

**Household and Education of Mexican Men and Women**  
**Paper presented by Carla Pederzini Villarreal**

## Abstract

This paper concentrates on the family determinants of education in Mexico in three different age groups, with special on the sex differences of this impact for each age group. Mexico is an interesting case study for education as it represents a country, which, like much of Latin America, has experienced growth in educational attainments over the last decades. Nevertheless, given its level of GDP, Mexico actually does very poorly in terms of education, with its population having 2 and a half years less of education than what it should have (BID, 1996). Additionally, Mexico has very high inequality in income and wealth, as well as a large indigenous population difficult to access both due to the diversity of languages and geographical isolation.

The analysis uses the National Survey of the Population and Housing Count (Conteo), carried out in 1995. The estimation methods are based on reduced form models of the demand for education. 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:  $E_{ij} = B_0 + B_1X_i + B_2X_{ij} + \delta_i + \epsilon_{ij}$ , 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, and  $X_{ij}$  represents the characteristics specific to the child. The dependent variable considered in the model is school attendance. Only the sample of children of the household head is considered. This raises sample selection questions since a bias may arise 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. In order to compare the impact of each variable on school attendance in different age groups the analysis is conducted for children 6-13 (primary school), 12-15 (middle school) and 16-19 (high school), by sex and by rural/urban residence. The variables included are directly related to the individual (age, sex and marital status for the 16-19 age group), the household (mother's education, father's education, household size, household type, number of younger sibling, number of older siblings and number of siblings of the same age group, household income, mother's absence and female headed households and the locality (urban/rural). A variable measuring the number of secondary schools is also included in the model for the age group 12-15.

Results The odds of attending school are much lower for children from the rural areas. The biggest negative effect of this variable is found on children who should be attending secondary school. In the first group analyzed we found that school attendance of girls who occupy the last places in the birth order is favored, while first-born girls get poorer results in terms of school attendance.

The impact of female headed households varies according to the age group and sex considered. In the oldest group considered this variable has a positive impact for girls and a negative impact for boys. The big impact of marital status on school attendance confirms the incompatibility of marriage and schooling. The significance of this variable is much higher in the urban areas.

Mother's schooling is the most important variable in determining school attendance in the youngest and oldest age groups considered. As shown in pervious literature mother's schooling is more important for girls than for

boys. Income always has a positive effect on school attendance; nevertheless the biggest impact of this variable is the secondary age group (12-15). In the youngest group only girls are positively affected by this variable. The results of this analysis confirm the importance of considering age groups when analyzing the determinants of school attendance. The most vulnerable group in terms of school attendance turned out to be the middle one which comprises the population who should be attending secondary school. It is in this group where the income level is most important and where the differences between boys and girls are more obvious. This analysis also shows that girls are more affected by the household characteristics and that girls can get a better position in terms of school attendance when they occupy the more advanced places in the birth order.

## ***Introduction***

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## ***Data and Methodology***

The analysis uses the National Survey of the Population and Housing Count (Conteo), carried out in 1995. The estimation methods are based on reduced form models of the demand for education. 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:

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

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, and  $X_{ij}$  represents the characteristics specific to the child. The dependent variable considered in the model is school attendance.

Only the sample of children of the household head is considered. This raises sample selection questions since a bias may arise 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. In order to compare the impact of each variable on school attendance in different age groups the analysis is conducted for children 6-13 (primary school), 12-15 (middle school) and 16-19 (high school), by sex and by rural/urban residence.

The variables included are directly related to the individual (age, sex and marital status for the 16-19 age group), the household (mother's education, father's education, household size, household type, number of younger sibling, number of older siblings and number of siblings of the same age group, household income, mother's absence and female headed

households and the locality (urban/rural). A variable measuring the number of secondary schools is also included in the model for the age group 12-15.

### **Individual Variables**

#### **Age**

Since the probability of dropping out from school increases with age, we would expect a negative effect of age on school attendance.

#### **Sex**

The fall in female attendance at the end of primary education (Parker and Pederzini, 2000) leads us to expect a negative relation between the variable for women and school attendance, specially in the age group from 12-15.

#### **Siblings and Birth Order**

Evidence shows that older brothers help finance younger siblings' education (Greenhalgh (1985) and Parish and Willis(1993)). Behrman and Taubman(1986) show that birth order effects, with better conditions for the elder, remain significant even when controlling by size and other household characteristics. Quimsumbing (1994) and Parish and Willis (1993) confirm these findings.

Even though the database used for this paper does not allow us to identify the birth order of each individual in the household, some conclusions can be made regarding the effects of the presence of older or younger siblings in the household, which will permit us to determine whether younger, medium or older children are better off in terms of school attendance.

### **Household Variables**

#### **Parental Education.**

Parental education is considered a key variable for human capital intergenerational transmission and household well being. This variable acts through other variables such as income, mother's time quality or the type of parent's aspirations towards their children's educational attainment. According to Montgomery and Chongshun (1996) parental education plays a key role on children's educational aspirations and access to better secondary schools in Continental China. In fact, due to its pedagogical and example role, education does better than family income in predicting children's education (Hausman and Székely,). In most high income countries it has been found that mother's education is more important than father's. Nevertheless, the evidence from some African countries shows the opposite (Tansel, 1997). For the Mexican case, it has been demonstrated that parent's education is positively correlated with children's educational performance (Palafox, Prawda and Vélez).

There is evidence supporting the idea that parent's education has a greater influence on children of the same sex and that the effect of maternal schooling is greater on daughters than paternal schooling on sons. The relative preference of mothers for their daughters education and the fact that their own education gives them more power in decision making and a higher status within the family explains the greater influence of mother's schooling on her daughters' schooling (Al-Samarrai and Peasgood).

### **Household Size.**

Children from smaller households tend to get better results in school. Typically they get more quality time with parents and because smaller households can dedicate more resources to cultural and educational activities. Several authors have confirmed this negative relation between household size and educational attainment: Knodel, Havanon and Sititrai(1990) for Thailand, Garasky (1995) in the United States and Lillard and Willis (1994) for Malaysia. Nevertheless, there is evidence that questions this relationship (Hossain (1990)). For the Mexican case Palafox et. al. (1994) have found an inverse relationship between household size and educational attainment.

### **Single parent and Female Headed Households.**

In most female-headed households the mother supports economically the family and is also responsible for child rearing. This type of household may have more limited resources because in general female income is lower than male, while children get less attention from the mother because of her multiple responsibilities. Some studies in Mexico and other Latin American countries have found that children from single parent households get worse results than other children even after controlling the socioeconomic status of the family (Garasky, 1995 and Gómez de León and Parker, 1999). Motivational and psychological factors associated to parents' separation normally explain these results. Nevertheless, not all children from single parent households get the same results: Biblarz and Raftery (1999) findings show no important differences in educational attainment of children from single parent households compared with boys and girls from other kind of households. Other studies find differentiated effects by sex in education for children in single parent households (Al-Samarrai and Peasgood, 1998 and Powell and Parcel, 1997).

### **Income Level**

Poor households can dedicate fewer resources to finance education related expenses, such as transport, books and other school related materials. Additionally, the opportunity cost of school attendance is much higher for the poorest households in terms of wages not earned or household chores not done. The loss of this income is harder to endure as the economic level of the family gets lower. Some papers find evidence of a positive relationship between household income and educational demand (Tansel (1997a and 1997b)). A higher correlation between these two variables can be interpreted as a lower level of social mobility<sup>1</sup>.

### **Mother's Absence**

Mothers play an essential role in learning motivation and emotional stability of their children. Their absence may affect the educational performance of her children. The negative impact can be greater for girls if they have to replace their mother's household work.

### **Non-Nuclear Household**

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1 Tansel (1997b) and Hannum(1999) find similar results for Turkey and rural Chinese areas respectively: income has a greater impact on girls' schooling than on boys' schooling. According to Tansel, this finding means that income restrictions are more effective for girls than for boys. Behrman and Knowles believe that a lower correlation between schooling years and income for boys than for girls means that female education is considered more as a luxury and less a need.

Nuclear households are normally considered “modern” households where education is highly valued. Children from this type of household should hold higher education levels. However, the presence of other adults in extended families may favor children’s school performance by liberating them from housework and helping them with school homework

## **Locality Variables**

### **Rural and Urban Residence**

Life in an urban locality is associated with higher educational levels. Among other reasons, this is due to higher supply of educational services, higher human capital demand in the labor market and the cultural characteristics of urban families where education is highly valued.

## **Municipal Level Variables**

### **Secondary School Supply**

Some studies have found that distance to school is an important determinant of school attendance (Tansel, (1997)). In Mexico every locality has at least one primary school, but for secondary school the distance to school could be an important factor for school attendance. Secondary school supply is included in the model for the population aged 12 to 15.<sup>1</sup>

## **Regression Results**

### School Attendance of Primary School Aged (6 to 13) Population (Table 1)

The main results of the estimation of the primary school aged population model are presented in this section.

The results show that the odds ratio of school attendance is 16% lower for girls in this age group than for boys. This finding confirms previous findings, which show that girls drop out from school more frequently than boys at the end of primary school.

Maternal Schooling is the most significant variable after controlling for age in this group. With the exception of rural girls, maternal schooling always shows a larger impact on school attendance than paternal schooling, even though paternal schooling was in all cases highly significant. An additional schooling year for the father increased the odds of attending school in 14% with small differences between urban and rural boys and girls. There were no important differences found in the impact of paternal education for rural and urban population.

The results for female-headed households show a positive relationship with school attendance, with a 25% increase in the odds ratio of attendance. Most women head of households participate in the labor market and school may play an important role for them as a childcare option while they work. It is interesting to observe that when the models are estimated separately the positive effect is only present in the model for rural population.

The number of children under 5 in the household always has a negative and significant impact on school attendance, with the exception of the male rural population, where it turned out be not significant. One extra sibling under 5 reduces the odds ratio of attendance in 12%.

**Table No. 1 Parameters of the Attendance Model for Children aged 6 to 13  
(Logistic regression)\***

	<i>Total</i>			<i>Urban</i>			<i>Rural</i>		
	<i>Total</i>	<i>Female</i>	<i>Male</i>	<i>Total</i>	<i>Female</i>	<i>Male</i>	<i>Total</i>	<i>Female</i>	<i>Male</i>
<b>Individual Characteristics</b>									
Age	<b>0.822</b>	<b>0.772</b>	<b>0.877</b>	<b>0.845</b>	<b>0.803</b>	<b>0.891</b>	<b>0.805</b>	<b>0.748</b>	<b>0.867</b>
	<b>(-20.103)</b>	<b>(-18.586)</b>	<b>(-9.542)</b>	<b>(-11.352)</b>	<b>(-10.443)</b>	<b>(-5.471)</b>	<b>(-16.743)</b>	<b>(-15.512)</b>	<b>(-7.876)</b>
Female	<b>0.843</b>			<b>0.825</b>			<b>0.856</b>		
	<b>(-4.165)</b>			<b>(-3.065)</b>			<b>(-2.863)</b>		
<b>Parents' Characteristics</b>									
Mother's Schooling	<b>1.165</b>	<b>1.180</b>	<b>1.151</b>	<b>1.184</b>	<b>1.218</b>	<b>1.153</b>	<b>1.135</b>	<b>1.129</b>	<b>1.144</b>
	<b>(17.504)</b>	<b>(13.622)</b>	<b>(11.212)</b>	<b>(14.274)</b>	<b>(11.765)</b>	<b>(8.425)</b>	<b>(9.667)</b>	<b>(6.709)</b>	<b>(7.029)</b>
Father's Schooling	<b>1.140</b>	<b>1.140</b>	<b>1.142</b>	<b>1.134</b>	<b>1.131</b>	<b>1.138</b>	<b>1.137</b>	<b>1.139</b>	<b>1.136</b>
	<b>(15.575)</b>	<b>(11.231)</b>	<b>(10.826)</b>	<b>(11.11)</b>	<b>(7.813)</b>	<b>(7.917)</b>	<b>(9.877)</b>	<b>(7.253)</b>	<b>(6.746)</b>
<b>Household Characteristics</b>									
Female Headed Household	<b>1.246</b>	<b>1.246</b>	<b>1.253</b>	1.153	1.130	1.201	<b>1.338</b>	<b>1.363</b>	<b>1.301</b>
	<b>(3.027)</b>	<b>(2.175)</b>	<b>(2.151)</b>	(1.462)	(0.926)	(1.264)	<b>(2.645)</b>	<b>(1.957)</b>	<b>(1.708)</b>
Children under 5	<b>0.884</b>	<b>0.865</b>	<b>0.902</b>	<b>0.818</b>	<b>0.798</b>	<b>0.836</b>	<b>0.930</b>	<b>0.918</b>	0.944
	<b>(-5.302)</b>	<b>(-4.43)</b>	<b>(-3.137)</b>	<b>(-5.622)</b>	<b>(-4.541)</b>	<b>(-3.469)</b>	<b>(-2.378)</b>	<b>(-1.96)</b>	<b>(-1.345)</b>
Big Household	1.015	0.956	1.087	0.996	0.871	1.166	1.007	0.999	1.001
	(0.131)	(-0.285)	(0.525)	(-0.026)	(-0.621)	(0.669)	(0.043)	(-0.003)	(0.004)
Medium Household	<b>1.138</b>	1.090	<b>1.200</b>	<b>1.319</b>	1.211	<b>1.458</b>	1.045	1.042	1.042
	<b>(1.666)</b>	(0.786)	<b>(1.653)</b>	<b>(2.562)</b>	(1.251)	<b>(2.456)</b>	(0.391)	(0.257)	(0.257)
Siblings 6 to 13	<b>0.898</b>	<b>0.886</b>	<b>0.909</b>	<b>0.881</b>	<b>0.890</b>	<b>0.868</b>	<b>0.918</b>	<b>0.895</b>	0.944
	<b>(-4.803)</b>	<b>(-3.842)</b>	<b>(-2.93)</b>	<b>(-3.745)</b>	<b>(-2.494)</b>	<b>(-2.854)</b>	<b>(-2.838)</b>	<b>(-2.606)</b>	<b>(-1.333)</b>
Siblings 14 to 19	<b>1.049</b>	<b>1.080</b>	1.014	1.025	1.048	0.995	<b>1.065</b>	<b>1.109</b>	1.021
	<b>(1.981)</b>	<b>(2.252)</b>	(0.39)	(0.668)	(0.932)	(-0.091)	<b>(1.945)</b>	<b>(2.189)</b>	(0.461)
Ln Income by adult	<b>1.043</b>	<b>1.058</b>	1.025	<b>1.070</b>	<b>1.085</b>	1.053	<b>1.041</b>	<b>1.058</b>	1.023
	<b>(3.505)</b>	<b>(3.518)</b>	(1.367)	<b>(2.509)</b>	<b>(2.285)</b>	(1.225)	<b>(3.051)</b>	<b>(3.135)</b>	(1.144)
Mother's absence	<b>0.682</b>	<b>0.596</b>	0.774	1.051	1.155	0.972	<b>0.488</b>	<b>0.379</b>	<b>0.636</b>
	<b>(-2.88)</b>	<b>(-2.761)</b>	(-1.342)	(0.228)	(0.434)	(-0.097)	<b>(-4.152)</b>	<b>(-4.063)</b>	<b>(-1.769)</b>
Non nuclear Household	1.059	1.115	1.009	1.052	1.139	0.967	1.100	1.146	1.065
	(1.031)	(1.388)	(0.112)	(0.604)	(1.123)	(-0.281)	(1.256)	(1.263)	(0.587)
<b>Locality Characteristics</b>									
Rural Locality	<b>0.866</b>	0.914	<b>0.818</b>						
	<b>(-3.169)</b>	(-1.426)	<b>(-3.081)</b>						
Number of observations	45163	22234	22929	27819	13669	14150	17344	8565	8779
Model Statistics	chi2(14)=2730.420	chi2(13)=1647.43	chi2(13)=1120.86	chi2(13)=1441.21	chi2(12)=882.83	chi2(12)=573.01	chi2(13)=895.17	chi2(12)=585.68	chi2(12)=341.170

\* Significant variables in bold.

With the exception of male rural population, the number of same age group siblings has a negative and significant impact on school attendance. On more sibling of the same age reduces the odds ratios of school attendance in 10%.

The variable which measures the number of older siblings aged 14 to 19 has a distinct impact on attendance depending on sex: it is positive and significant for girls and not significant for boys. Rural women show the largest positive impact from this variable. One more older brother 14 to 19 raises 11% the attendance odds ratio of female rural population and 8% of female total population.

The results analyzed so far show that more elevated positions in birth order benefit girls' school attendance. On the one side the presence of siblings under five has a negative impact on them while older siblings impact positively their attendance. This result may be due to the fact that girls carry a heavier burden related to their younger siblings' care.

The variable which measures tenure in a large household resulted non significant, while medium household had a positive and significant impact on attendance only for male population.

The model estimation results confirm the positive impact of income level on school attendance. The estimation of the models for different population groups showed that this variable is only important for girls. We could explain this result the way Behrman and Bowles do: Female school attendance is a luxury good; its consumption raises more than males' attendance when income goes up.

Mother's absence in the household decreases attendance odds ratio of primary school aged population in about 32% and in more than 50% for rural population. Rural women are most affected by this variable, with a 60% decrease in attendance. These results may be explained by the fact that in rural areas girls have to replace their mother in household work and child care activities when she is absent, while in the urban areas there are child care options available.

There was no significant impact of living in a non-nuclear household on school attendance for the primary school aged population.

Finally, the model estimation results showed that living in a rural locality had the expected negative impact on school attendance. The odds ratio of school attendance is 14% lower for rural population in this age group.

#### School Attendance of Secondary School Aged (12 to 15) Population (Table 2)

The disadvantage shown by female and rural population in the primary school aged population becomes even more clear in the model for the secondary school aged population<sup>2</sup>. Again, in this age group we find that father's and mother's schooling are still highly significant variables. One more year of father's schooling increases the odds ratio of children's school attendance in 24% while mother's schooling effect is 10%. Mother's education is much less important in this age group than in the other two analyzed age groups. We even found that for rural women in this age group mother's education turned out to have a negative impact<sup>3</sup>.

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**2** The estimated odds ratio for the variable representing the female population was 0.3613 and highly significant ( $z$  statistic of -36.34). Living in a rural community (2,500 or less inhabitants) has a negative impact on school attendance, decreasing the odds ratio in 63%. The impact of this variable is much stronger on male population than on female population (85% reduction vs. 50%).

**3** It is worth to mention that average years of schooling for female rural population in this age group is only 2.66 and the standard deviation of 2.572. 69% of these mothers have less than four years of formal schooling. The negative sign of the variable is probably indicating that at such low levels of schooling, the positive effects of mother's education on secondary aged daughter's attendance cannot be observed.



**Table No. 2 Parameters of the Attendance Model for Children aged 12 to 15  
(Logistic regression)\***

	<i>Total</i>	<i>Total Female</i>	<i>Male</i>	<i>Total</i>	<i>Urban Female</i>	<i>Male</i>	<i>Total</i>	<i>Rural Female</i>	<i>Male</i>
<b>Individual Characteristics</b>									
Age	0.581 (-36.907)	0.537 (-28.209)	0.564 (-25.549)	0.363 (-28.468)	0.294 (-26.602)	0.349 (-14.876)	0.669 (-23.169)	0.664 (-12.062)	0.566 (-22.355)
Sex	0.361 (-36.343)			0.151 (-29.995)			0.521 (-18.617)		
<b>Parents' Characteristics</b>									
Mother's schooling	1.105 (14.400)	1.075 (7.185)	1.147 (11.955)	1.277 (17.763)	1.429 (18.147)	1.225 (9.721)	0.987 (-1.427)	0.755 (-15.772)	1.134 (8.509)
Father's schooling	1.240 (27.138)	1.354 (24.962)	1.081 (7.119)	1.094 (6.936)	1.135 (6.939)	1.066 (3.004)	1.286 (23.647)	1.823 (25.403)	1.145 (9.145)
<b>Household Characteristics</b>									
Female Headed Household	1.258 (5.123)	2.075 (9.939)	0.809 (-3.401)	0.386 (-10.076)	0.344 (-9.031)	0.953 (-0.240)	1.537 (7.141)	15.934 (18.340)	1.060 (0.761)
Children under 5	1.784 (30.950)	1.68 (17.935)	1.932 (22.022)	0.868 (-3.191)	1.593 (6.835)	0.383 (-12.414)	2.087 (32.448)	1.123 (2.919)	2.612 (26.915)
Large Household	0.249 (-17.279)	0.081 (-21.546)	0.529 (-4.531)	0.136 (-10.709)	0.048 (-11.802)	5.001 (4.640)	0.311 (-12.278)	0.203 (-10.198)	0.290 (-7.380)
Medium Household	0.905 (-2.048)	0.379 (-13.49)	1.628 (6.159)	1.518 (3.914)	0.776 (-1.748)	5.659 (9.892)	0.779 (-4.217)	0.200 (-15.671)	1.256 (2.443)
Siblings 6 to 13	1.451 (24.213)	1.406 (14.453)	1.776 (21.786)	1.278 (6.982)	1.139 (2.682)	1.246 (3.081)	1.517 (21.400)	1.897 (16.971)	1.796 (17.485)
Siblings 14 to 19	1.251 (10.736)	1.396 (12.002)	1.207 (4.957)	1.261 (5.167)	1.291 (4.095)	0.895 (-1.507)	1.276 (9.755)	1.469 (10.518)	1.403 (7.231)
Ln Income by adult	1.260 (29.374)	1.163 (7.530)	1.337 (29.521)	1.177 (4.761)	1.074 (1.576)	1.115 (2.029)	1.347 (34.222)	1.456 (13.846)	1.386 (30.161)
Mother's absence	0.889 (-0.587)	0.804 (-0.768)	1.053 (0.180)	0.473 (-2.821)	1.154 (0.381)	0.680 (-1.084)	1.275 (0.730)	0.672 (-0.722)	2.634 (2.040)
Non nuclear Household	0.857 (-4.103)	0.907 (-1.466)	0.744 (-5.332)	3.078 (12.912)	1.738 (4.228)	1.866 (4.197)	0.447 (-17.013)	0.408 (-8.998)	0.560 (-8.453)
<b>Locality Characteristics</b>									
Rural Locality	0.371 (-32.021)	0.500 (-15.904)	0.153 (-32.921)						
<b>Municipality Characteristics</b>									
Secondary School Supply	1.066 (6.258)	1.180 (11.045)	1.062 (3.988)	1.604 (14.970)	1.294 (7.815)	1.995 (10.058)	1.011 (1.018)	1.175 (8.427)	0.990 (-0.610)
Number of observations	35999	15632	20367	14878	8036	6842	21121	7596	13525
Model Statistics	chi2(15)=11189.26	chi2(14)=5248.160	chi2(14)=6292.520	chi2(14)=7069.67	chi2(13)=5397.75	chi2(13)=876.27	chi2(14)=5558.47	chi2(13)=1763.31	chi2(13)=4529.680

The positive effect of female headship on school attendance for this age group is reflected on the positive sign of the variable for rural population (1.537) and on girls (2.075). Surprisingly, this variable is positive for rural girls and negative for urban girls. For the male population in this age group the negative effects are significant only for the total population. The differentiated effect of this variable could be explained by labor market accessibility. Female heads are aware of the importance of schooling for the labor market. Nevertheless in the urban areas the employment opportunities take daughters to the labor market as a way of improving the low-income conditions of female-headed households.

Variables measuring the number of siblings in the different age groups have a positive impact on attendance, while tenure in a large household lowers school attendance odds ratio in 95% and medium household has a positive impact of 22% in relation to the omitted variable which is small household tenure. Rural and urban girls' school attendance benefits from the presence of older siblings aged 14 to 19. In contrast, only rural boys aged 12 to 15, benefit from older siblings aged 14 to 19. Household size variables play an important role on the model for urban male population in this age group. Both, tenure in a large and in a medium household, have a positive impact on attendance in relation to the small household omitted variable. Each one of these variables increases the odds ratio of school attendance more than 5 times. This result indicates that school attendance of urban male population in small households is much lower than school attendance in the other two household size categories; the smaller the household size, the more economic responsibilities for the boys aged 12 to 15. When the household is bigger, responsibilities dilute among more siblings.

With the exception of male urban population, large households always show a negative impact on school attendance, which is much more important for girls than for boys. Medium households reduce in 10% the odds ratio of school attendance in the total population but is only negative for the rural population (-22%) while it is positive on the urban population (it increases the odds ratios of school attendance in 50% with respect to the omitted variable, small household). It is worth to mention that while for girls this variable reduces the odds ratio of school attendance for boys the impact is positive.

The effect of household income is important for this age group, with greater importance on rural than urban population. A unit increase in the income log leads to a 26% increase in the school attendance odds ratio, with more significance for boys than for girls. Since boys join the labor force at younger ages, a higher opportunity cost of school attendance for male population may be the explanation of this result.

Mother's absence is significant only for urban population in this age group. Living in a non-nuclear household has a negative impact on girls' and boys' school attendance. This variable has the opposite effect on rural and urban population: negative in the first case and positive in the second one. This effect may be associated with cultural characteristics of non-nuclear households in rural areas where education does not play an important role. The reason for the positive impact of this variable in urban areas may be that the presence of other members releases children from household duties or market work, allowing or even propitiating their school attendance.

As expected, secondary school supply has a positive and significant effect on this age group school attendance, where strong differences between girls and boys were found. For the total female population one more secondary school per capita in the municipality increases the school attendance odds ratio in 18%, 17.5% for the rural girls and 29.4% for the urban. For the male population the impact is quite different: it increases the odds ratio 6.2% for the total male population and almost doubles it for urban population but turned out non significant for rural population. This variable may be capturing other characteristics of the municipality that offset the positive impact of school supply on school attendance

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♣ Significant variables in bold.

**Table No. 3**  
**Parameters of the Attendance Model for Population aged 16 to 19**  
**(Logistic regression)\***

	<i>Total</i>			<i>Urban</i>			<i>Rural</i>		
	<i>Total</i>	<i>Female</i>	<i>Male</i>	<i>Total</i>	<i>Female</i>	<i>Male</i>	<i>Total</i>	<i>Female</i>	<i>Male</i>
<b>Individual Characteristics</b>									
Age	<b>0.730</b> (-10.08)	<b>0.726</b> (-6.067)	<b>0.729</b> (-8.105)	<b>0.714</b> (-9.066)	<b>0.702</b> (-5.818)	<b>0.719</b> (-6.957)	<b>0.752</b> (-4.8)	<b>0.775</b> (-2.282)	<b>0.725</b> (-4.521)
Married Status	<b>0.331</b> (-4.465)	<b>0.319</b> (-2.603)	<b>0.344</b> (-3.550)	<b>0.229</b> (-4.401)	<b>0.331</b> (-2.279)	<b>0.182</b> (-3.634)	0.663 (-1.122)	0.293 (-1.178)	0.811 (-0.524)
Sex	1.080 (1.118)			1.068 (0.827)			1.187 (1.256)		
<b>Parents' Characteristics</b>									
Mother's schooling	<b>1.105</b> (8.83)	<b>1.127</b> (6.365)	<b>1.093</b> (6.183)	<b>1.113</b> (8.421)	<b>1.134</b> (6.103)	<b>1.101</b> (5.947)	<b>1.061</b> (2.133)	<b>1.102</b> (1.989)	1.035 (0.996)
Father's schooling	<b>1.082</b> (7.562)	<b>1.064</b> (3.401)	<b>1.095</b> (6.984)	<b>1.081</b> (6.484)	<b>1.056</b> (2.734)	<b>1.096</b> (6.055)	<b>1.057</b> (2.190)	1.051 (0.994)	<b>1.066</b> (2.167)
<b>Household Characteristics</b>									
Female Headed Household	<b>1.269</b> (2.329)	<b>1.707</b> (3.196)	1.038 (0.283)	<b>1.232</b> (1.732)	<b>1.579</b> (2.379)	1.017 (0.109)	1.349 (1.542)	<b>2.114</b> (2.202)	1.056 (0.219)
Children under 5	<b>0.835</b> (-3.542)	0.899 (-1.309)	<b>0.798</b> (-3.448)	<b>0.820</b> (-3.073)	0.860 (-1.545)	<b>0.787</b> (-2.783)	<b>0.844</b> (-2.005)	0.991 (-0.060)	<b>0.791</b> (-2.283)
Large Household	<b>0.776</b> (-1.607)	0.737 (-1.143)	0.815 (-1.043)	0.812 (-1.103)	0.873 (-0.440)	0.813 (-0.857)	0.662 (-1.386)	<b>0.374</b> (-1.801)	0.870 (-0.386)
Medium Household	<b>0.809</b> (-2.094)	0.808 (-1.232)	0.820 (-1.587)	<b>0.814</b> (-1.733)	0.979 (-0.109)	<b>0.747</b> (-1.960)	0.783 (-1.213)	<b>0.412</b> (-2.473)	1.061 (0.237)
Siblings 6 to 13	0.969 (-0.878)	0.972 (-0.479)	0.961 (-0.887)	<b>0.925</b> (-1.778)	0.935 (-0.970)	<b>0.907</b> (-1.707)	1.088 (1.355)	1.122 (0.958)	1.070 (0.914)
Siblings 14 to 19	<b>0.923</b> (-1.890)	1.009 (0.121)	<b>0.878</b> (-2.451)	0.949 (-1.022)	1.028 (0.334)	0.902 (-1.599)	<b>0.879</b> (-1.606)	0.960 (-0.267)	<b>0.846</b> (-1.757)
Ln Income by adult	1.034 (0.900)	1.058 (0.845)	1.019 (0.414)	<b>1.163</b> (2.959)	<b>1.167</b> (1.829)	<b>1.151</b> (2.189)	0.917 (-1.580)	0.926 (-0.705)	0.914 (-1.431)
Mother's absence	0.973 (-0.120)	0.736 (-0.572)	0.975 (-0.101)	1.190 (0.664)	0.743 (-0.478)	1.226 (0.682)	0.543 (-1.285)	0.692 (-0.349)	0.515 (-1.239)
Non nuclear Household	1.035 (0.400)	0.986 (-0.099)	1.062 (0.551)	0.936 (-0.635)	0.978 (-0.133)	0.902 (-0.755)	<b>1.355</b> (1.960)	1.067 (0.218)	<b>1.464</b> (2.076)
<b>Locality Characteristics</b>									
Rural Locality	<b>0.597</b> (-6.566)	<b>0.638</b> (-3.247)	<b>0.572</b> (-5.839)						
Number of Observations	7749	2504	5245	4629	1703	2926	3120	801	2319
Model Statistics	chi2(15)= 722.26	chi2(14)= 236.56	chi2(14)= 497.8	chi2(14)= 521.19	chi2(13)= 176.12	chi2(13)= 363.64	Chi2(14)= 68.67	chi2(13)= 30.11	chi2(13)= 52.45

\* Significant variables in bold.

such as greater employment opportunities. Anyhow, it becomes clear from the model results that female attendance is greatly benefited from increases in school supply<sup>4</sup>.

### School Attendance of Population Aged 16 to 19 (Table 3)

Even though empirical findings show that marriage is an important deterrent of school attendance, the inclusion of this variable in the model is difficult because endogeneity may be present since school attendance decisions are taken at the same time as marriage decisions. In order to solve this potential problem a Hausman test was conducted. The results showed marriage is exogenous so the variable could be included<sup>5</sup>.

In contrast with the two previous age groups, in this age group women show the same odds ratio of school attendance that men do.

Marriage, which includes consensual unions, showed a negative impact on attendance.<sup>6</sup> The impact of this variable turned out significant only for the urban population model. In the rural areas marriage does not make a big difference in education since the probabilities of continuing school are rather small anyway.

Father's schooling is highly significant and has a greater impact when men are considered separately, especially in rural localities. In contrast, mother's schooling is still more important for women and rural areas. Interestingly, female headship has a positive impact on all considered samples in this age group.<sup>7</sup>

Children under five impact negatively school attendance of population 16 to 19 but are only significant for the male population<sup>8</sup>. It is important to keep in mind that the presence of children under five in a household with population in this age group means that the reproductive period of the family has lasted over 10 years

Medium households are negatively and significantly related to school attendance in the total and rural population samples in relation to the small households (omitted variable), whereas large households are negatively related to school attendance in the total population and rural female population samples.

Siblings 6 to 13 are negative for school attendance only in the total urban population and total male population samples. The negative impact of siblings 14 to 19 is significant for the total population sample, male population, rural population and rural male population

Income was not significant on the total population sample, but has positive effect for the urban population samples, male and female.

Mother's absence was not significant for this age group sample, whereas non-nuclear household showed a positive impact in the rural sample<sup>9</sup>.

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<sup>4</sup> This variable is not exact because it is calculated at the municipality level. It would have been much more useful to include this variable at the locality level but the database did not contain the locality information.

<sup>5</sup> Men supply at municipal level was used as instrumental variable for the test.

<sup>6</sup> The odds ratio of school attendance decreases 70% for married population.

<sup>7</sup> Living in a female headed household increases school attendance odds ratio in 35% with a higher impact on women (47%) than men (25%).

<sup>8</sup> It should be noted that some of children could be sons or daughters of the population aged 16 to 19. The database of the Conteo only provides kindred with the household head but in the case the children were grandchildren, we are not able to tell which daughter or son is the parent.

<sup>9</sup> Tenure in a non nuclear household increases school attendance odds ratio of rural population in 26% with a similar percentage for women and men.

## **Concluding Remarks**

One of the main results of this analysis is that the female school attendance determinants differ substantially from male school attendance determinants. Family composition and the position of each member within the family impact school attendance in different ways for girls and boys.

Being a woman has a negative impact on school attendance of population age 6 to 13 and 12 to 15 but is non significant on the 16 to 19 age group. This result means that women who remain in their parents' home at 16 do not show disadvantage in school attendance in relation to men of the same age and condition. Working with three different age group samples allowed us to determine that it is between 6 and 16 years of age when girls experience a disadvantage related to school attendance.

Living in a rural locality reduces school attendance dramatically with a higher impact on the population aged 12 to 15 and on boys in comparison with girls. It is worth noting that this variable does not show a significant impact on girls aged 6 to 13.

The incompatibility between marriage (or union formation) and school attendance was confirmed by the results of the sample of population aged 16 to 19. The impact of this variable is especially large in urban areas, whereas it was not significant in rural areas.

Mother's schooling is the most important determinant of school attendance in the first and third sample analyzed, while father's schooling is most important for the middle sample where its impact is greater than the one of mother's schooling. We also find a larger impact of father's schooling in the sample of male rural population aged 16 to 19.

Results found here support an established finding: mother's schooling is more important for girls than for boys, while father's schooling is in relative terms, more important for boys.

Female headship relates positively with attendance in the total and female sample. Only in urban population aged 12 to 15 we find a negative impact of this variable. It is interesting to see that for the population aged 16 to 19 this variable has the opposite effect on girls than boys: positive in the first case and negative in the second one.

Children under five are negatively related to school attendance in the first and third sample. Nevertheless this variable showed a negative impact on the urban population 12 to 15, whereas in the sample of population 16 to 19 it was significant only for male population.

Siblings in the same age group always are negatively related to attendance in the primary school aged sample. For the 12 to 15 female population siblings 6 to 13 have a negative impact on school attendance, while the impact for the same age male population is positive. This finding would seem to indicate that girls' school attendance diminishes when domestic needs are greater at home, as is presumably the case with younger siblings in the household.

Siblings aged 14 to 19 impact differently in different age group samples. The impact is positive for the two younger age groups and negative for the older one. Thus, the impact on school attendance is greater when the siblings are of the same age group. Female school attendance from ages 6 to 15 seems to benefit from the presence of siblings 14 to 19.

From the results of all the variables measuring the presence of siblings in the household at different age groups we can infer that primary school age girls, especially in the rural areas, have much higher chances of school attendance when they occupy higher positions in birth order: they profit from the presence of older siblings while they do not undergo the disadvantages of the presence of children under five at home.

The results from the estimation of the three models indicate that children in large households have less probabilities of school attendance in the two older groups. Nevertheless, urban male population from 12 to 15 benefit from belonging to a large or medium household. Thus, small households are not advantageous to this population sample.

Tansel's findings regarding the importance of distance to school on education were confirmed by the results of our model for the population 12 to 15 where the school supply variable was included. Moreover, rural girls seem to benefit more than rural boys from school proximity, whereas in the urban areas the opposite was observed.

Income level was positive with lower or higher importance to each sex depending on the age group. The higher impact of this variable was observed in the population aged 12 to 15, with a larger impact on boys. In the primary school aged population sample the impact of this variable was smaller and only significant for girls.

Mother's absence has a strong negative impact on children 6 to 13 but is significant only on the girls' sample. This variable loses significance as we move to older age groups. For the intermediate age group (12 to 15) mother's absence is significant only in the women sample. In the older group sample this variable turned out not significant.

Non-nuclear households did not show the expected negative impact on school attendance. Moreover, some positive effects of this variable were found. From these results we can conclude that extended households in some way support school attendance.

The results of the analysis performed for this paper clearly show that school determinants need to be studied by age group, since we found that the impact of one variable on school attendance may differ completely from one age group to the next. We also found that family determinants act in different ways in each sex group.

Finally, the results discussed here allow us to conclude that the most vulnerable age group in relation to school attendance is the one aged 12 to 15. It is in this sample where income has the largest effect, where difference in school attendance between girls and boys can be observed and where large household show the largest negative effect.

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### **Specification of Variables Used in the Models:**

#### **Dependent Variable:**

Attendance =1 if the individual attends school

#### **Independent Variables:**

##### **Individual Variables**

Age Years of age at last birthday

Female =1 if sex is feminine

##### **Household Variables**

edmadhog Years of school approved by mother

edpadhog Years of school approved by father.

jfemhog =1 if household headship is feminine

hogde =1 if household has more than 7 members

hogmed =1 if household has between 5 and 7 members

men5hog number of household members under 6 years of age

menprihog number of household members between 6 and 13 years of age

mensechog number of household members between 14 and 19 years of age

madaus =1 if the mother is absent

nonuc =1 if household type is non nuclear.

lingwag Income indicator according to the number of adult equivalents <sup>10</sup>

$$lingwag = \ln \left( \frac{TotalHouseholdIncome}{Adult\ equivalents\ by\ household\ according\ Wagstaff} \right)$$

##### **Locality Variables**

Rural =1 if number of locality inhabitants < 2500

##### **Municipal Variables**

Secmil Number of secondary schools in the municipality for each 1000 inhabitants between 10 and 14 years of age<sup>11</sup>

$$Secmil_m = \frac{No.\ of\ secondary\ schools_m}{((Population_{10a14_m})/(1000))}$$

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<sup>10</sup> For the selection of an adult equivalent scale three methodologies were compared: Deaton, IWagstaff and OCDE. No major differences were found. Wagstaff was selected because income estimations were intermediate. For more information on these methodologies Parker and Wong (1999).

<sup>11</sup> This variable was included only in the model for the population aged 12 to 15. Unfortunately, we had to work at the municipal level since the CONTEO database does not provide an ID for the locality. This feature limits the explanatory capacities of the variable.