Si; Knodel, John; and Lam, David. "Family size and children's education in Vietnam", *Demography* no. 35, (1998): 57-70

Anh, Truoung S. J. Knodel D. lam and J. Friedman. "Family Size and Children's Education in Vietnam." *Demography* Vol. 35 (1989): pp. 57-70.

Astone, Nam Marie Constance A. Nathanson, Robert Schoen and Young J. Kim. "Family Demography, Social Theory, and Investment in Social Capital." *Population and Development Review* 25, no. 1 (1999): 1-31.

Barros, Ricardo Paes de and David Lam. "Income and Education Inequality and Children's Schooling Attainment." *Opportunity Foregone: Education, Growth, and Inequality in Brazil.* Nancy Barbara Burns and Richard Sabot Birdsall, Washington, D.C.: Inter-American Development Bank, 1996.

Barros, Ricardo, Louise Fox and Rosane Mendonca. "Female-Headed Households, Poverty, and the Welfare of Children in Brazil." *The Journal of Human Resources* (1997): pp. 231-57.

———. "Poverty Among Female-Headed Households in Brazil."*Investments in Women's Human Capital.* T. P. Schultz, pp. 345-79. Chicago: The University of Chicago Press, 1995.

Bean, Frank and Tienda Marta. *The Hispanic Population in the United States*. New York: Russel Sage Foundation, 1987.

Becker, Gary Stanley. *A treatise on the family*, Cambridge, Mass.: Harvard University Press, 1981.

Becker, Gary Stanley. *Human capital : a theoretical and empirical analysis, with special reference to education*, Chicago : The University of Chicago Press, 1993.

Becker, Gary S. and Lewis, H. Gregg. "On the Interaction between the Quantity and Quality of Children", *The Journal of Political Economy*, vol. 81, no. 2, Part 2: New Economic Approaches to Fertility. (1973): S279-S288.

Birdsall, Nancy and Richard Sabot. *Opportunity Foregone: Education in Brazil*. Washington, D.C.: Inter-American Development Bank, 1996.

Bledsoe, Caroline, John Casterline, Jennifer Johnson-Kuhn and John Haaga eds. *Critical Perspectives on Schooling and Fertility in the Developing World*. Washington, D.C.: National Academy Press, 1999.

Bound, John. Holzer, Harry J. “Industrial shifts, skills levels, and the labor market for white and black males.” *The Review of Economics and Statistics*, August, 75:387-96, 1993.

Caldwell, J. *Theory of Fertility Decline*. London: Academic Press, 1982.

Castelo Branco, Helena A. *Familia: Indicadores Sociais.* Vol. 1. Rio de Janeiro: Instituto Brasileiro de Geografia e Estatistica, 1989.

Deaton, Angus. *The Analysis of Household Surveys: A Microeconometric Approach to Development Policy*. Baltimore: Johns Hopkins University Press, 1997.

Filmer, Deon and Lant Prichett. "The Effect of Household Wealth on Educational Attainment: Evidence From 35 Countries." *Population and Development Review* 25, no. 1 (1999): 85-120.

Garfinkel, Irwin Sara McLanahan and Philip K. Robins, eds. *Child Support and Child-Well-Being*. Washington, D.C.: The Urban Institute Press, 1994.

Harbison, Ralph and Eric Hanushek. *Educational Performance of the Poor: Lessons From Rural Northeast Brazil*. Oxford: Oxford University Press, 1992.

Hauser, Robert M. 1989. “Review of Blake, Family Size and Achievement.” *Population and Development Review* 15(1):561-67.

Hauser, Robert M. and Sewell, William H.. 1981. “Birth Order and Educational Attainment in Full Sibships.” American Educational Research Journal 22(3):1-23.

Hermalin, Albert, Judith A. Seltzer and Ching-Hsiang Lin. 1982. Transitions in the Effect of Family Size on female Educational Attainment: The Case of Taiwan. Comaprative Education Review, vol. 26, no 2.

Hernandez, Donald J. *America's Children: Resources From Family, Government, and the Economy*. New York: Russell Sage Foundation, 1993.

IBGE. *Indicadores Socias: Uma Analise Da Decada De 80*. Rio de Janeiro: IBGE, 1995.

Jones and Kelley. “Decomposing Differences Between Groups” Sociological Methods and Research, Vol. 12 No. 13, (1984): 323-343.

Knodel, John & Wongsith, Malinee. “Family size and children's education in Thailand: evidence from a national sample”, *Demography* no. 28 (1991): 119-131.

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

Knodel, John E. “The closing of the gender gap in schooling: the case of Thailand”, C*omparative Education*, no. 33 (1997): 61-86 Mar '97

Knodel, John; Jones, Gavin W. “Post-Cairo population policy: does promoting girls' schooling miss the mark?,” *Population and Development Review*, 22 (1996): 683-702.

Lam, David and Deborah Levison. "Structural Adjustment and Family Labor Supply in Latin America." *Demographic Responses to Economic Adjustments in Latin America.* Andrew Mason and Jorge Bravo, eds. George Tapinos, Oxford: Oxford University Press, 1997, pp. 201-28.

Lam, David and Suzanne Duryea. "Effects of Schooling on Fertility, Labor Supply, and Investment in Children With Evidence From Brazil." *Journal of Human Resources* (1999).

Levison, Deborah, Suzanne Duryea, Jasper Hoek, and David Lam, "In and Out: Child Forays into the Labor Force in Brazil," mimeo., Ann Arbor: Population Studies Center, University of Michigan, 2000.

Levison, Deborah. "Children's Labor Force Participation and Schooling in Brazil." Ann Arbor, MI: The University of Michigan, 1991.

Lloyd, Cynthia and S. Desai. "Children's Living Arrangements in Developing Countries." *Population Research and Poloicy Review* 11, no. 2 (1992): 193-216.

Lloyd, Cynthia. “Investing in the Next Generation: The Implication of High Fertility at the Level of the Family.” Population Council Working Paper No 63. 1994.

Martine, George. "Brazil's Fertility Decline, 1965-95: A Fresh Look at Key Factors." *Population and Development Review* 22, no. 1 (1996): pp. 47-75.

McLanahan, Sara S. "The Consequences of Single Motherhood." *American Prospect* 18 (1994): 48-58.

———. "Family Structure and the Reproduction of Poverty." *American Journal of Sociology* 90 (1985): 873-901.

———. “The consequences of single motherhood”, *American Prospect*, no.18 (1994): 48-58.

Mello e Souza, Alberto and Nelson do Valle Silva. "Family Background, Quality of Education and Public and Private Schools: Effects of School Transitions" in Barbara Burns and Richard Sabot and Nancy Birdsall, *Opportunity Foregone: Education in Brazil.*. Washington, D.C.: Inter-American Developmental Bank, 1996.

Mendes, Marcia Martins and Dias Vera Regina. "Implicacoes Da Dinamica Demografica Sobre o Sistema Educacional." *Indicadores Sociais: Uma Analise Da Decade De 80.* Rio de Janeiro: IBGE, 1995.

Merrick, Thomas. *Population and Economic Development in Brazil, 1800 to the Present.* Baltimore: Johns Hopkins University Press, 1979.

Oaxaca, Ronald L. Ransom, Michael R. "On discrimination and the decomposition of wage differentials." Journal of Econometrics, sz, 61 (1994): 5-21.

Parish, William L.; Willis, Robert J. Daughters, education, and family budgets: Taiwan experiences. The Journal of Human Resources, 28:863-98 Fall '93

Plank, David N. *The Means of Our Salvation: Public Education in Brazil, 1930-1995*. Oxford: Westview Press, 1996.

Preston, Samuel H. "The Changing Relation between Mortality and Level of Economic Development", *Population Studies* vol. 29, no. 2

Preston, Samuel H. "Family Sizes of Children and Family Sizes of Women." *Demography* 13, no. 1 (1976): 105-14.

Taubman, Paul and Jere Berhman. 1986. Effect of Number and Position of Siblings on Child and Adult Outcomes." Social Biology 33(1-2):22-34.

Thomson, Elizabeth, Thomas Hanson and Sara McLanahan. "Family Structure and Child Well-Being: Economic Resources vs. Parental Behaviors." *Social Forces* 73, no. 1 (1994): 221-42.

Wood, Charles and Jose Alberto Magno de Carvalho. *The Demography of Inequality in Brazil*. Cambridge: Cambridge University Press, 1988.