

# **GENDER DIFFERENCES IN EDUCATION IN MEXICO**

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The views and interpretations presented in the Chapter are solely those of the authors; they do not represent those of any institution or organization.

## **I. Introduction**

One of the basic principles behind a just society is equality in access to opportunities. While defining what consists of equality of opportunities is notoriously difficult, there is general agreement that access to education constitutes one of the most important. Nevertheless, it is obvious that equal access to even basic education is not universal in many countries and huge differences exist in educational attainment both within and across countries.

The level of education is a fundamental factor in a country's economic development. There is ample evidence that a highly educated labor force is one of the key factors to promoting economic growth. Low levels of education are highly correlated as well with poverty. Lack of adequate education levels has been one of the most important factors contributing to the persistency of high levels of poverty in Latin America (Londoño, 1996).

Just as important as the overall level of education in a country is its distribution between its residents. In most countries, the level of schooling for females is lower than that for males. Furthermore, the gender gap in education is higher in developing countries than in more developed countries.

Women's education has been demonstrated to have substantial positive external effects apart from their beneficial effects on the woman herself. Besides generating private returns from labor market participation, women's education has strong impacts on numerous other variables as well, such as their children's health and mortality, as well as their own fertility and reproductive health. A large literature exists which has demonstrated that social returns to investing in women's education outweigh the social returns to investing in men's education (Schultz, 1993, King and Hill, 1993).

Other studies have shown that it is important not just to improve overall education levels men and women but to reduce gender gaps between men and women as well. There is some evidence that gender inequality in education is associated with reductions in GDP per-capita as well as other indicators of development such as life expectancy and infant mortality (King and Hill, 1993). The implication of this is that the benefits of increasing female education are more than just an increase in income or in productivity. If equality in educational attainment between the sexes is

not achieved, improvements in social indicators can only be achieved at much higher levels of economic growth.

Within Latin America, gender differences are generally lower than in other developing countries, although the growth rate in overall education levels has been less than in other regions (BID, 1996). Furthermore, substantial progress has been made in the last decades at eliminating gender differences in education. Since 1960, there has been a large general expansion in education within the region and sharp falls in gender differences between men and women. Primary school enrollment and completion statistics show no differences by gender in most countries and to a large extent these trends carry over to secondary education. Those countries which are most likely to still have gender gaps favoring men in education among the population under 25 are poorer countries, such as Bolivia, whereas in wealthier countries there are no significant differences between men and women in educational attainment, except in very poor and/or indigenous areas. In general then, countries with relatively higher levels of education tend also to be countries in which there are few differences between men and women in educational attainment (Bustillo, 1993).

This paper concentrates on the determinants of education in Mexico, an area in which there has been little empirical investigation. Mexico is an interesting case study as it, like much of Latin America, has experienced strong recent growth in educational attainment. Nevertheless, given its level of GDP, some authors have argued that Mexico's current level of education is deficient. A recent study by the Inter-American Development Bank of Latin America (BID, 1996) argues that the Mexican population has on average two and a half years less of education than what it "should" have given its level of GDP with respect to other Latin American countries (BID, 1996). This is likely related to the high level of income and social inequality in Mexico which implies unequal access to basic services such as health and education.

This paper has two central goals. The first is to analyze the determinants of the level of education of boys and girls in Mexico. Here we will concentrate on the effects of family background, economic and poverty status of the family, schooling supply effects, government programs, and demographic composition of the family. Our second objective is to shed light on the factors which may affect gender differences in education. In Mexico the gender gap in education has decreased substantially between men and women over the last 50 years. This paper attempts to analyze the variables which affect how families invest in boys' and girls' education.

The paper is organized as follows. We first describe the educational system in Mexico and present trends in educational attainment over the last decades. We then provide a brief description of the existing theoretical and empirical literature on the determinants of educational investment in children as well as evidence on differential investments between girls and boys. We then present a detailed descriptive analysis of current trends in schooling attainment of individuals aged 6 to 30. Next, we turn to the empirical models, where we estimate the determinants of school attendance, and of falling behind in school. The regressions focus on child, family, as well as community characteristics. We conclude with interpretations and policy implications. For all of the empirical analysis, we use the 1995 National Survey of the Population and Housing Count (Conteo), which we now describe.

## **2. Data**

The National Survey of the Population and Housing Count (Conteo) was carried out in 1995 as a Census of the population. The Conteo has two parts, including the short Census questionnaire applied to the entire population and a more detailed household questionnaire was applied to a sub-sample of the population at the same time. Here we use only this second part of the Conteo. This data set includes information on all individuals in the household, including their labor market behavior, educational level and whether they are currently studying, all forms of monetary income including program transfers, as well as demographic and other useful information, such as disabilities.

The Conteo is the best available information for the purposes of our study for a number of reasons. First, it has a very large sample (over 50,000 households), which enables us to have sufficient sample to carry out disaggregations by population group. Secondly, it includes all monetary income sources at the individual level whereas many other data sets in Mexico only include labor or employment income. Third, it has very good information on educational attainment including number of years studied, number of years dedicated to technical careers, as well as whether individuals are currently attending school and if not, whether they have ever attended.

## **3. The educational system in Mexico**

With the creation of the Secretary of Education in Mexico in 1921, the provision of education officially became a federal responsibility. The Mexican education system consists of mandatory

free primary and, as of 1992, secondary education. As might be expected, primary coverage is almost universal in Mexico, but secondary coverage lags substantially behind.<sup>i</sup> At the high school level, (*preparatoria*) students may choose between a curriculum oriented towards preparing them for higher education and a curriculum which is oriented towards technical schools and/or curriculum which prepares them for entering the work-force. Nevertheless, by the high school level, as we will see below, the majority of youth are no longer attending school.

Technical school is an option which is quite common, particularly among women. Technical school is normally 1 to 3 years of school which can be done after primary, secondary or high school. Generally, technical school involves the training of a particular skill or occupation, such as computing, nursing, secretaries, and electronic technicians. Almost 15% of all women (versus 7.5% of men) report that they have attended technical school, and the percentage of female workers with technical school is approximately 21 percent (compared with 8% of male workers). Of individuals between the ages of 12 and 30, who attend technical school, 67% are women.

University level education is attained by only a small fraction of the population. Approximately 15% of men aged 25 to 40 and 11% of women aged 25 to 40 report having completed at least one year of university-level education.

Overall levels of education have been increasing steadily over the last 50 years, as measured by average years of schooling attained. The level of education has increased dramatically between the older and younger generations both for individuals living in urban and rural areas. (Figure 1) For instance, whereas the average years of completed schooling for individuals between the ages of 25 and 29 in urban areas is approximately 10 years of schooling, for the population aged 65 and older, this figure is only about four years of schooling for women and five for men.

Figure 1 also shows that currently, as well as historically, education levels are much lower in rural areas than urban areas, although there has been some closing of the gap between urban and rural areas.<sup>ii</sup> For the population above the age of 40, years of completed schooling in rural areas are less than half than those in urban areas. The levels of education in rural areas are particularly low for individuals above the age of 65, where the average level of educational attainment is only 1.5 years for men, and 1.2 years for women.

In terms of the gender gap in education, Figure 1 demonstrates that the gender gap is

generally increasing with age, which implies that over time the gender gap appears to be closing. With respect to number of years of schooling, higher education levels of men than women begin to appear only in the age group 20 to 24 and are increasing thereafter. Nevertheless, it is important to mention that the gender gap appears to be decreasing after the age of 50. We believe that this tendency can, at least partially, be explained by a selection mechanism. Women tend to have a longer life span than men, and given that it is probable that individuals who live longer also have higher education levels, a decreasing educational gap by gender could be explained.

It is important to emphasize the role of technical school in gender differences in education. The Conteo is the first data set in Mexico which allows the accurate measurement of number of years spent in technical school. As girls and young women are much more likely to attend technical school than boys and young men, the Conteo allows a more accurate measurement of number of school years attained. Without correct accounting for technical school, there would appear to be a larger gap in years of completed schooling than is actually the case. Nevertheless, this raises another issue, which is whether technical schooling should be "counted" in the same manner as other types of schooling. For instance, many technical schools require only primary education as a prerequisite, and it is not obvious that one year of this technical schooling can be considered equivalent to a year of secondary education.<sup>iii</sup> For the analysis in this article, however, we will consider technical schooling to be equivalent to one year of schooling.

The descriptive evidence presented here show large increases in education levels of the population over time as well as evidence that gender gaps in education between men and women have decreased as well. The considerably large falls in the gender gap are noteworthy and similar to trends in other Latin American countries. While we know of no obvious large-scale gender specific policies in education in Mexico<sup>iv</sup> over the last thirty years that would have contributed to the reduction of the gender gap, we mention two factors here that may be related. The first relates to the general expansion in education, which implies additional schools and easier access to these schools. Parents may be more reluctant to send their daughters than their sons to schools that are not located close by or that require substantial walking. A general expansion in education facilities could through this mechanism have a larger impact on girls' school attendance than on boys'.

A second factor which may be related to the reduction of the gender gap is the increase in women's labor force participation, which has coincided with the period of reduction of the gender gap. The rise in labor force participation of women in Mexico has been the fastest of all countries

in Latin America with increases in the participation rate of 256% between 1970 and 1990 (Valdez et al., 1995). Whereas Mexican female labor force participation was well below the average of the region in 1970, this increase has allowed Mexico to "catch up" with the rest of the region. Male labor force participation, on the other hand, has fallen over this period. The implications of increases in labor force participation on education investment are numerous, probably the most important is that increased participation of women implies larger returns to investing in education for girls. That is, if parents expect that their daughters are likely to spend more years working in the labor market, they may invest more heavily in their daughters' education.

Finally, what is also notable from these descriptive trends are the differences between educational attainment in rural and urban areas. This descriptive evidence suggests that economic status as well as access to basic education services are likely an important part of the story behind the differences in education levels between these populations.

#### **4. Theoretical and empirical literature on educational investments in children**

Economic theories on the determinants of investment in education usually begin with the theory of human capital, whereby individuals choose to invest in education depending on the costs and benefits of this investment (Becker, 1975). Costs include both direct expenditures associated with schooling as well as indirect costs representing opportunity cost (usually foregone earnings during the time of studies), whereas benefits refer to the increase in the present value of lifetime earnings associated with education investments. Investments in education are therefore expected to increase with expected returns and decrease with increased costs.

This general theory of human capital includes a focus on gender, related to the organization of work in households. According to Becker, either because of biological differences or previous discrimination against women which affect their expected returns to educational investments, women's investment in human capital may be lower than men's. Closely related, Mincer and Polacheck (1982) demonstrate that ones' perspectives on time use and labor market participation in the future help to determine investments in human capital. Because of their larger responsibilities of household tasks, women anticipate shorter periods and/or interrupted periods of employment, which motivates them to invest differently in human capital than men, both in quantitative and qualitative terms.<sup>v</sup>

Another reason for why gender differences in education may exist can be found in the large percentage of returns to education for women which are social, implying that women receive less of the benefit of their investment. Men, on the other hand, capture a larger fraction of the total returns to education in the labor market. (Schultz, 1992; King and Hill, 1993)

In the case of the human capital decisions of children, these are often viewed as decisions made for children by their parents. Decisions by parents to invest differently in their sons and daughters' education may be due to differences in the expected net (of costs) returns of boys' and girls' education. Girls may be viewed as having a lower expected return to educational investments, so that it may be more "efficient" and not necessarily openly "discriminatory" to invest more in son's schooling.

King and Hill focus on various reasons for why the costs and returns to male and female education may differ from the perspective of parents. For instance, if schools are located far away, parents may be more reluctant to allow daughters to travel long distances than sons. With respect to benefits, girls may face lower returns to human capital investments because of labor market discrimination or because of lower time spent in the labor market, thereby reducing the benefits to investing in the education of girls. Parents may also be motivated to invest in children who will be more likely to support them economically in their old age. If parent's expectations are that their sons will be more likely to provide economic support in their old age, they may be more likely to invest in son's education levels.<sup>vi</sup>

Intra-household allocation models provide an alternative focus towards viewing family resource allocation decisions (Thomas, 1993; Quisimbing et al, 1997). Under these models, heterogeneity of preferences between family members is permitted, such that the outcomes may reflect the level of bargaining power of the different members. These models are interesting in that they allow the income, assets, and educational level of different persons in the household to have different impacts on the outcomes of interest. Numerous studies have found evidence of differential impacts of resources controlled by women versus resources controlled by men. (See Haddad et. al, 1997 for a summary of recent literature). In this paper, we allow men and women's education level to have different impacts on boys' and girls' education and in this way test to some extent the implications of intra-household models.

#### Empirical studies on schooling



There are a number of empirical studies relevant to our analysis. As we cannot adequately address all of them here, we will briefly mention some of the most recent and relevant studies in the context of Mexico.

There have been very few studies which empirically analyze the determinants of education in Mexico. One exception is Post et. al, (1998) who analyze rates of continuation from primary to secondary school in the different states of Mexico, with particular focus on mandatory secondary education, which was implemented in 1992. They argue that community characteristics are important for analyzing gender differentials in education, that is, the more marginated the state, the greater the inequality in girl's education. They also analyze the determinants of being a full-time student for the age group 13 to 15 in Mexico in 1984 and 1992, finding that family resources had a larger impact on children studying in 1992 than in 1984.

Palafox et al. (1994) analyze the determinants of schooling achievement in Mexico using an interesting database on cognitive achievement scores in math and Spanish of children in primary schools. They find that male students tend to do better both in mathematics and Spanish than female students, even after controlling for socio-economic characteristics. Parental education levels are positively associated with student achievement as is living in a two parent family.

Knaul and Parker (1998) jointly consider the relationship between schooling and work participation of urban youth in Mexico, looking at the determinants of beginning a work spell, or leaving school in the context of the economic crisis of 1995. They find that schooling tends to more related to market work for boys and domestic work for girls. <sup>vii</sup>

## **5. Current trends in education achievement in Mexico**

In this section, we present trends in school attendance and educational attainment of the population of individuals between the ages of 6 and 30, taking into account differences at the urban-rural level and differences by income level. We chose this age group in order to provide a full picture of educational attainment, given that even at age 25, over 5% of the population still reports that they are attending school.

Figure 2 presents the percentage of the male and female population attending school. The

figure shows that by the age of 8, the percentage of children attending school is over 95%. It is interesting to note that school attendance increases from age 6 to age 9, which is evidence of a certain degree of late enrollment, although this late enrollment does not appear to differ by gender. School attendance begins to fall by the age of 11, with important declines in attendance beginning at the age of 12, an age which (usually) coincides with the end of primary school. At this age, it is also important to note that a gender gap begins in attendance. For instance, at age 13, 87.0% of boys are attending school versus 82.4% of girls. These trends are suggestive that more girls than boys tend to end their education level at the primary level. Nevertheless, by the ages of 16 and 17, which normally corresponds to the end of secondary level education, boys begin to drop out at the same rate as girls. At the age of 19, a gap begins once again, presumably resulting from young men entering college at a higher rate than young women. For instance, 27% of males aged 19 are attending school whereas 24% of females of this age are attending school.

Figure 3 considers these trends by rural-urban residence. In Mexico, rural areas are defined as localities with less than 2,500 residents. Rural areas tend to have a higher percentage of the population in poverty, lower availability of health and educational services and less social infrastructure of roads, water systems, telephone services as well as other services.

The percentage of the population attending school is uniformly lower for rural areas than for urban areas. Figure 3 also shows that the gender gap in school attendance is larger in rural areas than in urban areas. In the case of urban areas, attendance appears to be about the same for boys and girls until the age of 17, where boys begin to have a higher school attendance than girls. This presumably corresponds to the age at which individuals begin to enter college. In the rural communities, a gender gap in attendance begins at the age of 11 and is larger in the rural communities. For instance, by the age of 13, 76.6% of boys are attending school in rural communities versus only 67.2% of girls. By the age of 17, there appears to be little difference in school attendance between boys and girls; more noticeable are the very low overall attendance rates of both boys and girls.

Figure 4 presents the relationship between school attendance and per-capita household income level, divided into 5 groups (constructed by quintiles based on per-capita income). It is clear that lower levels of per-capita household income are associated with lower school attendance. It is particularly noteworthy that the lower income groups show evidence of a very late entry to school, as enrollment increases sharply from ages 6 to 9. This is an important tendency, as late entry

implies that children even before they begin school are in some sense "behind" in school and this is likely associated with an increased risk of school dropout at earlier ages. This raises the question of why lower income households send their children to school later and presumably is also associated with gaps in educational attainment between urban and rural areas.

The number of years of completed schooling for individuals aged 6 to 30 by urban and rural areas is shown in Figure 5. The gender gaps evident in school attendance are not obvious in years of completed schooling. Actually, for urban communities, there is a "reverse" gender gap which seems to favor girls, as girls appear to have a higher number of completed years of schooling than boys until their mid twenties. For the rural communities, the number of years of completed schooling is more or less equal until the age of 24, where a gap begins with men having a higher number of years of completed schooling than women.

Figure 6 shows number of years of completed schooling by income group. Again, there are very clear tendencies that families with higher levels of income tend to have children with higher levels of schooling, even at very young ages. A noticeable gap in the number of years of schooling between the lower income groups and the upper income groups is already evident in children by the age of 8 and the gaps only increase with age.

The conflicting patterns of school attendance and years of completed schooling are quite striking. Why does a significant and important gender gap in attendance beginning at the secondary level of schooling not coincide with a reduced number of years of schooling at these ages, even in rural areas where attendance gaps are quite large?

One possible explanation is that while fewer girls attend school, those that do attend school, do better in school than boys. That is, they are more likely to complete school levels on time, less likely to fall behind in school and less likely to repeat grades. While we do not have explicit information on repeated grades, we can look at the extent to which children fall behind in school, where we define falling behind by the schooling gap (Birdsall et al., 1999). This schooling gap is defined as the number of years behind where a child should be in school, assuming the child entered school on time and progressed normally through school, that is never repeating a grade.<sup>viii</sup> Table 1 clearly shows that the schooling gap begins to become larger for boys than for girls by the ages of 9, both in urban and rural areas.<sup>ix</sup> There are also large differences between urban and rural residence with children living in rural areas being further behind in school at all ages. By the age of 12, for

instance, boys in rural areas, on average, are 1.7 years behind where they should be in school, whereas the corresponding figure in urban areas is 0.71.

To summarize then, in this section we have considered gender differences in education in terms of attendance and attainment. We have found that, with respect to attendance, girls begin to drop out of school at a higher rate than boys beginning at the age of 12, particularly in small communities and in low income households. Nevertheless, we have found that these differences in attendance do not necessarily translate into immediately overall higher levels of education for young men, but rather these differences show up in terms of educational attainment after the ages of 20. The reasons for this are that even though boys have higher rates of attendance than girls, particularly in rural areas, they tend to be more likely to fall behind in school.

The degree to which both boys and girls (particularly boys) fall behind in school is an important correlate in schooling achievement. The phenomena of late entry and grade repetition which presumably these trends reflect are important issues in Mexico and likely related to labor market participation and domestic work at early ages, which although may not immediately result in school dropout, are likely to promote grade repetition and subsequent dropout.

This complex picture of educational attainment in the younger generations suggests that both attendance and school performance (that is, whether one passes the year of study) while in school are important indicators of long run school attainment. In the next section, we consider the determinants of school attendance and of the schooling gap.

## **6. Empirical model and sample**

In this section, we turn to our estimation models of the determinants of educational investments in boys and girls. The estimation methods are based on reduced form models of the demand for education.<sup>xxi</sup>

Consistent with the descriptive data presented above, we consider two separate dependent variables in our empirical model: school attendance and the schooling gap. Behrman and Knowles, 1999 argue for the necessity of using various indicators of education rather than simply using the usual completed years of schooling. It should be noted that the second model, that of schooling gaps, clearly represents a more long term measure of schooling attainment than that of current

school attendance, as it represents, in some sense, the accumulated result of education achievement since the child started school. While, it might then not seem appropriate to include variables indicating a family's current economic situation, it should be noted that nearly all of our variables can be considered as variables which have some permanence, e.g. mother and father's education, disabilities, housing dwelling characteristics.

### Samples used in the analysis

In our analysis, we focus on the group of youth aged 12 to 15. We chose this group for several reasons. First, the descriptive evidence above suggested that a gender gap in attendance begins to appear at the age of 12 between boys and girls and is particularly high between the ages of 12 and 15, which is precisely the age at which children should be attending secondary school. Secondly, the analysis showed that the largest gaps between boys and girls in terms of falling behind in school begin after age 11.

Finally, we are concerned about sample selection issues which occur after the ages of 15, particularly for girls. In our sample, we use only children who are children of the household head and/or spouse of the household head because these are the only children for which we can identify their parents, and henceforth analyze the impact of parent characteristics on child schooling. Nevertheless, this raises sample selection questions as to whether these children and youngsters are representative of the sample of all children. We are concerned with the biases arising from excluding youngsters who marry at an early age and leave the household to form their own household, an effect which is particularly important for girls.

Comparing the marital status of girls between the age of 16 and 20 demonstrates that girls who are not children of the household head are much more likely to be married (about 10% versus 1% of those living with parents). That is, they have most likely left the household they grew up in to form another household with their husband. This implies a selection in that the girls who remain living in their original household with their parents are much more likely to continue studying than girls who leave their household to marry. This further justifies our restriction of sample to individuals below the age of 15.

### Independent variables

We consider several sets of independent variables, including characteristics of the child, characteristics of the parents, household and demographic characteristics and community level characteristics, including the supply of secondary schools.

#### Characteristics of the child and siblings

Characteristics of the child included in the model are the age and sex of the child. We also experimented with variables measuring the birth order, including dummy variables measuring whether the child was the oldest or youngest child living in the family.<sup>xii</sup> Some recent evidence has found that middle children do worse in terms of household schooling investments. (Parish and Willis, 1993). Nevertheless, these variables were found to be insignificant in all cases and were left out of the final models.

We also include measures of children aged 0-5, children aged 6-11, and other siblings aged 12 to 20 in the household. We expect that the presence of younger children may have negative impacts on schooling, due to either additional domestic responsibilities or economic necessities. Other siblings of school age may have negative impacts on education through tradeoffs between quantity and quality, or through the "dilution" of family resources. Nevertheless, we recognize that these measures of other children in the household can be considered to be endogenous. The estimated coefficients on these variables should be treated as correlations, with no implication of causality.

#### Characteristics of the parents

We are particularly interested in the potential effects of father and mother education levels. Parental education should have a positive influence on child education through parental influence, a home environment more oriented toward study, the greater ability of parents to help children with homework etc. It is also likely to pick up economic status of the household although we include a number of other measures of economic status.<sup>xiii</sup> Some previous literature in other countries has demonstrated that father and mother educational levels have different impacts on the level of education and other outcomes of sons and daughters. In particular, it has been found that mother's level of education generally has a larger impact on child education outcomes, particularly those of girls.

We also include a dummy variable measuring whether the father of the child is present in the household. This variable may pick up both economic and work effects as well as motivational or psychological aspects associated with schooling. Parents absent from the household may place additional work burdens on children, for instance if children enter the labor force to replace adult labor or if children at home engage in more domestic work to make up for parents. Studies in the context of other countries have found that children of single parents often perform worse in school, even when controls for income status are in place (Garasky, 1992). These worse outcomes are often attributed to motivational and psychological factors associated with a parent's separation or divorce. In our case, there are very few mothers of children not living in the household, whereas approximately 15% of fathers are absent from the household. Almost all of the households where father are absent are female-headed households.

#### Characteristics of the household

The economic status of the household, as demonstrated in the descriptive statistics, should be a fundamental determinant of educational determinants and differences in education between boys and girls. Economic status affects educational investments in children through the ability of the household to pay direct and indirect costs of their child's schooling. Poorer households have fewer resources with which to finance such aspects as transportation and school supplies. Additionally, the opportunity cost of children attending school may be higher for poor households in terms of forfeited income and/or help in domestic chores.<sup>xiv</sup>

We include a measure of the household's unearned income levels to capture the effects of income on educational investments. We exclude labor income from the measure of income levels for two main reasons. First, we consider that child and youth income is endogenous given that work decisions of children are clearly endogenous to their educational decisions. Secondly, in a family labor supply model the labor force decisions of all household members are jointly determined so that it would also be inappropriate to consider adult labor income as exogenous to children's educational investments.

As additional indicators of economic status and wealth, we also include whether the floor of the household dwelling is an earth floor and whether the household has access to running water inside the house. Finally, we include a measure of whether there are any disabled individuals in the household. This variable may be important to the extent to which children may substitute for the

labor of disabled individuals.

### Characteristics of the community

The availability, distance and accessibility of schools are key variables for measuring the costs of attending school. We use measures of the number of per-capita secondary schools, where per-capita refers to the secondary school age population (ages 12 to 15) as indicators of the supply of schools in the municipality.<sup>xv</sup> We do not have direct measures of the distances to schools for the children in each community. Rather, we use an (admittedly crude) indicator of altitude in the municipality as a measure of difficulty of access to schools in rural areas only.

Table 2 provides the means and standard deviations of the variables used in the analysis. The Table shows the differences in the education variables by gender. It is important to note that the differences between boys and girls, both in attendance and in the schooling gap, are significant both in urban and rural areas. The Table also makes evident the lower economic status of children in rural areas versus urban areas. For instance, in urban areas over 60% of households report having running water in their dwelling, versus only 20% of households in rural areas. Table 2 also shows the much larger levels of education of parents in urban versus rural areas. In general, parental education levels are more than double the level in urban versus rural areas. The number of children in the family is much larger as well in rural areas, as expected.

## 7. Regression results

In this section, we present the main regression results. We estimate models for school attendance and the schooling gap separately for boys and girls in rural and urban areas.<sup>xvi xvii</sup> Our principal focus in the discussion of the results is on differences in the determinants of education by gender, although we also compare the results between urban and rural areas.

Beginning with school attendance in urban areas, (Table 3) the results show large impacts of parental education on attendance of girls and boys. The education level of both parents is highly significant, and for girls, the education of the mother has a larger positive impact than the level of education of the father. Nevertheless, the reverse is true for boys, as the education of the father has a larger impact on their school attendance than the mother's. For girls, each additional year of schooling that their mother has increases their probability of attending school by 1.3 percentage



points versus 1.1 percentage points for father's education. In the case of boys, each additional year of mother's schooling increases the probability of attendance by 0.7 percentage points whereas for father's education the corresponding figure is 1.1.

With respect to the income level, for both boys and girls the results show that family income has an important positive impact on children's schooling. The size of the impact is larger for boys than for girls by about 30%. A larger impact of family income on boy's education is consistent with an interpretation that boy's education is more elastic than girl's that is, it is subject to bigger changes with income fluctuations. In other words, increases in family income are more likely to be spent on boy's education whereas falls in family income are more likely to hurt boys' education than girls.

Father's absence from the household has important negative impacts on the probability of their children attending school for both boys and girls in urban areas. The magnitude of the impact is similar between boys and girls and suggests that a father's absence reduces the probability of attending school by over 3 percentage points. The presence of disabled individuals is negatively and significantly related to the probability of school attendance only in the case of boys, reducing attendance by 3.4 percentage points. This negative effect of disabled members likely suggests that boys may substitute for family disabled workers in the labor force, thereby reducing the probability that they attend school.

On the other hand, small children in the family have a larger negative effect on school attendance for girls than for boys, although it is significant for both. For instance, an additional child in the family aged 0 to 5 reduces the probability of school attendance for girls in urban areas by 2.8 percentage points versus only 2.1 for boys. This may reflect that older daughters have additional domestic responsibilities associated with younger brothers and sisters, which are incompatible with school attendance, whereas increased younger brothers and sisters may increase the probability of entering the labor force for older brothers. In the case of siblings one's age or older, the evidence indicates that this negatively affects the attendance of girls only, which may indicate that in large urban families, girls are the ones most likely to be excluded from educational investments, at least in terms of school attendance.

All of the other measures of household economic status and household dwellings with earth floor demonstrate that greater economic status leads to a higher probability of school attendance.

Finally, the supply of secondary schools appears to have no impact on the probability of attending school both for boys and girls in urban areas.

Turning now to school attendance in rural areas, mother and father educational levels continue to be important and significant determinants of school attendance in all of the samples. Again, the impacts of mother's education have a larger positive impact for girls, whereas the impacts of father's education are larger for boys. The estimated impacts are quite large, and demonstrate that in rural areas, the education of the mother and the father have impacts which are twice the size of those in urban areas. For instance, for girls each additional year of mother's education increases the probability of attending school by 2.1 percentage points versus 1.9 percentage points of father's education.

Our measure of family income has positive impacts on school attendance for both boys and girls in rural areas, and, as in urban areas, the impact is larger for boys school attendance than girls school attendance. Compared with urban areas, the magnitude of the impact is much larger than in urban areas, indicating that income has an even larger impact on educational investments in rural areas than in urban areas. This can be interpreted as evidence that income "matters" more for schooling attainment in rural areas, or that differences in educational outcomes by income levels are greater in rural areas than in urban areas.

Absent fathers continue to have a negative effect on school attendance which is also twice the size in rural areas than in urban areas. The impact is more than twice the size for boys than for girls, which is consistent with boys substituting in the labor market for their absent father. The corresponding effect of the father being absent is to lower the probability of school attendance by 5.8% percentage points for girls and 12.2% for boys.

In rural areas, the presence of disabled individuals is negatively and significantly related to the probability of school attendance again only in the case of boys, again providing support for the point that boys may substitute for disabled workers in the labor force, thereby reducing the probability that they attend school. Small children have a negative impact only on the school attendance of girls, not boys. Again, this is consistent with the fact that older daughters have additional domestic responsibilities associated with younger brothers and sisters, which may be incompatible with school attendance.

Finally, at the level of the community, the supply of secondary schools is positively and significantly related to the probability of school attendance both for boys and girls only in rural areas, with larger impacts for girls. This is consistent with evidence that the supply of secondary schools is a larger problem in rural areas and suggests that increases in the supply of schools in rural areas will have a larger impact on girls' school attendance. Altitude has a negative and significant effect on the probability of school attendance, which is consistent with a story where higher altitude may measure difficulty of access to schools and thereby negatively affect school attendance.

We now turn to the regressions of the schooling gap. We should reiterate that this indicator is a longer-term indicator of schooling attainment. A number of our independent variables are also in some sense long term measures of such aspects as family background, so that the estimated coefficient here may be more revealing in terms of the determinants of more long run educational outcomes of children.<sup>xviii</sup>

We begin with the schooling gap in urban areas. (Note that a *higher* schooling gap indicates greater years behind in school and thus implies a more negative outcome, the reverse of our indicator of school attendance.) Table 4 shows, as in school attendance, that parental education levels are a key determinant of educational attainment. Nevertheless, unlike school attendance, the impact of mother's education is greater than the impact of father's education both for girls and boys. For instance, each additional year of mother's schooling reduces the schooling gap by .07 years for girls and 0.6 for boys, versus the corresponding impacts of 0.6 and 0.5 in the case of father's schooling. This differential finding from school attendance may suggest that over the longer-run, mother's education plays a greater role in their children's educational attainment both for boys and girls, although it should be emphasized that father education is also significant in both groups and its impact is not small.

Absent fathers tend to increase the schooling gap in urban areas only for boys, resulting in an increase in 0.18 in the schooling gap, again supporting the idea that absent fathers results in a higher probability of working and thus causing boys to fall behind in school. As with the results for school attendance, the presence of disabled individuals only affects the probability of boys falling behind in school whereas the number of younger children in the family has a positive effect of falling behind in school only for girls. Other siblings have a large positive effect on falling behind in school for both samples, indicating that size of family is an important aspect for investment in child schooling and supporting the idea that larger numbers of children tend to be correlated with

fewer resources for investment in each individual child.

Turning to the determinants of the schooling gap in rural areas, parental education again has strong impacts on the schooling gap and, as was the case in school attendance, the impacts are much larger in rural areas than urban areas (Table 4). Mother's education has a larger positive impact on schooling outcomes than father's education, both for boys and girls. The size of the impacts is again much larger in rural areas than in urban areas, indicating that parental education levels make a greater difference to children's education in rural areas. For instance, for girls an additional year of mother's schooling reduces the number of years behind school on average in 0.15 years versus 0.08 years for father's education. The income measures show important impacts of income in increasing children achievement. As has been seen throughout the empirical analysis, the size of the impact of household income is larger for boys than for girls.

Absent fathers tend to increase the schooling gap for both girls and boys in rural areas, with a larger impact on boys than girls. Small children in the household are likely to increase the extent to which children fall behind in school, and once again, the effects are larger in the case of girls. In both samples, older siblings have positive and strong impact on the probability of falling behind in school, providing support for the "dilution" of family resources argument. Finally, the supply of secondary schools in rural areas appears to increase attainment only for girls in rural areas.

To summarize, these results have shown unquestionably large effects of family background on children's schooling attainment. Mother and father's education, as well as variables measuring the economic status of the family have shown very large impacts on the schooling attainment of their children. These impacts are, in general, much larger in rural areas than urban areas, showing that family background is even more important in the context of rural settings.

Family income has a very important significant impact on increasing educational investments. The size of the magnitude is consistently higher on boys' education than girls both in urban and rural areas. Our interpretation of this finding is that boys' education is more elastic than girls' education, that is, there are larger changes in response to changes in family income. This implies that families are more likely to spend additionally on boy's education in good economic times and remove them from school in poor economic times. This is quite consistent with a story in which poor economic times result in an increase in families sending their boy children to school to work and thereby reducing their educational attainment.<sup>xix</sup>

Variables which in some degree measure the capacity of (or lack of) households to supply labor to the market tend to have much larger negative impacts on boys whereas variables indicating necessity of domestic work have larger negative impacts of girls. This is consistent with arguments where labor market participation interferes more with the schooling of boys and domestic work interferes more with the schooling of girls. It is also clearly related to higher participation by boys at a young age in the labor market (Knaul and Parker, 1998). This work is suggestive that a more inclusive definition of work should be taken into account in analyses of child work and school attendance (see Knaul, 1999 this volume).

### **8. The gender gap revisited.**

We now address the question of the extent to which gender gaps continue to exist in our schooling indicators, even after controlling for a number of individual, family and community variables. Table 5 provides predicted probabilities of school attendance derived from the probit regression for boys and girls. The difference in the values between boys and girls can be interpreted as the impact of gender evaluated at the mean value of all other independent variables. We also present the ratio of the predicted value of girl's school attendance to boy's school attendance as a measure of gender differences. Values below 100% measure the extent to which girl's school attendance is lower than boys, controlling for other factors.

For the group of boys and girls aged 12 to 15, the table shows that in attendance, there continues to be a very large gender gap in rural areas, and a smaller gender gap in urban areas favoring boys. Nevertheless, the size of this gender gap varies depending on characteristics of the household. Both in urban and rural areas, the gender gap is generally larger with lower schooling of parents, particularly that of the mother, indicating that family background is not just an important determinant of overall schooling levels but of the difference in schooling levels between boys and girls as well.

We turn now to the predicted schooling gap by gender, derived from the regression equations for boys and girls (Table 6). (Recall that a larger schooling gap is a negative outcomes, so that values of our indicator below 100% indicate a more favorable outcome for girls). Table 6 confirms that this gap is fairly large in urban areas, showing that overall, boys are generally a significant number of years behind where they should be in school than girls. In rural areas,

however, the schooling gap is slightly larger for boys. The relationship with family background is somewhat different as in rural areas, the gap does not seem to be particularly variable with family background. In urban areas, the difference between girls and boys is largest (i.e. boys do worst relative to girls) in families where the father is not present, perhaps indicating that boys bear a greater burden of this absence in terms of their ability to attend and complete school on time. Note that in a number of Latin American countries, a “reverse” gender gap in boys and girls schooling has begun to appear at the secondary level (Duryea and Areunds-Kerunning, 1999). Given this evidence it would seem important to be watchful of continued tendencies in urban areas in Mexico.

In summary, these results confirm the earlier descriptive evidence which suggested that girls are at a greater risk for dropout and boys for falling behind in school. Girl’s school attendance is particularly problematic in rural areas, whereas the problem of boys falling behind in school is, relative to girls, significantly greater in urban areas.

## **9. Conclusions**

This paper has shown that important progress has been made in improving educational attainment in Mexico over the past generations. The average number of years of schooling attained has doubled over the last four decades and gender differences in education have been substantially reduced. Nevertheless, Mexico still lags behind other Latin American countries in terms of education, given its level of GDP. Furthermore, large differences in educational attainment between rural and urban areas remain, differences which are clearly related to economic status.

The gender gap in education has fallen substantially over the last thirty years; overall, girls and boys below the ages of 20 do not display significant differences in educational attainment, as measured by years of schooling completed. Nevertheless, the existing educational difficulties of boys and girls appear to differ substantially by gender. In attendance, girls begin to attend school less than boys (presumably due to higher dropout) by the age of 12. This is consistent with fewer girls going on to secondary school after finishing primary school.

In spite of these trends, a gender gap in years of completed schooling by age does not show up between boys and girls until past the ages of 20. The reason for this is that while boys attend school more during these ages, they are more likely to repeat grades and fall behind in school. The policy implication which surges as a result of this analysis is that policies should be aimed at

stopping the dropout of girls after primary school and at trying to understand why boys who continue attending school are more likely to fall behind in school than girls.

Additionally, it is important to add that men are still more likely to enroll in college than women. For the future, an important issue with respect to gender and education, particularly in urban areas, will be attendance at the university level and the types of careers and majors which women choose to study. In many Latin American countries, it has been shown that women tend to be concentrated in traditionally female areas, such as education and health (Bustillo, 1991).

The general expansion in education levels in Mexico which, while perhaps not specifically oriented to increasing girl's education,<sup>xx</sup> may have had a larger impact on girl's attendance if schools are more easily accessible and girls are more likely to drop out of school if schools are located outside of the community. This paper has shown evidence that, although important for both genders, the supply of secondary schools is a larger determinant of girls' schooling than boys in rural areas. An obvious policy implication towards continuing to reduce the gender gap as well as increasing overall education levels in rural areas is to continue the construction of secondary schools.<sup>xxi</sup>

Another clearly important factor behind the reduction of the gender gap in education is the effect of parental education levels. Of the impacts of parental education on boys and girls, the one that is always of largest magnitude is the impact of mother's education on girl's schooling. We have found evidence that the education of parents is highly important to explaining educational outcomes, even after controlling for a number of other income status variables. We have also shown that the largest gender gaps favoring boys are in households where the parents, in particular the mother, have lower education levels so that increasing parental education levels will continue to help reduce this gender gap. Gender gaps favoring boys are clearly related with economic background and households with more unfavorable indicators (low parental education and income) are much more likely to show gender gaps in education which favor boys.

Research within the context of other countries has shown that resources controlled by women tend to have more favorable impacts on children's welfare outcomes than resources controlled by men. The evidence in this paper, that mother's education generally have a larger impact than those of father's education in the context of more long-term measures of educational attainment of children, points towards the confirmation of these findings within the context of

Mexico. This is consistent with intra-household research, which has shown that a greater woman's bargaining power, as proxied by indicators of women's education and income, tends to have larger positive impacts on children's well-being. This should not be interpreted to mean that the impacts of fathers are unimportant. In general they are also very significant determinants of their children's educational attainment.

Finally, our analysis has pointed towards a relationship between the necessity of child labor within households and their schooling attainment, in which ways which differ by gender. Absent fathers and the presence of disabled persons in the household have strong negative effects on schooling attainment above all for boys. It is likely that these variables have negative effects on schooling for boys because they show the necessity for child labor to substitute for adult labor supply.

In the case of girls, however, small children in the household have a negative and significant impact on schooling outcomes in all cases, whereas the same is not true for boys. This would seem to indicate that girls are likely to do worse in school when domestic needs are greater at home, as is presumably the case with small children in the household. In summary, different types of work appear to interfere with schooling achievement of boys and girls. For boys, educational attainment appears to be worse the greater the need for additional household labor supply to supplement family income. For girls, on the other hand, domestic work appears to play a greater deterring influence to school. The issue of which type of work (if any) may be more "compatible" with school is an important issue, one which we leave for future research.



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<sup>i</sup> Approximately 10% of children attend private primary and secondary schools.

<sup>ii</sup> These tables may overstate the differences between rural and urban areas, as presumably an important

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proportion of the individuals who currently live in urban areas migrated at some point in their lives from rural areas, and individuals who migrate may be likely to have a higher educational level than those who stay.

<sup>iii</sup> Nor is it obvious how to measure equivalency in this sense although a likely candidate would be to compare the returns to education from different types of schooling.

<sup>iv</sup> An exception is Progresa, the Education, Health and Nutrition Program, begun in 1997 which we describe later in this document.

<sup>v</sup> An alternative perspective is provided by Francis Vella (1993) who maintains that the attitudes towards female work, which may be constructed independently of the education system, are those which determine investment in human capital. Her results demonstrate that the attitudes of women towards women's work are developed in youth and can lead to substantial reductions in human capital investment, labor supply and returns to education.

<sup>vi</sup> Parish and Willis (1992) provide an interesting set of alternative hypotheses to viewing educational investments in daughters and sons. First, the authors focus on altruism, which implies that aside from their own consumption, parents care about the well-being of their children. Altruistic parents invest more in children with greater opportunities, equaling the well-being of their children through compensatory transfers towards the most "disadvantaged". If there is more altruism towards sons than daughters, sons will receive larger transfers than daughters. Under the hypothesis of "resource dilution," large families result in lower levels of education for all children. Middle children are those who are most affected. The number of children and the order of birth can affect the education opportunities even in the absence of manipulation in favor of the own interest of the parents. The authors also focus on the potential role of credit restrictions or conditional altruism. The lack of capacity of the individuals to obtain credit against their future income as collateral implies that the current conditions of the family will determine if investments in education are made. Parents are willing to finance only those children who, according to their perception, are in conditions to return the resources. This can explain gender discrimination, according to the authors, as sons may have greater possibilities to pay back investments.

<sup>vii</sup> In the context of Latin America, King and Bellew analyze the gender inequality in Peru between 1940 and 1980, arguing that gender inequality in education has decreased substantially. Important determining factors of school enrollment include parent's education level as well as wealth. Their findings suggest that wealthier parents are more likely to send daughters to school. Barros, Fox and Mendoça (1997) demonstrate the lower probability of school attendance among children living in female-headed families in Brazil. Also for the case of Brazil, Levison (1991) and Psacharopoulos and Arriagada (1989) show the importance of similar factors as well as education of parents and family income on both labor force participation and school attendance. The importance of parental education levels as determinants of both child work and school attainment are also shown in Lam and Schoeni (1992) and Parish and Willis (1992).

<sup>viii</sup> The schooling gap is defined as  $G = \text{age} - \text{years of completed schooling} - 6$ .

<sup>ix</sup> Note that we do not know whether boys and girls who are currently not attending have permanently dropped out or will return at some point to school.

<sup>x</sup> The (parental) demand for education of children is expected to depend on factors affecting the expected returns from the educational investments, as well as factors affecting direct and indirect costs of schooling. This framework implies the following model of demand for schooling:

$$E_{ij} = B_0 + B_1X_i + B_2X_{ij} + \delta_i + \varepsilon_{ij}$$

where  $E_{ij}$  represents the educational investments in child  $j$  in household  $i$ ,  $X_i$  represents the vector of explanatory variables common to all members of the household (within these are community characteristics which are obviously identical for all household members), and  $X_{ij}$  represents the characteristics specific to the child (Parish and Willis, 1995). The error term is specified in two parts, one term which is specific to each child, and another which is common to all siblings. Because of the common part of the error term to each child in the same family ( $\delta_i$ ), we estimate robust (Huber-White) standard errors.

<sup>xi</sup> Note that given the structure of our sample, that we may have numerous children from the same family (who all then have the same household characteristics) implies the possible appropriateness of a household fixed effects model where all characteristics (observed and unobserved) at the level of the household are "differenced out". This model has the advantage of assuring that unobserved heterogeneity at the household level is not biasing the estimated coefficients, with the corresponding disadvantage that the impact of individual household variables cannot be analyzed. This model, however, requires variation in outcomes within each group (in this case the household) and so results in our case, in the loss of the majority of the

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sample.

<sup>xii</sup> Unfortunately, we have no information on children who are no longer living in the household so that the oldest child in the household is not necessarily the oldest child of the parents. Additionally, we do not know if a mother's fertility has been completed so that the youngest child may not be the last child.

<sup>xiii</sup> In the case where education is missing for parents, we impute the mean value.

<sup>xiv</sup> In this paper we do not attempt to analyze the complicated relationship between child work and school attendance. See Knaul and Parker, 1998 for an analysis of the inter-relationships between the work and school in the context of longitudinal data for Mexico.

<sup>xv</sup> While we have access to information on the supply of schools at the level of the locality, unfortunately the database of the Conteo does not contain information on the locality so that we are unable to match this school information to the locality level. Instead, we use the next level of geographic aggregation, the municipality.

<sup>xvi</sup> Note that estimating separate models is equivalent to estimating aggregate models where boys and girls are estimated together with a dummy variable distinguishing whether the child is a boy or a girl with interaction terms between gender and the other independent variables.

<sup>xvii</sup> We carried out a likelihood ratio test to evaluate whether the coefficients in the model for girls differ from that of boys. With a chi-squared statistic (16) equivalent to 49, we clearly reject that boys and girls can be pooled together.

<sup>xviii</sup> Behrman and Knowles (1999) have shown that a long-term indicator of income (e.g. *permanent income*) leads to much larger estimates of the impact of family income on schooling than indicators of current income.

<sup>xix</sup> Note that this may partially reflect the point that the data we use comes from the year 1995, which was a year of severe economic downturn. It would be important to repeat this analysis for years of different economic circumstances to see if these findings continue to hold up.

<sup>xx</sup> Progresá, the Education, Health, and Nutrition Program, is an example of a new program (begun in 1997 after the Conteo was carried out) targeted at promoting the educational level of boys and girls in poor, rural contexts. Among its other benefits, the program includes educational grants to children attending school between the third grade of primary and the end of secondary school. To receive the grants, children must be attending school and successfully complete the school year cycle. Additionally, grants for girls at the level of secondary school are slightly higher than for boys. The program currently has incorporated approximately 2.3 million families in marginalized rural areas.

<sup>xxi</sup> In urban areas, we found no overall significant impact of the supply of secondary schools. This is not to suggest that educational services are unimportant in affecting educational attainment in urban areas, it may be that quality is a greater issue in urban areas although unfortunately we have no indicators in this paper of school quality.