



INTER-AMERICAN DEVELOPMENT BANK
BANCO INTERAMERICANO DE DESARROLLO
LATIN AMERICAN RESEARCH NETWORK
RED DE CENTROS DE INVESTIGACIÓN
RESEARCH NETWORK WORKING PAPER #R-449

**A DYNAMIC ANALYSIS OF HOUSEHOLD DECISION-MAKING
IN URBAN COLOMBIA, 1976-1998:
CHANGES IN HOUSEHOLD STRUCTURE,
HUMAN CAPITAL AND ITS RETURNS,
AND FEMALE LABOR FORCE PARTICIPATION**

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AUGUST 2002

**Cataloging-in-Publication data provided by the
Inter-American Development Bank
Felipe Herrera Library**

Sánchez Torres, Fabio.

A dynamic analysis of household decision-making in urban Colombia, 1976-1998 : changes in household structure, human capital and its returns, and female labor force participation / by Fabio Sánchez Torres, Jairo Núñez Méndez.

p. cm. (Research Network Working papers ; R-449)

Includes bibliographical references.

1. Human capital--Colombia. 2. Women--Employment--Effect of education on. 3. Labor supply--Effect of education on. I. Núñez Méndez, Jairo. II. Inter-American Development Bank. Research Dept. III. Title. IV. Series.

331.11 S336 --dc21

©2002

Inter-American Development Bank
1300 New York Avenue, N.W.
Washington, D.C. 20577

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Abstract¹

The objective of this paper is to examine the changes and dynamics of household structure, human capital and the returns to education, labor earnings, women's labor force participation and investment in human capital. The approach used in the analysis is the so-called "cohort technique," which consists of following across time men and women born in the same year or year spell. The main sources of information for this work are the quarterly Household Surveys beginning in 1976. With such information a database of more than 6 million observations (workers, parents, children, etc.) was constructed. The research results show that the number of children of the younger parents has drastically decreased. This process has been accompanied by a significant increase in women's labor force participation and higher women's school attainment. The study also points out that the school attainment of the younger generation of women is higher than men's and that the income gap between men and women of the new generation, after controlling for education, is lower than the gap in older generations. Finally, the study indicates that human capital accumulation has been very unequal for different income groups. The children of low educated parents achieve low levels of education both in old and new generations. Thus, escaping from the poverty trap is as difficult today as in the past, as education opportunities are concentrated in the middle and high-income groups.

Key words: human capital, cohort analysis, return to education.

¹ We wish to acknowledge insights and comments by Orazio Attanasio, Miguel Székely and other participants in the seminar held in Mexico City in March 1999.

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1. Introduction

The objective of this study is to examine, by means of the cohort technique, the changes and dynamics of the structure of households, human capital and returns to education, labor force participation and investment in human capital for the period 1976-1998. In the last quarter of the twentieth century Colombia experienced profound changes in its economic and social structure. These changes include the acceleration of the urbanization process, the massive incorporation of women into the labor force, greater stocks of human capital for men and, in particular, for women, and a sharp decrease in fertility rates. At the same time, there have been important changes both in the structure and composition of families, such as an increase in the percentage of single-parent families, and in children's accumulation of human capital.

How fast have these changes been? What has been the evolution of returns to education? What have the main determinants of women participation changes been? Has the labor income gap between men and women diminished? Has the accumulation of human capital been similar among children of parents belonging to different socioeconomic backgrounds?

The answers to these questions are interrelated and may be described in the following manner. Higher stocks of human capital and greater educational attainment by women are associated with greater labor participation by women and a higher opportunity cost of children, which leads to a lower number of children and smaller families. In addition, more educated mothers raise fewer children and invest more in them. Given these circumstances, they are increasingly able to run and maintain a household without the presence, and sometimes without the assistance, of the husband.

The objective of this study is to answer these questions based on the evidence extracted from the Colombian urban household surveys of the last quarter-century. The trends found will show how urban households in Colombia have evolved and what may be expected for the next century. The present study involved constructing a large database with information on personal and household characteristics of men, women and their families for the period 1976-1998. The information makes it possible to examine changes in family structure and analyze the accumulation of human capital of men, women and children. It is also possible to measure the evolution of labor earnings and the changes in the returns to education, as well as explain patterns of female labor force participation.

Thus, according to the findings, the story presented in detail below is as follows. Returns to education and expected earnings of women have increased for most education levels, which may have contributed, along with more educated parents in each successive generation, to raising the level of education among women. At the same time, higher levels of women's education in urban Colombia have prompted an increase in their labor participation rates and their investment in children, with a corresponding decrease in family size and expected number of children. The present document, which will present each part of the story, is divided into five sections, including the introduction. The second section examines the evolution by cohorts of family structure and composition. The results will show that the younger generations of household heads are more likely to lead extended rather than nuclear families. It is additionally found that single-parent families are also more common in younger generations. The empirical evidence will show as well that family size is smaller in younger households. Also analyzed are mating decisions at three points of time, which indicate that men and women tend to marry people of the same education level. Section Three examines the stock of human capital, returns to education, earnings and earning differentials by cohort. It is found that the stock of human capital is larger in younger generations and that women's stock has grown faster than men's. It is also found that, although returns to education are lower for younger cohorts than their older counterparts, there is a significant premium in returns to education for college-educated workers. Section Four presents changes in women's labor force participation. The evidence shows that younger cohorts of women have experienced a remarkable increase in labor participation, basically explained by their higher schooling attainment. Section Five analyzes the dynamics of children's investment in human capital and children's school enrollment rates by cohort and parents' education. It is observed that, for any parent cohort, the children of more educated parents have greater enrollment rates and, consequently, greater schooling attainment. Moreover, for the younger parents' cohorts, the school attainment gap between the children of the more educated and the children of the less educated seems to have increased. Section Six concludes.

2. Family Structure

2.1 Family Type and Composition

This section presents the evolution of the family type and family composition according to the cohort (year of birth) of the household head. The data was compiled from quarterly household

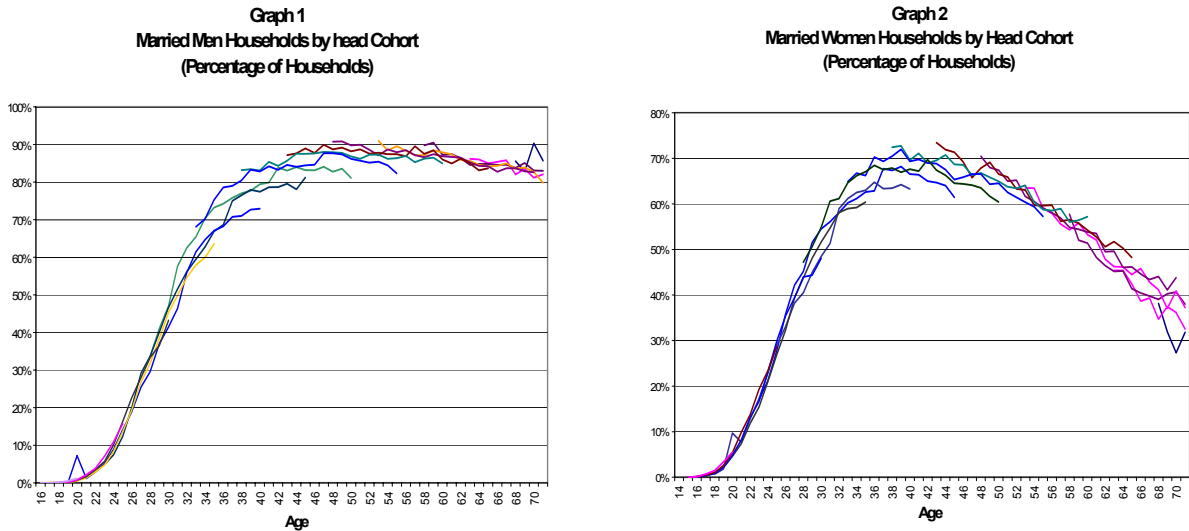
surveys from 1976 to 1998. Information was compiled regarding household characteristics (number of household members, and marital status, age, gender and education of the household head) and the sample was divided, according to household head's year of birth, into five-year spells beginning with 1910-1914. The mean value of the variable to examine was then calculated for each household head cohort at each (average) observable age. For instance, it was possible to observe in the 1976 household surveys the men and women of the 1910-1914 cohort when they were (on average) 64 years old, in the 1977 household surveys when they were 65, and so on. The mean value of the variable to be computed (number of household member, percentage of childless couples, etc.) can then be computed at each (average) age of the household head cohort. At the same time, it is possible to observe, for example, the men and women of the 1945-1949 cohort in the 1976 household surveys when they were (on average) 29 years old, in the 1985 household surveys when they were 38 years old, and so on.

Given the data and the methodology described above, the percentage of men and women, either single or married, is calculated for each cohort. In addition, the percentage of different types and composition of households is characterized for each observable age and cohort.

Graphs 1 and 2 depict the percentage of married men and married women. As expected, the percentage of married men and married women increases with age. However, there are two differences between the patterns of men and women. First, while most men (around 90 percent) remain married until death, the percentage of married women reaches a peak at age 40 and diminishes afterwards. This may be due to women's higher life expectancy. Second, the percentage of married women is higher than men's percentage until about age 32, when the percentage of married women becomes lower. Thus, at age 44 the percentage of married men reaches 90 percent (for older cohorts) while the percentage of married women barely reaches 70 percent (also for older cohorts). For younger cohorts, the percentage of married men and women is lower, as observed in Graphs 1 and 2.² This is clearly the result of an increase in the percentage

² We also established the mating decisions of men for the years of 1976, 1987 and 1998. In 1976 the most educated married men had spouses belonging to both the most educated women's groups and to the non-educated groups, while non-educated men married mostly non-educated women (see Appendix 1). This mating pattern may be due to the low proportion of educated women (in relation to men) in 1976. However, the pattern has drastically changed over time, mainly for educated men. In fact, married men with college education in 1985 and in 1998 have spouses belonging in higher proportions to the same education level group. Thus, 29% and 43% of married men with college education had, in 1987 and 1998 respectively, wives with that education level. In contrast, in 1985 and 1998 married men with fewer than 10 years of schooling had wives mostly with 10 or fewer years of schooling, as observed in Appendix 1.

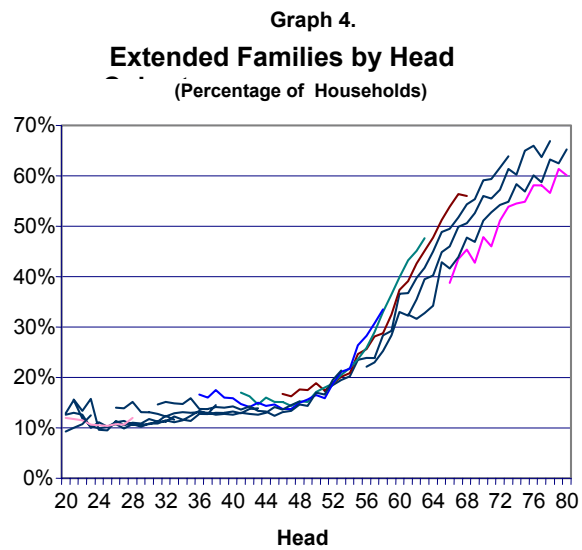
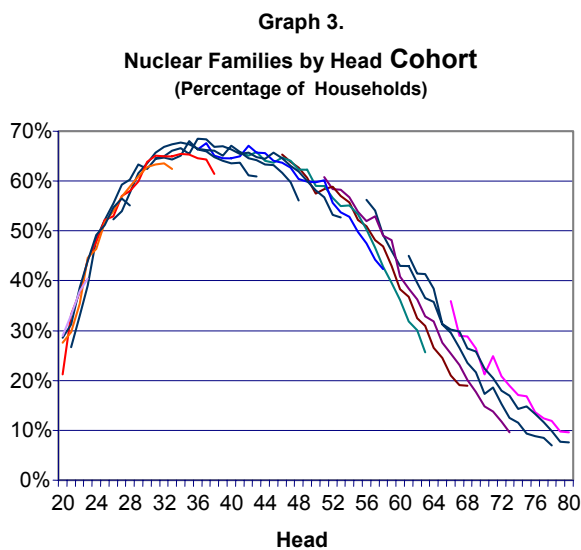
of separations and divorces. This is in turn reflected in the increase of single-parent families, as will be seen below.³



Graphs 3 and 4 depict, respectively, the percentage of nuclear (husband, wife and children younger than 30) households and extended families (defined as families whose members are children 30 years old or more or have additional adults) by the age and cohort of the household head. According to Graph 3, 30 percent of households with heads of around age 20 are nuclear families. This percentage increases with the age of the head until age 38, when the percentage of nuclear families reaches its peak. Thus, 68 percent of 38-year-old household heads lead nuclear families. However, for household heads at age above 38 the percentage of nuclear families decreases and, as shown in Graph 4, the percentage of extended families increases. This pattern is mainly due, of course, to the rising age of children. However, the decreasing pace is

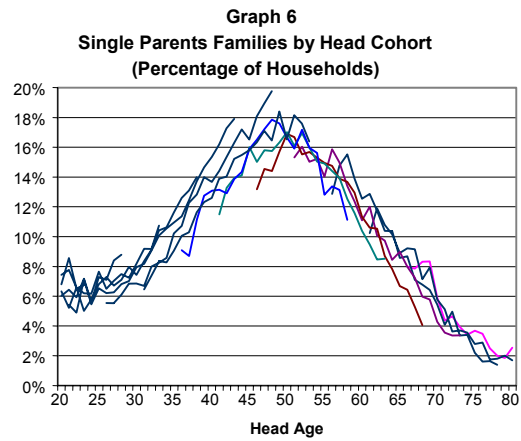
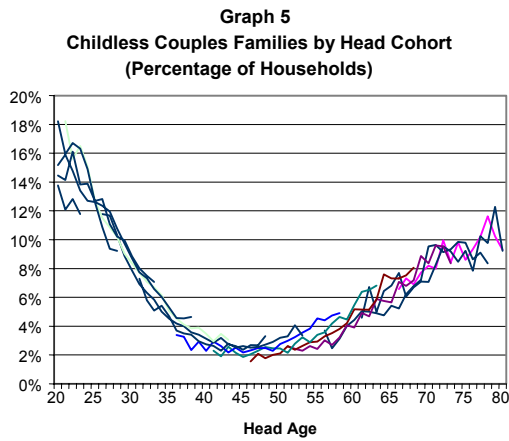
³ We carried out a similar exercise for the percentage of male and female single-person households. The results obtained were practically a mirror of Graphs 1 and 2. The percentage of male single-person households decreases rapidly, from 16 percent to 2 percent, between the age of 20 and the mid-30s. The percentage of single-person male households remains low, even for men of a very old age. The pattern of single female households was quite different. First of all, while 12 percent of 20-year-old females are in single-person households, among 30-year-old women this figure is 2 percent. The pattern reverses, however, at around age 50. While 2 percent of 50-year-old are in single-person households, this figure doubles to 4 percent among 60-year-old women and reaches 10 percent among 80-year-old women, which shows that men generally died at an earlier age than women. Although some cohort differences can be observed in the graphs, they are apparently quite small.

quite slow until about the household is about age 50. Thus, fewer than 20 percent of the households led by heads younger than 50 are extended family households. However, this percentage increases sharply for household heads older than 50 years. For instance, around 60 percent of the households headed by 70-year-olds are extended families. The pattern described clearly illustrates the natural result of aging of young children and parents. Thus, the older the parents (and the children), the greater the percentage of extended families. Finally, there are apparently some cohort effects in the trends of percentage of nuclear and family extended. According to the graphs, household heads belonging to younger cohorts are more likely to lead extended-family households.

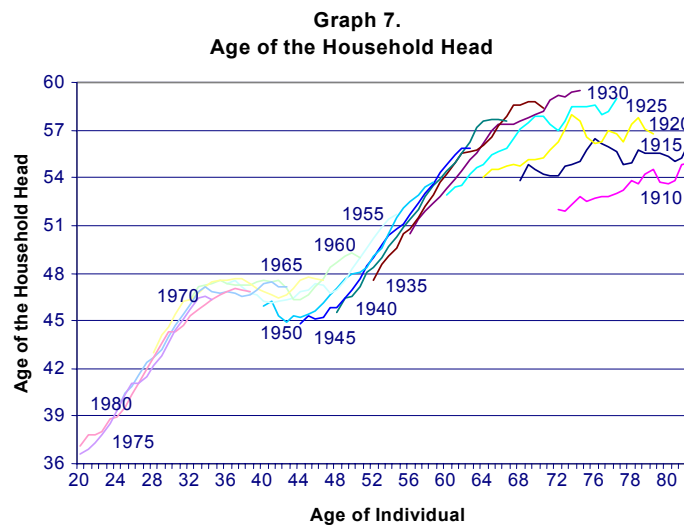


Graph 5 shows the percentage of households, by age and cohort of the head, made up of childless couples. The percentage of households made up of childless couples and headed by a 25-year-olds is around 12 percent and decreases as the head's age increases, making up only 2 percent of households headed by 50-year-olds. However, the trend reverses for heads older than 50. Graph 6 presents by cohort and age the percentage of households whose head is a single parent. It is clear from the graph that the older the household head (up to age 45), the higher the probability of heading a single-parent household. However, once the household head is older than 45 the probability of heading a single-parent household decreases. It is also quite apparent from Graph 6 that there is a strong cohort effect on single parenthood. Thus, at a given

household head age, the percentage of single-parent families among the younger generations is higher.

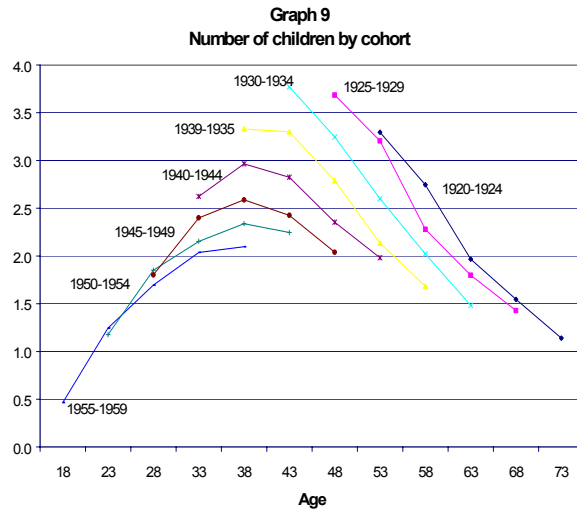
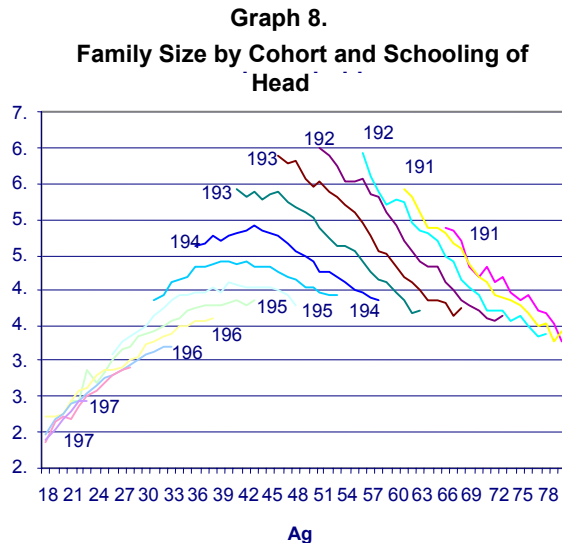


Finally, Graph 7 relates the age of the individual (excluding the household head) with the age of the household head by cohort. The graph indicates that patterns in family formation have varied significantly among cohorts, particularly between older and younger cohorts. In fact, Graph 7 shows that household heads belonging to older cohorts were much younger than today's household heads. However, large changes in family formation have occurred for cohorts born after 1965. These changes may be related to significant increases in school attainment among younger generations of men and women (as shown below) that have delayed their mating decisions.



2.2 Family Size

Graph 8 presents the family size by cohort of the household head at each age. We can observe from Graph 8, and Graphs A.1 to A.6, that there is a strong cohort effect on family size regardless of the household head's education level. Thus, the family size of the 1935 cohort household head at age 40 totals about seven people, while the 1955 cohort family size is 4.8.



The family sizes of the older generations of household heads are quite similar regardless of the household head's household education level. However, in younger cohorts the reduction in family sizes seems to be stronger among the families of the most educated household heads. This may be explained for the higher opportunity cost of raising a child for the most educated women. In fact, according to Appendices 1 and 2, the percentage of women born before 1930 with 11 years of education or more was about 8 percent (and about 15 percent for men) and the percentage with college was less than 1.5 percent (and about 7 percent for men). However, the percentage of women born between 1950 and 1970 with 11 years of education or more is about 40 percent (and about 36 percent for men) and the percentage with college around 10 percent (and less than 9 percent for men). Clearly the younger generations of women have, on average, higher school attainment, which may explain both the reduction in family size (Graph 8) and in number of children (Graph 9) that have occurred over time. In fact, as shown in Graph 9, the

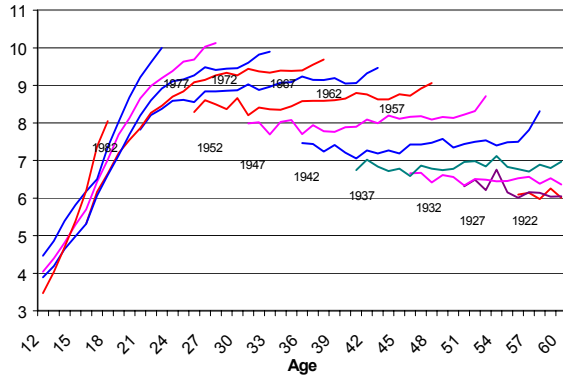
number of children fell almost by 50 percent in a 20-year span. Thus, the cohorts born in 1935-39 had about four children compared with the two children of the cohorts born in 1955-59.

3. The Stock of Human Capital and its Returns

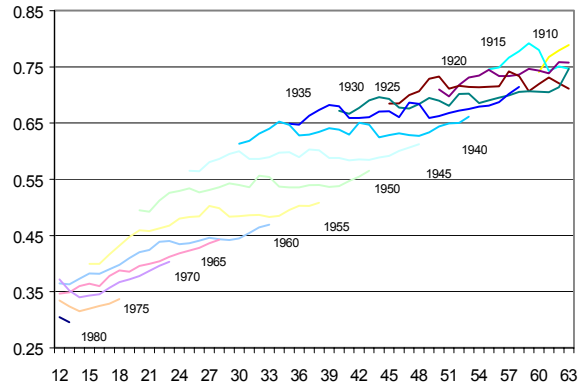
3.1 Stock and Accumulation of Human Capital

This section examines the stock and coefficient of variation of human capital for men and women by cohorts. Graph 10 depicts the stock of human capital of men's cohorts since 1927. Until the 1947 cohort the accumulation of human capital was quite slow. The difference in years of schooling from one cohort to the next, five years younger, was 0.25 years. The stock subsequently grew a little faster for the 1952 and 1957 cohorts, slowed down for the 1962 and 1967 cohorts, and apparently accelerated for the cohort born after 1970. The increase in men's years of schooling has been accompanied by an important change in the profile of degree completion. Thus, around 7 percent of the men born before 1930 completed a college degree and more than 65 percent had primary or less than primary education (Graph 14 and Appendix A.1). The percentage of men born between 1930 and 1960 with primary education or less decreased from 60 percent to 30 percent and the percentage with complete and incomplete secondary school increased from 27 percent to 55 percent, while the percentage with college education only reached 10 percent. Graph 11 presents the coefficient of variation of the men's stock of human capital, which is lower among younger cohorts. This implies a significant reduction in the dispersion of human capital among men as the coefficient of variation depends on the differences in inter-cohort education attainment. The coefficient of variation also increases overtime for the same cohort. Thus, at an early age of the cohort the education attainment gap is not very wide. However, as long as some people drop out from the school system the intra-cohort education coefficient of variation rises, reflecting the differences in education opportunities. Among the new generations of men, as shown in Graph 11, the "slope" of the coefficient of variation does not seem to be lower.

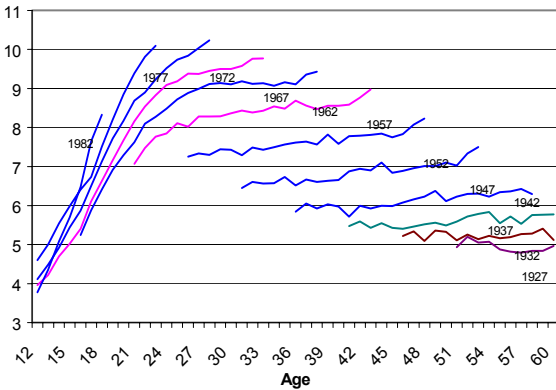
Graph 10
Men's Average Years of Schooling by Cohort



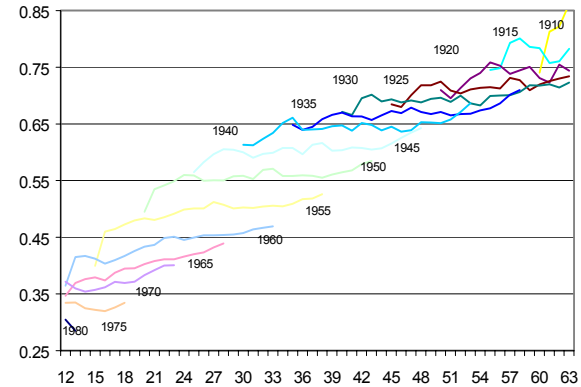
Graph 11
Men's Variation Coefficient



Graph 12
Women's Average Years of Schooling by Cohort

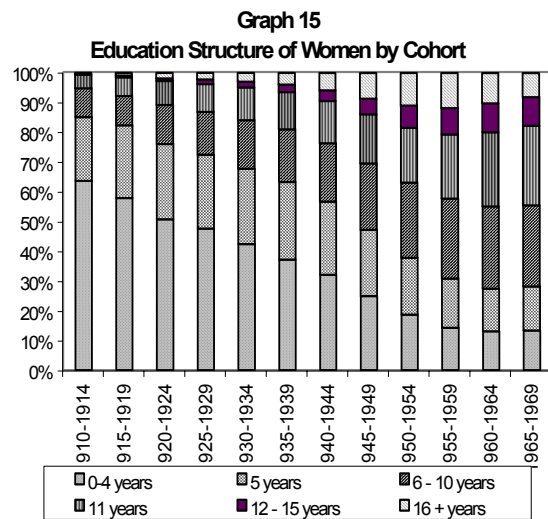
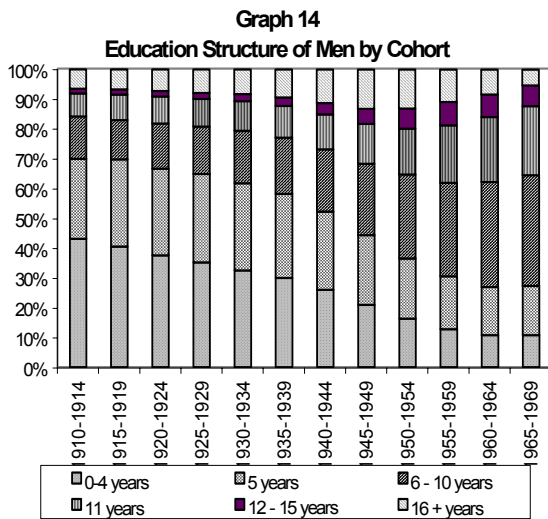


Graph 13
Women's Variation Coefficient



Graph 12 contains the stock of women's human capital by cohort, measured as their average years of schooling. It is fairly clear from the graph that there has been a significant increase in women's human capital. For instance, the average years of schooling of the 1927 cohort were about 5, while for the 1947 cohort the average was about 6.5. However, the accumulation of human capital accelerated for the cohorts 1947 to 1962 at a rate close to one additional year by cohort, slows down a bit for the 1967 cohort and has gone quite fast for the younger cohorts. Thus, the average years of schooling at 30 were 7.2 for the 1952 cohort, 8.2 for the 1957 cohort and 9.5 for the 1967 cohort. As with men, the increase in years of schooling of women has gone together with an important change in the profile of degree completion. Thus, only around 1.5 percent of women born before 1930 completed a college degree, and more than 75 percent had primary or less than primary education (Graph 15 and Appendix A.2). The percentage of women born between 1930 and 1960 with primary education or less decreased

from 65 percent to 27 percent, a rate of decline more rapid than among men; the percentage with complete and incomplete secondary school increased from 27 percent to 53 percent, while the percentage with college education only reached 11 percent (Graph 15). The coefficient of variation of the stock of women’s human capital has the same pattern as that of men: it was as high among the old generations of women as it was among the old generations of men, and it has decreased as well among the new generations of women, reflecting the inter-cohort expansion of educational opportunities. However, as with men, the “slope” of the coefficient of variation for the same cohort also rises.



3.2 Returns to Human Capital

3.2.1 Data and Methodology

The data utilized in this section are primarily from the 93 quarterly Household Surveys for the main seven Colombian cities, from March 1976 to June 1998. The sample is limited to individuals from 12 to 60 years receiving labor earnings. The top coded earning data (on monthly basis) and missing and not reported earning data (on monthly basis) have been corrected by using the methodology described in Núñez and Jiménez (1998) and Núñez and Sánchez (1999), respectively.

From 1977 to 1981, around 9,000 people were interviewed in each quarterly survey, which means that the annual sample during this period was around 36,000 people. Since 1982

the number interviewed has tripled to around 110,000 per year. In order to obtain a large sample the 93 quarterly surveys were compiled into a single file, producing a database with more than 2 million observations (Table 1). The objective is to examine the changes in the behavior of labor income and returns to education for education groups, gender and cohorts.

Table 1.
Sample Size

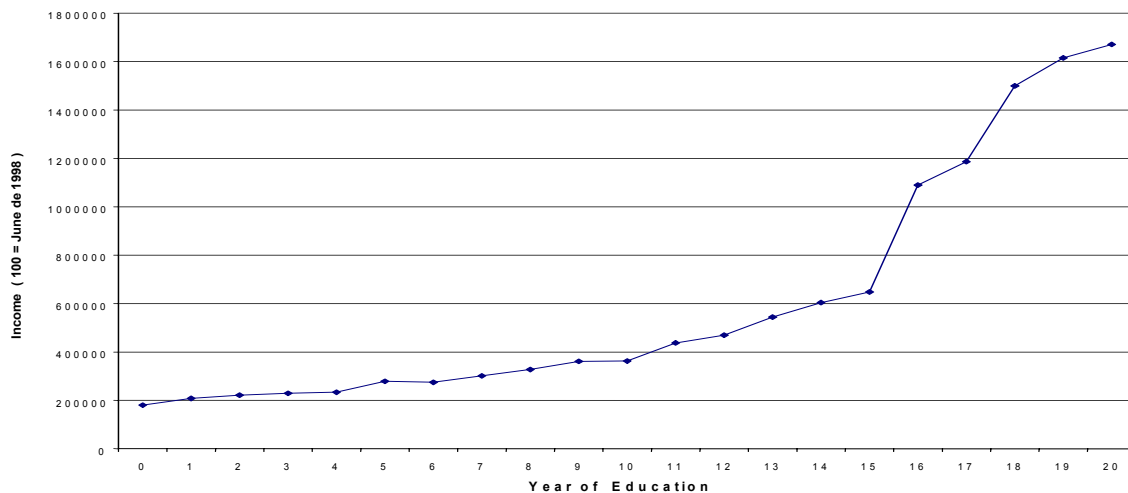
Year	Frequency	Share	Accumulated
1976	41,761	2.07%	2.07%
1977	38,344	1.90%	3.98%
1978	23,621	1.17%	5.15%
1979	38,428	1.91%	7.06%
1980	33,363	1.66%	8.72%
1981	44,871	2.23%	10.95%
1982	103,255	5.13%	16.08%
1983	123,730	6.15%	22.22%
1984	128,941	6.41%	28.63%
1985	100,818	5.01%	33.64%
1986	106,294	5.28%	38.92%
1987	112,702	5.60%	44.52%
1988	113,772	5.65%	50.17%
1989	114,784	5.70%	55.87%
1990	97,090	4.82%	60.69%
1991	100,869	5.01%	65.70%
1992	104,601	5.20%	70.90%
1993	107,988	5.36%	76.26%
1994	112,157	5.57%	81.83%
1995	107,491	5.34%	87.17%
1996	105,897	5.26%	92.43%
1997	99,838	4.96%	97.39%
1998	52,456	2.61%	100.00%
Total	2,013,171	100.00%	

One of the main sample problems is whether the characteristics of the migrant labor force differ from those of the urban “historical population.” If their socioeconomic characteristics were different, the results may be biased. A possible solution could have been to exclude the migrant population from the sample. However, we were not able to do so, mainly for two reasons: i) the questions about the person’s geographic origin and number of years living in the city (where the Household Survey is conducted) were not asked in every quarter; and ii) the computation of the migration variable (percentage of workers who have lived less than 5 years in the city) shows bizarre jumps from one survey to the next. Calculations based on the household survey show, however, that the percentage of migrants has been around 11 percent of the labor force. In order to determine whether migrants’ characteristics and behavior differ from those of non-migrants we estimate both the average years of education of the migrant and the migrant’s

participation rate. The calculations are presented in Graphs A.7 and A.8. Graph A.7 shows that migrant and non-migrant years of education are quite similar, with a small difference in favor of non-migrants workers (around 0.1 years). The participation rates of migrant and non-migrant workers are also very similar (Graph A.8). These two results lead us to conclude that the utilization of the whole sample (without excluding migrants) does not introduce a significant bias (or even a small bias) into the estimations we will carry out.

In order to determine the education groups into which cohorts are to be divided, we calculated for the whole sample the person’s average monthly labor earnings by years of education. The results of the calculation are presented in Graph 16 and in Appendix A.7, which shows that there are significant increases in average income once a school degree (primary, secondary and college) is achieved. However, an enormous jump in income occurs once a college degree⁴ is obtained (almost 100 percent for men and 71 percent for women). From Graph 16 it is clear that the labor earnings exhibits “jumps” at five, eleven and sixteen years of schooling. According to this pattern, we defined six educational groups: workers between 0 and 4 years of schooling (incomplete primary), 5 years (complete primary), between 6 and 10 (incomplete secondary), 11 (complete secondary), between 12 and 15 (incomplete college and technical education) and more than 16 (complete college and more).

Graph 16.
Average Income by Year of Education



⁴ In fact, significant jumps occur after each year of education achieved after college, as shown in Graph 1.

3.2.2 Cohort Analysis

This section presents the estimates of the returns to education by cohort. The returns to education differ not only between education levels but also between generations and over time. These differences can be grasped by using cohort analysis techniques, which basically consist of following across time a sample of individuals born in a given year or time span. By using such a technique it is possible to capture the earnings profile and other variables for a group of people throughout the life cycle. It also allows comparing different generations at the same age and observing changes in patterns of income, relative income, savings, expenditures, number of children, participation rates, etc. One way of capturing cohort effects on income is by introducing into a Mincer equation cohort dummy variables interacting with schooling in order to isolate changes in returns to education by generation, as shown in the following equation:

$$\ln Y_i = \beta_0 + \beta_1 S_i + \beta_2 A_i + \beta_3 A_i^2 + \sum_{j=1}^{J-1} \xi_j d_j + \sum_{k=1}^{K-1} \psi_k d_k + \sum_{j=1}^{J-1} \alpha_j d_j S_i + \sum_{k=1}^{K-1} \zeta_k d_k S_i + \mu_i \quad (3)$$

Where d_k are year dummies and d_j are cohort dummies. We avoid the multicollinearity problem that may arise between age and cohort by defining a cohort as a group of individuals born within a five-year spell and not in a single year. The specification of equation (3) captures not only the cohort shift of the intercept but also the changes in the slope of the return to education ($d_j * S_j$). The coefficients obtained are presented in Table 2.⁵ The coefficients on the left side of Table 2 (year effects interacting with schooling) suggest that the average return to education had important fluctuations during the period under study. It decreased between 1976 to 1981 from 0.12 to 0.09 and remained constant until 1992, rising sharply to 0.11 between 1992 and 1998. The right side of Table 2 suggests that the average return to education by cohort has been decreasing. Thus, the rate of return to education for the generation born between 1910-1914 has been on average 0.12, while the rate for the generation born between 1970-1974 has been 0.08.

⁵ The identification problems of the age variable when cohort effects are introduced are well known. We think we avoid such a problem by defining cohorts with individual born in a five-year time span. However just to be sure of our procedure we ran the Mincer equation model without the age variable but leaving in the regression the cohorts and time effects. The estimates of the return to education either by cohort or year do not change at all, as shown in Graphs A.12 and 13.

Table 2.

Changes in the Return to Education by Year and Cohort					
Changes by Year¹			Changes by Cohort¹		
Year	Coefficient	Returns	Cohort	Coefficient	Returns
1976	0.0285	0.1169	1910-1914	0.0328	0.1212
1977	0.0226	0.1110	1915-1919	0.0325	0.1209
1978	0.0178	0.1062	1920-1924	0.0288	0.1172
1979	0.0110	0.0994	1925-1929	0.0250	0.1134
1980	0.0069	0.0953	1930-1934	0.0228	0.1113
1981	-0.0001	0.0883	1935-1939	0.0219	0.1103
1982	0.0027	0.0911	1940-1944	0.0206	0.1090
1983	0.0042	0.0927	1945-1949	0.0183	0.1067
1984	0.0043	0.0927	1950-1954	0.0132	0.1016
1985	0.0034	0.0918	1955-1959	0.0061	0.0945
1986	0.0002	0.0886	1960-1964	0.0000	0.0884
1987	0.0000	0.0884	1965-1969	-0.0040	0.0845
1988	0.0003	0.0887	1970-1974	-0.0095	0.0789
1989	0.0014	0.0899	1975-1979	-0.0282	0.0602
1990	0.0024	0.0908	1980-1984	-0.0482	0.0402
1991	0.0032	0.0916			
1992	0.0061	0.0946			
1993	0.0047	0.0931			
1994	0.0038	0.0922			
1995	0.0062	0.0947			
1996	0.0113	0.0997			
1997	0.0176	0.1060			
1998	0.0252	0.1136			

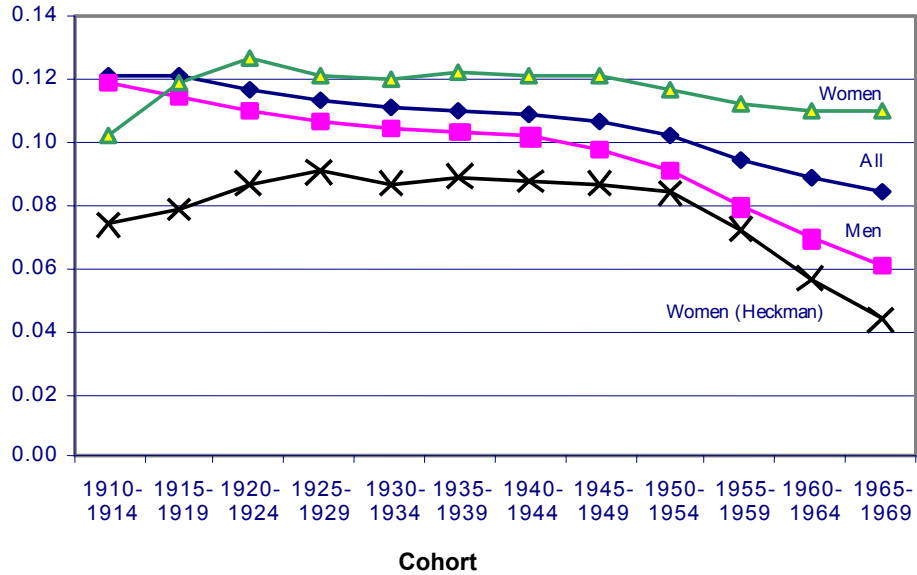
¹ The Return to Education by year or cohort is the sum of the average return (0.0884) and the specific coefficient by year and cohort

The estimates for men's and women's returns to education both by cohort and by year are depicted in Graphs 17 and 18. The men's returns to educations have been falling steadily for each cohort, although this process has been more pronounced for the cohorts born after 1950. In fact, men's returns to education fell from 0.12 for the cohorts born in the 1910s to 0.085 for the cohorts born in the 1960s. Women's returns to education exhibit a different pattern. They remained more or less constant for the cohorts born between the 1910s and the 1950s and fell only slightly (to about 0.11) for younger cohorts.

The results change dramatically, however, when we correct for participation bias by using Heckman's methodology (see Appendix A.3 and A.4 for the estimated equation). In order to avoid identification problems the following variables entered into the participation equation and did not enter into the wage equation: number of children under 6, between 6 and 11, 12 and 17, 18, etc., non-labor income, average age of household, average education of household and city dummies. According to Graph 17, women's returns to education are much lower if the equations are corrected. In addition, the decrease in returns to education observed in the younger men's

cohort is even sharper for younger women (see Appendix A.5 and A.6). This might be the result of a more idle labor force of young women due to their child-raising activities.

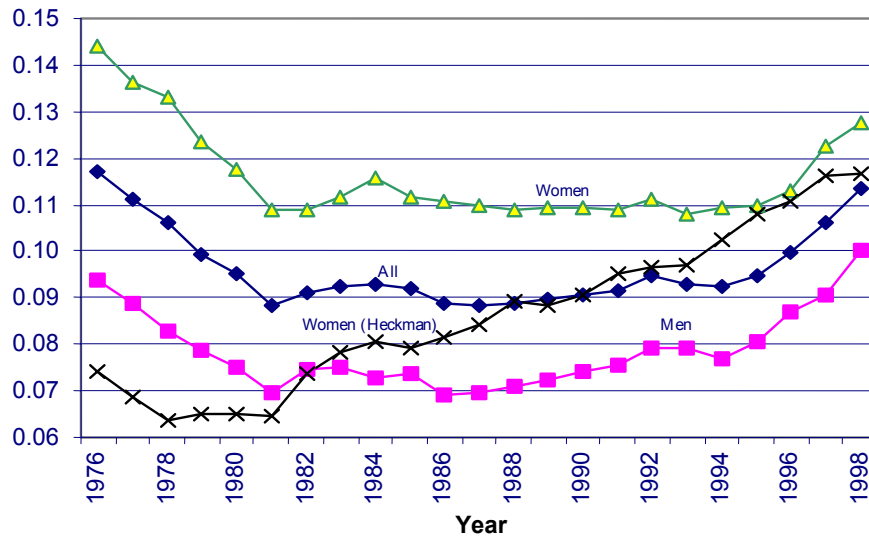
Graph 17.
Return to Education by Cohort



Graph 18 presents the yearly returns to education for men and women from 1976 to 1998. As observed, women’s returns (without Heckman’s correction) have been higher than men’s (by about 0.04 points), although they have displayed the same trend. In fact, returns to education fell between 1976 and 1981, remained more or less constant during the 1980s and increased during the 1990s. Women’s returns to education, corrected for participation, were lower than men’s at the end of the 1970s but grew steadily during the 1980s and 1990s.

The econometric results show the evolution of returns to education by cohort and gender. Nevertheless, this approach shows only the general trends. A complete picture of the evolution of earnings and returns to education and experience, relative earnings, relative returns to education and relative returns to experience by education groups, cohorts and gender will be presented in the following section.

Graph 18.
Returns to Education by Year



3.2.3 Income Profile by Cohort, Gender, and Education

This section presents the income profile of individuals in the sample by cohort, education level and gender. The sample is divided into fifteen five-year cohorts, starting with the cohort born between 1910 and 1914 and ending with the one born between 1980 and 1984. Each cohort was divided by gender and by six educational groups. The sample is thus divided into 180 groups that are tracked through each year of the sample. Then, the average labor earnings (deflated at 1998 prices) were calculated for every cohort, educational group and gender group for each year of the sample.⁶

In order to obtain a neat and clear picture of each cohort's earning profile of the different cohorts, the data was smoothed by following Deaton's (1997) and Attanasio's (1994) techniques. The smooth process consists of running a fifth-order polynomial on age and on cohort-specific intercept and year dummies whose coefficients are constrained to sum zero.⁷ The smoothed profiles are given by the polynomial on age with the cohort-specific intercepts. The smooth income profiles of men are presented in Graphs 19 to 24 and of women in Graphs 25 to 30.

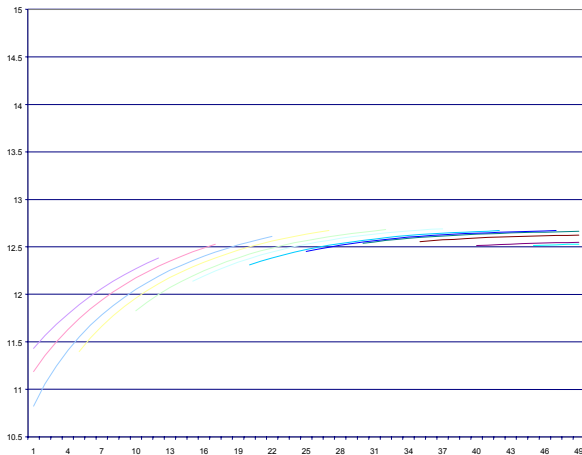
⁶ The size of each cohort-gender-education cell is presented in Tables A.1 and A.2.

⁷ Men's and women's earnings were calculated using Attanasio's (1994) methodology. The graphs obtained were somewhat messy, making it difficult to distinguish patterns of income among the different cohorts. Furthermore, towards the end of the graphs (at older age) all the cohorts jumped up and down, perhaps due to the sample size of the older cohorts, which are additionally divided into education groups.

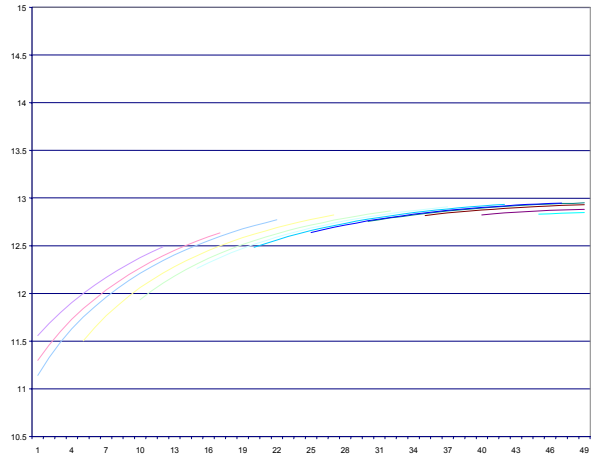
The labor earnings profiles show that average labor earnings differ by education and gender. Graphs 19 and 20 show that the average earnings of men with incomplete and complete primary school has increased for every cohort and, as expected, the average earnings of the former have always been lower than the latter's. Thus the younger the generation of the men with incomplete and complete primary the higher their average income. It thus appears that the returns to education for this education group have increased for the younger generations. Thus, inequality among this education group increased in favor of the young.

In relation to secondary schooling, as shown in Graphs 21 and 22, younger men with incomplete and complete secondary school earn less at the same age than older men with the same schooling. Unlike the men with primary school, the returns to educations of men with incomplete and complete secondary school have sharply decreased. The same pattern is observed in men with incomplete and complete college. Thus inequality increased among this education group in favor of the old.

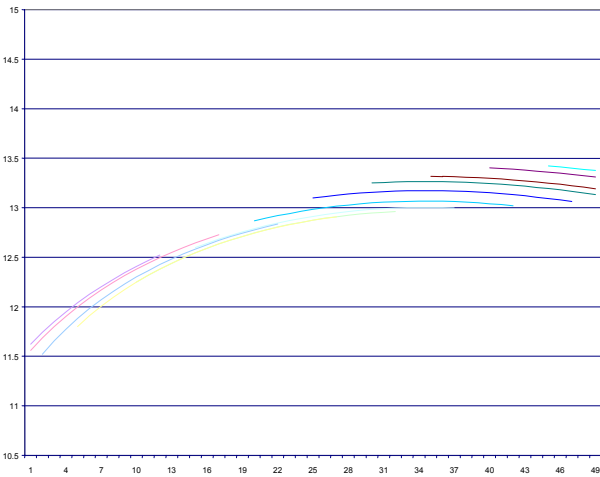
According to Graphs 23 and 24, each new generation of men with college education earned less than the previous generation at the same age. In this respect, inequality among this education group increased in favor of the old. Earning patterns of men's cohorts may also reflect observed changes in the relative supply by education. As shown above (Graph 14) the relative supply of men with incomplete and complete primary school has sharply dropped among more recent generations, which may have led to an increase in their labor earnings.



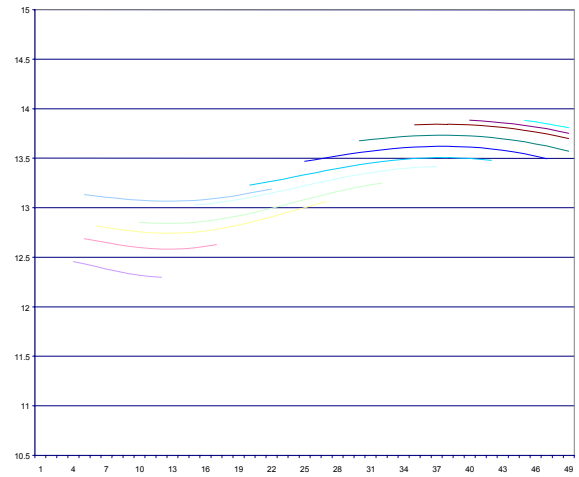
Graph 19 0-4 years



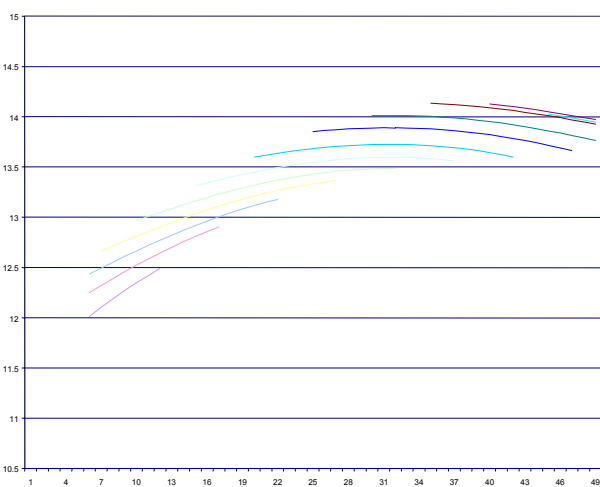
Graph 20 5 years



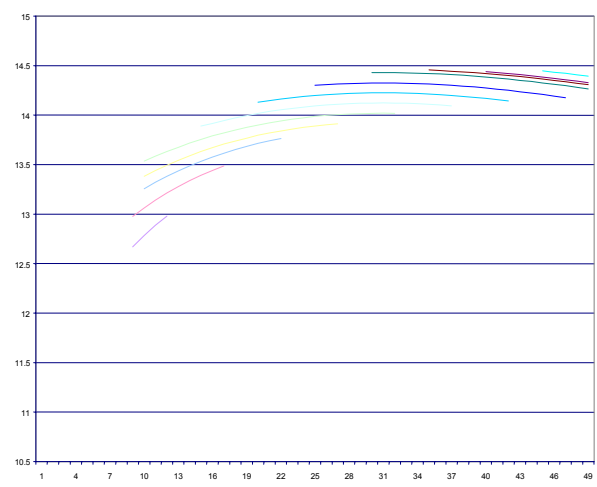
Graph 21 6-10 years



Graph 22 11 years



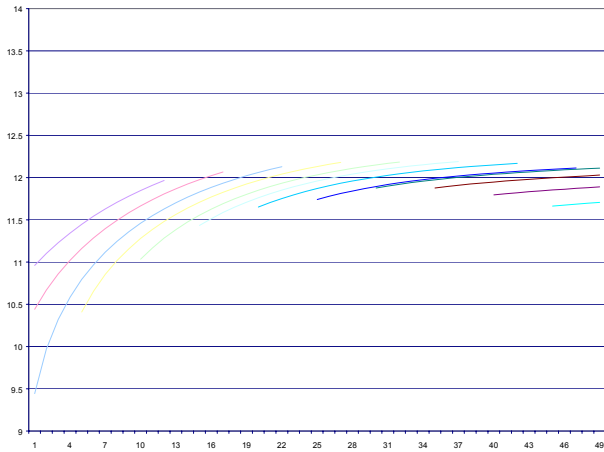
Graph 23 12-15 years



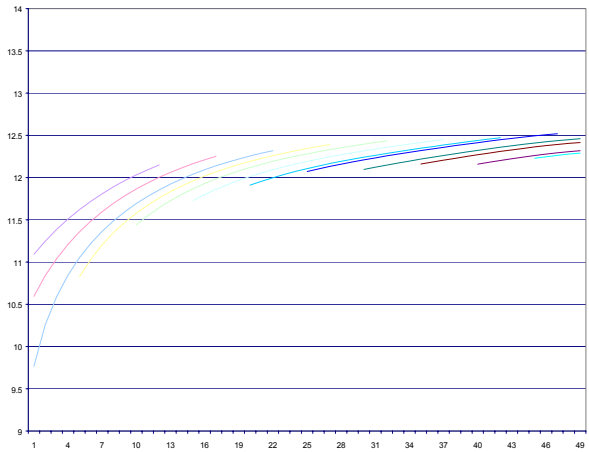
Graph 24 16+ years

Smooth Income Profiles of Men by Cohort and Education

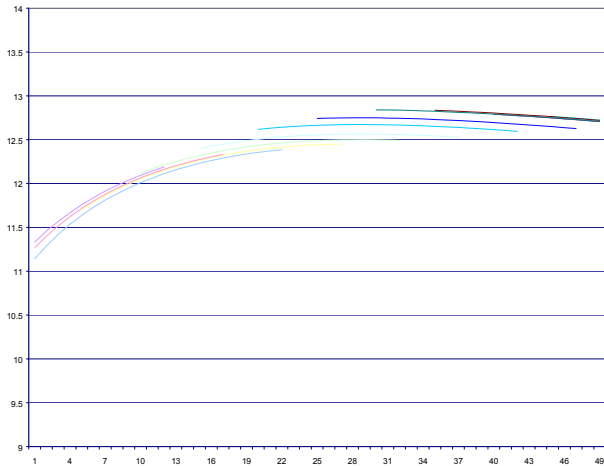
Smooth Income Profiles of Women by Cohort and Education



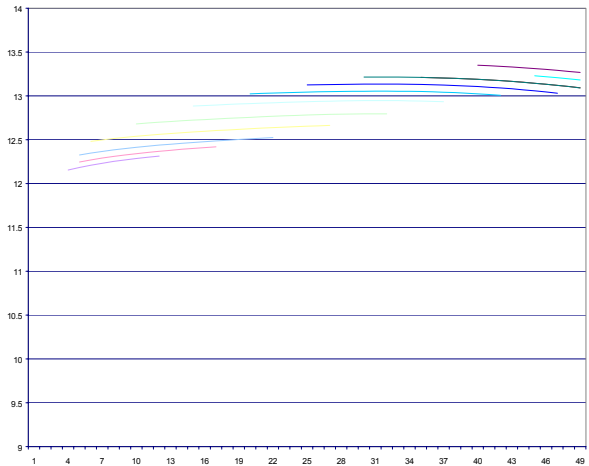
Graph 25 0-4 years



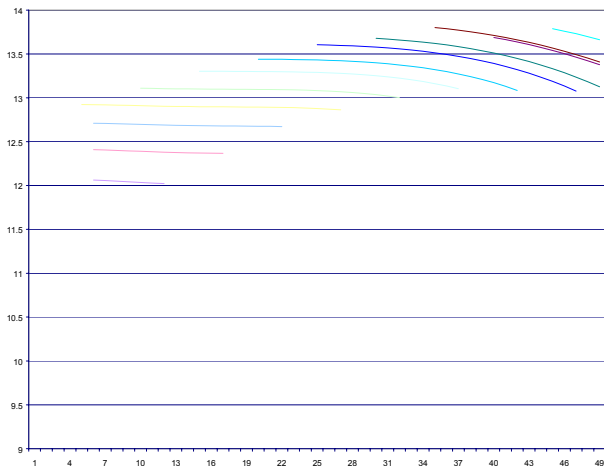
Graph 26 5 years



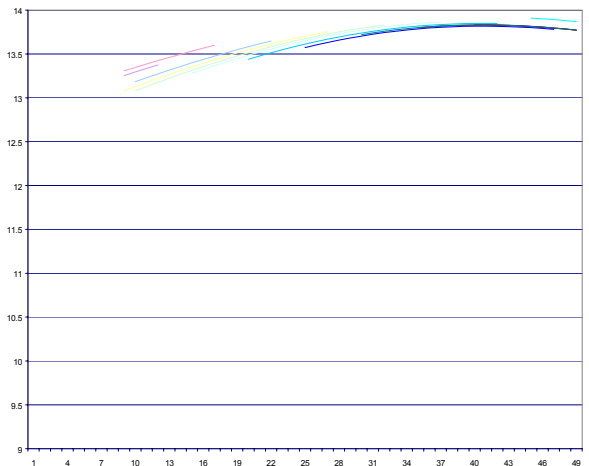
Graph 27 6-10 years



Graph 28 11 years



Graph 29 12-15 years



Graph 30 16+ years

Women's earnings profile by cohort is not always similar to men's. Like men, younger generations of women with incomplete and complete primary education earned more than older generations at the same age, as observed in Graphs 25 and 26. Nevertheless, labor earnings differences between generations seem to be larger among women than among men. According to Graphs 25 and 26, women with incomplete and complete primary school at a given age earned around 20 percent more than women five years older at the same age. The income pattern of women with incomplete and complete secondary school is presented in Graphs 27 and 28.

According to the graphs, younger women with incomplete and complete secondary school earned less than older women with the same education level did, at the same age. This implies that, as for men, the returns to education for secondary school of younger female cohorts has decreased. The same behavior is observed among women cohorts with incomplete college (Graph 29). Thus, older generations of women earned more than younger generations at the same age. Nevertheless, the earnings gap among cohorts is wider among women with this level of education as compared with other levels. Finally, Graph 30 presents the earnings profiles of women with college education by cohort. It is noticed that earnings differences between cohorts are not very large and that the earnings of the younger generations of women are higher than the earnings of older generations. It seems, then, that returns to college education for women have increased over time, despite the fact that the relative supply of women with college degree has also increased, as observed in Graph 15.

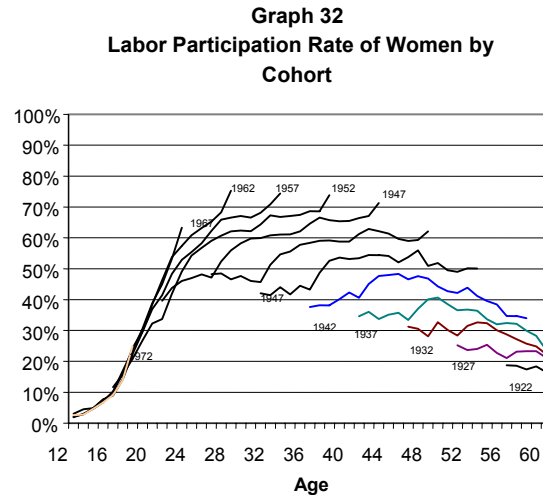
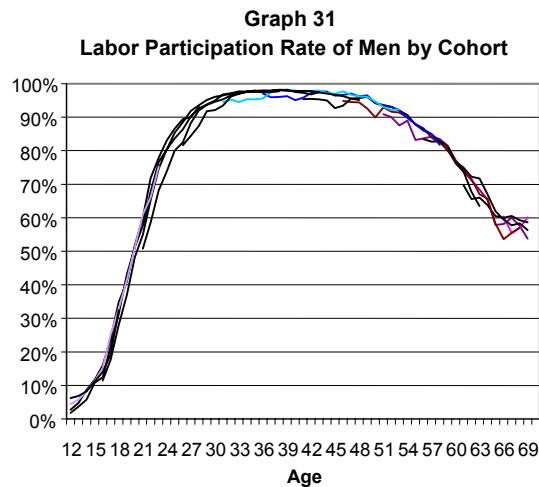
4. Labor Supply

4.1 Trends in the Labor Participation Rate

The previous sections analyzed trends in family composition and family size, returns to education of men and women, and relative earnings of men to women. These variables, as shown in Diagram 1, are closely related to the labor participation of men, and particularly that of women. The purpose of this section is to determine the impact of these variables on women's participation.⁸

⁸ Graph A.9 presents the behavior of labor force participation rate for men and women from 1976 to 1998. While men's participation rate has increased from 65 percent to 77 percent in the period under consideration, women's participation rate has increased quite significantly, from 30 percent to 50 percent. The largest jump in women's participation rate occurred in 1982, the result of legislation that set the minimum wage for women as well as men.

Graph 31 depicts men’s participation rates by cohort and age. It is clear from the graph that at age 25 more than 90 percent of men participate in the labor market regardless of the cohort. The rate remains around 95 percent until age 50, when men’s participation rate begins to decrease smoothly. At age 70 around 40 percent of men are still participating in the labor market.



Women’s labor force participation rate by cohort is depicted in Graph 32. It is quite clear that changes in women’s participation rate by cohorts have been significant. For instance, at age 40 about 35 percent of women belonging to the cohort born around 1937 participated in the labor market. This percentage reaches 65 percent for the generation born around 1957 and is much higher for the generation born around 1962. The next section will estimate a model to explain changes in women’s participation. Why do these trends occur, and how are they related to previous findings on returns to education and family size?

4.2 Determinants of Women’s Labor Force Participation

This section examines the determinants of women’s labor force participation. From the literature, it is known that the participation rate of women depends on variables related to women’s human capital and returns to education, demographic variables such as number of children, and business cycle variables such as unemployment rates, men’s wages, etc. The traditional approach to analyzing the determinants of women’s participation is by estimating probit or logit models with

cross-sectional data.⁹ However, this approach ignores both cohort and time effects that may influence women's participation.

Following Goldin (1983), an equation is estimated to explain the observed trends in women's labor participation rate as depicted in Graph 32. The explanatory variables are a) cohort variables, including cohort average (expected) number of children,¹⁰ cohort average years of schooling (Graph 12), cohort expected labor earnings,¹¹ and b) time variables such as men's wages, women's wages, and unemployment rate. Using as explanatory variables the expected number of children of the women's cohort and expected labor earnings makes it possible to avoid simultaneity¹² problems between number of children and labor participation, and between labor earnings and labor participation. The results of the regression, using three models, are presented in Table 3. In models 1 and 2, female wage cohort average years of schooling coefficients have a positive sign, as expected. On the other side, male wages, unemployment and number of children (fertility) coefficients have a negative sign.

⁹ Ribero and Meza (1997) and Tenjo and Ribero (1998) have used this methodology for the Colombian case.

¹⁰ We are not able to observe the total number of children of every women's cohort and each year. Moreover, and in order to correct the possibility that number of children may be an endogenous variable, we estimated it through a five-degree polynomial in age and cohort.

¹¹ We use women's expected earnings without correcting for selection bias. These are the observed earnings on which women base their participation decisions.

¹² This point is developed by Becker (1991).

Table 3. Variations in the Participation of Women ^a

	Model 1	Model 2	Model 3
Female Wage _t	0.365 (4.93)	0.330 (9.51)	
Male Wage _t	-0.550 (-2.506)	-0.999 (-7.46)	
Unemployment _t	-0.113 (-3.17)	-0.192 (-7.29)	-0.332 (-16.76)
Female Potential Wage _{i,t}			0.544 (26.41)
Schooling _i	0.377 (6.03)		
Schooling _{i,t}		0.566 (14.51)	
Fertility _i	-0.045 (-3.85)	-0.115 (-15.25)	-0.134 (-8.27)
Young * Fertility _i	0.015 (3.29)	-0.045 (-4.09)	
Old Dummy	0.014 (0.72)		
Constant	2.044 (0.92)	7.916 (4.77)	-6.794 (-24.57)
R²	0.32	0.58	0.73
Observations	265	265	265

^a Dependent Variable = Labor Force Participation for Cohort *i* at Time *t*.

The regression's coefficients were obtain by the method of Principal Components.

Model 3 is simpler but has greater explanatory power. We use only the unemployment rate, the number of children (fertility) and female potential wage. The latter variable was calculated by using the coefficients of returns to women's education and experience of Table 3, and the year and cohorts effects of Table A.6, according to the following equation:

$$Y_{it}^{EW} = \beta_0 + \beta_1 * S_{it} + \beta_2 * Exp_{it} + DYear + Dcohort$$

Where Y_{it}^{EW} represents the average expected women's labor income of cohort *i* at year *t*, β_1 represents women's return to education, β_2 the returns to experience, S_{it} the average years of schooling of cohort *i* at year *t* and Exp_{it} the average years of experience of cohort *i* at year *t*. *Dyear* and *Dcohort* represent the year and cohort dummy values of Table 3.

According to the results, potential or expected female labor income is very significant (t statistic of 26.1) and explains a great deal of the participation rate variance by cohort. Since the potential wage contains schooling by cohort that variable is eliminated from model 3.

Finally, by using the obtained coefficients, it was calculated how much of the change in participation rate of women at 40 between 1977 and 1997 is explained by each variable. The participation rate of women at 40 changes 31 percentage points between 1977 and 1997. Cohort effects (years of schooling of the cohort and number of children) explain 31 percentage points. Time effects (male and females wages and unemployment rates) explained -4.4 percentage points of the change. Although the effects of male and female wages are high, they cancel out (Table 4). Model 3, although it performs well econometrically, does not adequately explain the decomposition of the changes in women's participation rate.

TABLE 4. DECOMPOSITION OF THE CHANGES IN THE LABOR PARTICIPATION RATE OF WOMEN

	Model 1	Model 2	Model 3	Model 1	Model 2	Model 3
Age Groups	40 years	40 years	40 years	25 years	25 years	25 years
Time Interval	1977-1997	1977-1997	1977-1997	1982-1997	1982-1997	1982-1997
Observed Change	0.311	0.311	0.311	0.159	0.159	0.159
Explained by:						
Men Labor Income	-0.161	-0.089		0.049	0.027	
Women Labor Income	0.177	0.195		0.017	0.046	
Women Potential Income			0.190			0.107
Unemployment	-0.059	-0.035	-0.102	-0.074	-0.044	-0.102
Cohort Years of Schooling in t	0.254			0.109		
Cohort Average Years of Schooling		0.146			-0.004	
Number of Children	0.057	0.022	0.022	0.007	0.003	0.014
Young Dummy				0.002	-0.001	
Explained by:						
Cohorts Factors	0.311	0.168	0.213	0.119	-0.005	0.121
Time Factors	-0.044	0.072	-0.102	-0.008	0.029	-0.102
Explained by the model	0.268	0.240	0.111	0.111	0.024	0.019

Source: Table 3 and Household Surveys.

The results of the exercise are very revealing of the determinants of women's labor participation in urban Colombia, showing that higher levels of education (or higher expected income of the cohort) and lower fertility rates are behind the observed participation trends. These trends are thus the result of the deep structural social changes that have occurred in urban Colombia since the middle of the twentieth century.

5. Investment in Human Capital

5.1 Educational Attainment

This section presents the dynamics of children's human capital accumulation in the Colombian urban households by cohort. Children's human capital accumulation is defined as the average years of schooling that children attain at a certain age. The calculations of human capital accumulation are performed for different children's groups that correspond to cohort and level of education of the household's head. Thus, there are 45 children's groups resulting from 15 household's head cohorts and 3 levels of education (from 0 to 5, from 6 to 11 and from 12 and above years of schooling). The exercise consists of computing at each age of the children's group the average years of education attained by the group.

The results of the calculations for each one of the groups are shown in Graph 33. It is clear from the graphs that there has been some improvement in the accumulation of human capital among children with parents with low education. In fact, at age 24 the children's average years of education of the least educated parents increased from 8.8 to 9.3 (1910 parents' cohort versus 1940 parents' cohort). The education attainment might be even slightly higher for children of the 1960 parents' cohort. These figures show, however, that the pace of increase in the educational attainment of the children of the least educated has been very slow. Thus, at 20 years of age, the children of the younger cohort (among the least educated parents) attained only 0.15 more years of schooling than did children (ten years older) with parents ten years older.

Graph 33 also presents children's educational attainment (at every age) of children's groups with parents with 6 to 11 and 12 and more years of schooling. The graphs show that the differences in children's educational attainment (at age 25) among cohorts with parents of similar schooling are positive although not very significant. In fact, the educational

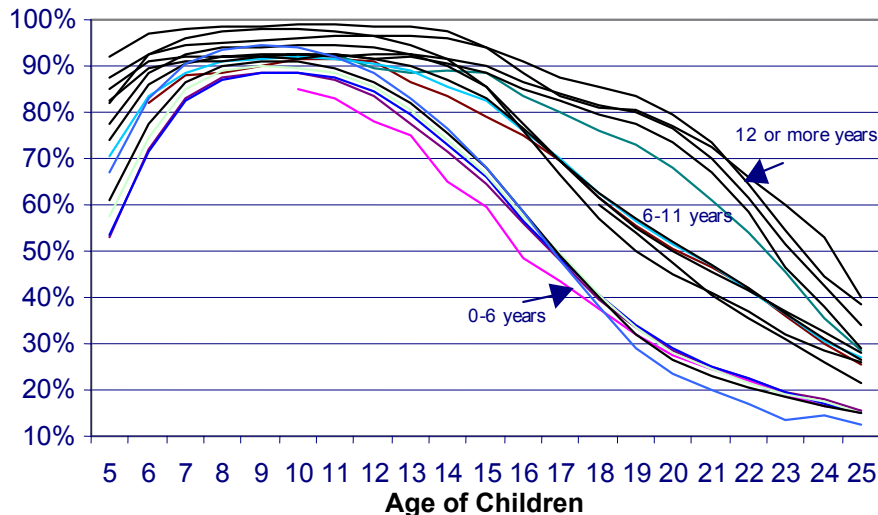
attainment of children with parents having 6 to 11 years of education belonging to the 1942 cohort is only 0.4 years higher than the educational attainment of children with parents belonging to the 1912 cohort. The educational attainment of the different groups of children (at every age) with parents having 12 or more years of education has also increased. Thus, the younger the parent's cohort the higher the educational attainment.

Differences in children's attainment are thus clearly related to parents' schooling. From Graph 33 it can be concluded that the cohort effect within the same parents' educational groups has been small and that differences in children's school attainment are determined by parents' years of schooling. In fact, at 25 the difference in years of education between the children of the most and the least educated parents of the same cohort has always totaled around 5.5 years. However, the graphs also indicate that the average years of schooling of children at age 24 is higher than the parents' average years of schooling. This result might indicate a) the existence of some sort of social mobility in urban Colombia; b) the fact that the children of the poor are more educated than their parents.

5.2 Enrollment Rates

Graph 34 depicts enrollment rates (percentage of children at certain age attending school) for children's groups similar to those described in the previous section. At age 10, almost 90 percent of the children of the least educated parents in younger cohorts go to school, compared to almost 100 percent of the children of the most educated parents. However, after age 13, the enrollment rate gap among children with parents with different levels of education starts to widen. Thus, at 18, the school attendance rate of children of the least educated is around 35 percent (though a bit higher for the new generations), around 55 percent for children with parents with 6 to 11 years of education, and about 80 percent for the children of the most educated parents. In addition, the attendance rate among the children of the least educated differs just a little across cohorts. On the other hand, the attendance rate of the children of the most educated parents has increased substantially for recent generations. Thus, at age 18, the attendance rate of the children with educated parents born in the 1910s has been about 75 percent, while the rate of those with parents born in the 1950s has risen to 85 percent.

Graph 34
Children's Enrollment Education Rates by
Household Head Education Level and Cohort



The second section presents the percentage of men and women by education level in each cohort (Graphs 14 and 15). The graphs show that the percentage of men and women with primary education or less has decreased in every cohort, which indicates that each new generation has had more educated parents and has attained higher levels of schooling. These results indicate that the enhanced education opportunities accompanying the expansion of education programs and the public school system have clearly reached the urban poor, but not quite enough to close the education gap (Sarmiento and Caro, 1997). As shown in the above graphs, most of the children who drop out of the school system belong to households with low-educated parents and are probably poor. Raising the enrollment rates of the poor, mainly of teenagers, is one of the most important challenges of Colombian social policy and it is, in addition, the surest way to close the income gap and escape from poverty.

5.3 Determinants of Child's Years of Schooling and School Enrollment

In order to complete the graphic analysis of the previous sections, a model has been estimated to capture the determinants of schooling and enrollments.¹³ The results of the exercise are presented in Table 5. As the table shows, the explanatory variables are divided into the following five sets: variables related to the children, parents, household characteristics, labor market and parent's cohorts. We can highlight the following findings:

- The completed years of schooling are a quadratic function of the child's age and have the shape of an inverted U.
- The effect of the parent's schooling on either a child's schooling or enrollment probability is captured by the interaction between the household head's schooling and the child's age. The shape of this interaction is either a curve with positive and decreasing slope, in the case of years of schooling, or an inverted U in the case of enrollment probability.
- The higher the number of children, the lower either child's schooling or enrollment probability.
- The child's years of schooling and enrollment probability are lower in single-parent households.
- The impact of both spouse labor participation and labor income on the child's schooling or enrollment, after controlling by education and number of children, is negligible. It seems that such variables captured the mother's opportunity cost.
- The child's schooling or enrollment probability is lower if either the household head or his (her) spouse is unemployed.
- The child's years of schooling are higher, *ceteris paribus*, if the parents belong to cohorts born in the 1930s and 1940s and are lower if the parents belong to the 1910 or 1960 cohorts. In contrast, the child's enrollment probability is higher, *ceteris paribus*, the older the parent's cohort.
- College/high school relative labor earnings have a strong positive impact on the child's enrollment probability but are non-significant for child's schooling.

¹³ Similar estimations were performed by Robbins (1998). However, Robbins' objective was to estimate the determinants of educational attainment (measured as completed years of schooling) of people who had

It can thus be concluded that children's educational attainment and school attendance are strongly associated with parents' education and household characteristics. The effect on education of the shocks affecting the household is captured by the unemployment variables. Thus, macroeconomic conditions that are transmitted to families to the labor market conditions also affect the accumulation of human capital (Behrman, 1999). The time variables captured the impact of other macro variables, including education policies. It was found (see Appendix A.8) that year dummy coefficients in the estimation of enrollment probability have more or less the same value. In contrast, such coefficients in the estimation of years of schooling grow over time, increasing quite notably during the 1990s.

already stopped attending school.

Table 5
Determinants of School Enrollment and Years of Schooling

	Schooling	Enrollment
Constant	-6.282 (-183.986)	-0.663 (-12.339)
Child's variables		
Child's age	0.928 (603.595)	0.454 (201.295)
Child's age^2	-0.014 (-288.335)	-0.021 (201.295)
Gender (men=1)	0.343 (113.070)	0.185 (42.418)
Parents' variables		
Average education of parents	-0.031 (-47.935)	0.117 (83.658)
Household head education * child's age	0.016 (356.758)	0.004 (52.353)
(Household head education * child's age)^2	-7.45e-06 (-363.298)	-4.08e-06 (-102.546)
Household's variables		
Number of children	-0.115 (-162.109)	-0.061 (-62.158)
Existence of spouse	0.403 (95.393)	0.305 (52.829)
Labor market variables		
Spouse labor participation	0.008 (0.812)	0.027 (1.778)
Spouse labor income	-0.009 (-9.098)	0.001 (0.778)
Household head unemployment	-0.302 (-35.770)	-0.301 (-26.735)
Spouse unemployment	-0.263 (-19.073)	-0.163 (-8.004)
Relative labor income (univ/high school)	0.624 (28.758)	0.004 (0.319)
Cohort variables		
1910 cohort	0.099 (3.970)	0.262 (6.789)
1920 cohort	0.395 (30.940)	0.177 (8.758)
1930 cohort	0.524 (50.827)	0.107 (6.296)
1940 cohort	0.520 (55.245)	0.025 (1.572)
1950 cohort	0.389 (44.903)	-0.029 (-1.958)
1960 cohort	0.159 (19.134)	-0.009 (-0.602)
Method of estimation	OLS	Logit
Number of observations	1795180	1578681
Year dummies	Yes	Yes
R²	0.749	-

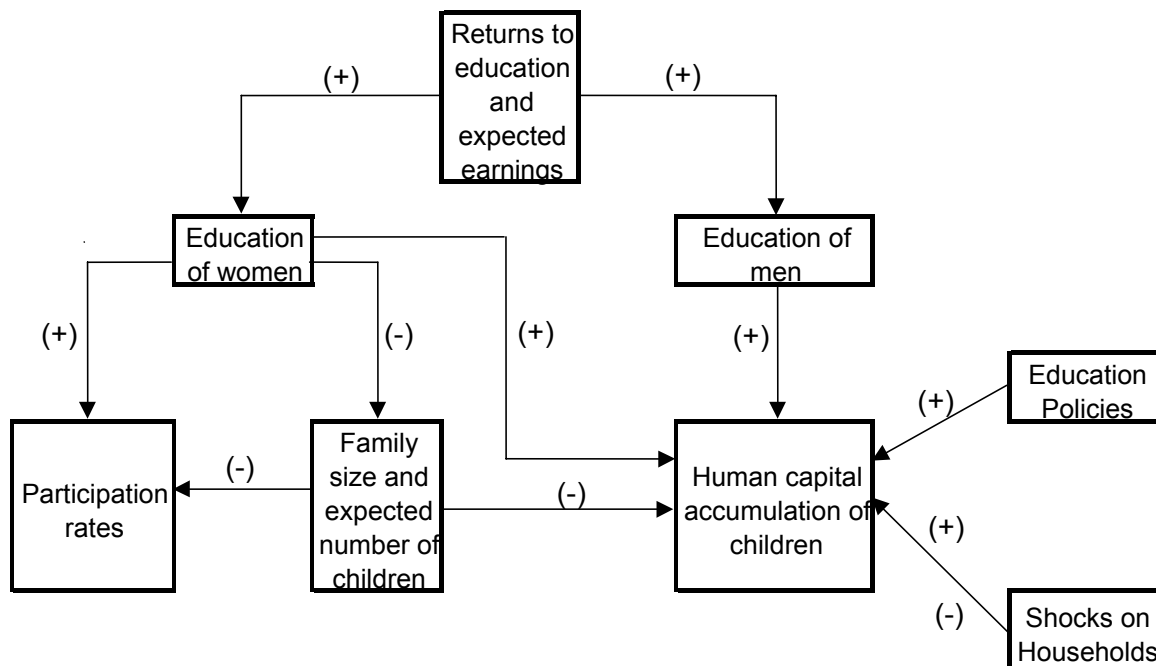
6. Conclusions

The results presented in this document are the first attempt to apply the cohort methodology to the Colombian urban household surveys. Areas examined have included changes in family structure and size, returns to education, labor income dynamics by level of education, relative labor income, changes in women's participation rate and its determinants, and accumulation of human capital. The dynamics and interrelation of these changes are depicted in Diagram 1.

For the new generations, the main change in urban family structure has been the decreasing share of nuclear families in total households, largely in favor of extended families and, to a lesser extent, childless couples. There have also been quite significant changes in family size. Thus, the average family size of household heads born in the 1920s and 1930s was around seven people. In contrast, the family size of recent generations of household heads is close to four. The same trends are observed for the number of children. Changes in the size of urban families have been accompanied by a moderate increase in schooling of both men and women, especially the latter.

Diagram 1.

A Diagram of Returns to Education, Participation and Human Capital



Estimates of returns to education show that they are positively related to completed school level or degree. Individuals who have completed college have the highest returns to education (more than 0.20), 80 percent more than the returns to complete primary and secondary school and three times the returns of incomplete secondary school. The labor income gap between workers with a college degree and workers with primary schooling has decreased across cohorts, in contrast to the trend across cohorts of an increasing income gap between workers with complete college and workers with complete and incomplete secondary school. Thus, a recent surge in labor income inequality (Núñez and Sánchez, 1998) may be due to the widening income differential between skill and unskilled workers that belong to younger cohorts. The gender income gap has been closing for the younger cohorts. The evidence examined shows that gender income differences have narrowed at every level of education, but especially between men and women with completed college degrees.

In addition, women's labor participation rate has increased remarkably. Its main determinants have been the significant increase in women's human capital, which brought about both higher expected labor income and opportunity cost of children, together with lower fertility rates. The estimates reveal that the most important determinant of the changes in female labor participation is women's income or expected women's income.

Finally, the accumulation of human capital among children has been basically associated with the level of education of the household head. The lower his (or her) level of education the lower the school attainment of his (or her) children. Nevertheless, there have been some positive cohort effects. Thus, the children of younger cohorts have both higher educational attainment and greater enrollment rates, although the parent's background seems to be the most important determinant of the children's accumulation of human capital. We also found that labor market shocks, in particular unemployment, seem to affect human capital accumulation as well.

We have thus completed the story presented in Diagram 1. Higher returns to education and expected earnings of women determine greater participation rates and a lower number of children. This latter variable affects the quality of children and the accumulation of human capital.¹⁴ Any social policy that increases the education of women

¹⁴ A wider discussion of these topics is presented in IADB (1998).

will have an impact on their potential earnings and on the probability of joining the labor market. At the same time, a more educated woman will have greater incentives to limit her number of children and will dedicate more resources to each of them. In the long run, a greater level of children's education would reduce income inequality.

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Table A.1. Men Statistics

Descriptive Statistics by Cohort and Education Level ^a									Sample Share ^b							
	0-4 years	5 years	6-10 years	11 years	12-15 years	16+ years	Total		0-4 years	5 years	6-10 years	11 years	12-15 years	16+ years	Total	
1910-1914	260,704	361,743	579,325	972,308	1,233,633	1,611,786	492,240		0.11%	0.07%	0.04%	0.02%	0.00%	0.02%	0.25%	
	981	708	977	1,320	1,166	1,424	1,060	1910-1914	42.98%	26.83%	14.30%	7.83%	1.52%	6.54%	100.00%	
	1,328	829	442	242	47	202	3,090		0.60%	0.32%	0.12%	0.11%	0.06%	0.18%	0.25%	
1915-1919	268,532	382,204	598,707	846,578	1,064,506	1,517,914	493,378		0.31%	0.22%	0.10%	0.07%	0.01%	0.05%	0.77%	
	723	869	1,059	1,023	1,295	1,291	970	1915-1919	40.43%	29.17%	13.30%	8.62%	1.77%	6.71%	100.00%	
	3,823	2,759	1,258	815	167	635	9,457		1.72%	1.08%	0.35%	0.38%	0.23%	0.57%	0.77%	
1920-1924	288,640	391,929	619,683	904,271	1,143,451	1,597,821	535,753		0.65%	0.50%	0.26%	0.16%	0.03%	0.12%	1.73%	
	760	766	1,188	1,156	1,434	1,330	1,031	1920-1924	37.44%	29.18%	15.16%	9.08%	1.94%	7.20%	100.00%	
	7,966	6,209	3,226	1,931	413	1,533	21,278		3.59%	2.43%	0.90%	0.91%	0.57%	1.39%	1.73%	
1925-1929	292,333	396,997	597,912	916,785	1,170,470	1,651,843	555,193		1.10%	0.93%	0.50%	0.29%	0.06%	0.25%	3.13%	
	660	709	997	1,198	1,204	1,448	1,006	1925-1929	35.06%	29.76%	15.97%	9.32%	2.04%	7.86%	100.00%	
	13,519	11,474	6,156	3,592	785	3,031	38,557		6.09%	4.49%	1.72%	1.69%	1.07%	2.74%	3.13%	
1930-1934	310,018	414,608	569,915	908,483	1,194,560	1,679,825	580,803		1.58%	1.43%	0.86%	0.49%	0.12%	0.40%	4.88%	
	641	774	904	1,147	1,165	1,303	970	1930-1934	32.39%	29.27%	17.70%	9.95%	2.45%	8.24%	100.00%	
	19,465	17,589	10,639	5,980	1,474	4,955	60,102		8.77%	6.88%	2.98%	2.81%	2.02%	4.49%	4.88%	
1935-1939	313,379	406,274	560,971	866,973	1,103,843	1,686,595	597,043		1.85%	1.75%	1.18%	0.66%	0.18%	0.58%	6.21%	
	614	744	924	1,107	1,194	1,385	998	1935-1939	29.87%	28.24%	19.01%	10.63%	2.88%	9.38%	100.00%	
	22,824	21,576	14,527	8,121	2,197	7,167	76,412		10.28%	8.44%	4.06%	3.82%	3.01%	6.49%	6.21%	
1940-1944	304,681	387,723	517,855	777,974	1,029,092	1,579,020	597,944		2.11%	2.14%	1.71%	0.95%	0.32%	0.91%	8.15%	
	579	752	867	1,062	1,105	1,252	966	1940-1944	25.92%	26.23%	21.03%	11.68%	3.90%	11.23%	100.00%	
	25,997	26,309	21,095	11,710	3,913	11,262	100,286		11.71%	10.29%	5.90%	5.51%	5.36%	10.20%	8.15%	
1945-1949	290,819	362,250	457,082	682,047	885,130	1,461,253	584,278		2.12%	2.38%	2.44%	1.36%	0.52%	1.33%	10.15%	
	524	664	735	973	1,022	1,232	931	1945-1949	20.87%	23.42%	24.04%	13.40%	5.12%	13.15%	100.00%	
	26,064	29,250	30,028	16,742	6,401	16,420	124,905		11.74%	11.44%	8.40%	7.88%	8.76%	14.86%	10.15%	
1950-1954	279,105	333,141	403,670	580,065	750,414	1,319,223	539,597		2.08%	2.59%	3.62%	1.97%	0.88%	1.67%	12.82%	
	535	654	688	925	968	1,200	903	1950-1954	16.26%	20.24%	28.22%	15.39%	6.83%	13.07%	100.00%	
	25,662	31,932	44,532	24,278	10,777	20,620	157,801		11.56%	12.49%	12.46%	11.42%	14.75%	18.67%	12.82%	
1955-1959	252,080	297,346	349,656	471,046	618,679	1,151,995	459,812		1.90%	2.65%	4.68%	2.88%	1.17%	1.62%	14.90%	
	516	547	663	757	882	1,201	837	1955-1959	12.75%	17.79%	31.37%	19.34%	7.87%	10.88%	100.00%	
	23,401	32,649	57,560	35,483	14,437	19,957	183,487		10.54%	12.77%	16.10%	16.70%	19.76%	18.07%	14.90%	
1960-1964	231,024	268,626	305,100	407,266	531,027	1,025,481	385,386		1.73%	2.57%	5.63%	3.49%	1.21%	1.20%	15.83%	
	497	569	555	706	792	1,072	729	1960-1964	10.91%	16.26%	35.55%	22.07%	7.64%	7.56%	100.00%	
	21,269	31,685	69,268	43,006	14,895	14,738	194,861		9.58%	12.39%	19.37%	20.24%	20.39%	13.34%	15.83%	
1965-1969	203,914	245,787	277,564	355,567	470,464	948,165	331,369		1.25%	1.91%	4.32%	2.68%	0.83%	0.61%	11.61%	
	384	581	608	621	755	1,078	690	1965-1969	10.79%	16.48%	37.25%	23.11%	7.12%	5.25%	100.00%	
	15,412	23,545	53,232	33,026	10,180	7,504	142,899		6.94%	9.21%	14.89%	15.54%	13.94%	6.79%	11.61%	
1970-1974	185,336	221,716	250,577	315,634	425,984	796,425	283,448		0.73%	1.07%	2.39%	1.61%	0.47%	0.19%	6.46%	
	407	428	514	548	717	853	567	1970-1974	11.37%	16.54%	36.93%	24.91%	7.31%	2.94%	100.00%	
	9,041	13,151	29,366	19,803	5,816	2,335	79,512		4.07%	5.14%	8.21%	9.32%	7.96%	2.11%	6.46%	
1975-1979	160,472	192,616	211,762	259,397	321,511	605,546	218,918		0.36%	0.44%	1.08%	0.60%	0.12%	0.01%	2.61%	
	384	365	460	460	512	685	449	1975-1979	13.72%	16.81%	41.48%	22.89%	4.77%	0.32%	100.00%	
	4,406	5,398	13,319	7,350	1,531	104	32,108		1.99%	2.11%	3.73%	3.46%	2.10%	0.09%	2.61%	
1980-1984	125,999	144,800	158,985	197,120	289,871	-	149,866		0.14%	0.11%	0.23%	0.03%	0.00%	0.00%	0.52%	
	448	377	400	425	420	-	414	1980-1984	27.44%	20.81%	44.90%	6.55%	0.30%	0.00%	100.00%	
	1,767	1,340	2,891	422	19	-	6,439		0.80%	0.52%	0.81%	0.20%	0.03%	0.00%	0.52%	
Total	270,496	328,484	364,159	504,759	659,785	1,315,170	466,998	Total	18.03%	20.77%	29.04%	17.26%	5.93%	8.97%	100.00%	
	580	666	717	865	937	1,225	866		18.03%	20.77%	29.04%	17.26%	5.93%	8.97%	100.00%	
	221,944	255,895	357,539	212,501	73,052	110,463	1,231,194		100.00%	100.00%	100.00%	100.00%	100.00%	100.00%	100.00%	

^a Each cell contains: Average Labor Income, Variance and Frequency.

^b Each cell contains: Sample Share, Cohort Share and Education Level Share.

Table A.2. Women Statistics

co	Descriptive Statistics by Cohort and Education Level ^a							Sample Share ^b							
	0-4 years	5 years	6-10 years	11 years	12-15 years	16+ years	Total	0-4 years	5 years	6-10 years	11 years	12-15 years	16+ years	Total	
1910-1914	120,614 416 490	197,699 519 165	298,303 481 75	403,110 560 36	-	381,407 532 5	169,277 475 771	1910-1914	0.06% 63.55% 0.32%	0.02% 21.40% 0.12%	0.01% 9.73% 0.04%	0.00% 4.67% 0.02%	0.00% 0.00% 0.00%	0.00% 0.65% 0.01%	0.10% 100.00% 0.10%
1915-1919	122,709 352 1,511	267,907 1,194 639	325,882 714 262	422,947 614 164	880,831 990 17	643,927 819 25	207,189 866 2,618	1915-1919	0.19% 57.72% 1.00%	0.08% 24.41% 0.45%	0.03% 10.01% 0.13%	0.02% 6.26% 0.10%	0.00% 0.65% 0.03%	0.00% 0.95% 0.04%	0.34% 100.00% 0.34%
1920-1924	135,007 398 3,016	219,516 873 1,510	324,101 693 782	511,194 715 480	755,390 959 56	923,267 849 112	232,233 709 5,956	1920-1924	0.39% 50.64% 1.99%	0.19% 25.35% 1.06%	0.10% 13.13% 0.40%	0.06% 8.06% 0.29%	0.01% 0.94% 0.09%	0.01% 1.88% 0.17%	0.76% 100.00% 0.76%
1925-1929	148,263 498 5,683	218,167 551 2,967	335,813 697 1,730	523,169 851 1,123	625,206 724 188	908,678 867 270	252,591 649 11,961	1925-1929	0.73% 47.51% 3.75%	0.38% 24.81% 2.08%	0.22% 14.46% 0.88%	0.14% 9.39% 0.68%	0.02% 1.57% 0.31%	0.03% 0.41% 0.11%	1.53% 100.00% 1.53%
1930-1934	166,122 744 9,365	234,022 624 5,592	348,786 678 3,614	512,574 751 2,447	726,307 960 426	961,380 948 663	286,152 745 22,107	1930-1934	1.20% 42.36% 6.19%	0.72% 25.30% 3.93%	0.46% 16.35% 1.84%	0.31% 11.07% 1.48%	0.05% 1.93% 0.71%	0.08% 3.00% 1.01%	2.83% 100.00% 2.83%
1935-1939	172,939 723 12,267	234,098 566 8,613	355,862 700 5,862	516,897 800 4,137	701,337 871 857	974,669 1,014 1,295	309,571 749 33,031	1935-1939	1.57% 37.14% 8.10%	1.10% 26.08% 6.05%	0.75% 17.75% 2.99%	0.53% 12.52% 2.51%	0.11% 2.55% 1.42%	0.17% 3.92% 1.97%	4.23% 100.00% 4.23%
1940-1944	165,496 383 16,209	232,754 627 12,453	336,069 653 9,970	503,309 801 7,209	692,426 907 1,796	945,821 984 2,977	328,354 715 50,614	1940-1944	2.08% 32.02% 10.71%	1.59% 24.60% 8.75%	1.28% 19.70% 5.08%	0.92% 14.24% 4.37%	0.23% 3.55% 2.98%	0.38% 5.88% 4.53%	6.48% 100.00% 6.48%
1945-1949	166,913 458 17,878	216,315 452 16,085	314,891 659 16,077	470,521 754 11,874	634,739 873 3,833	918,375 953 6,201	350,820 717 71,948	1945-1949	2.29% 24.85% 11.81%	2.06% 22.36% 11.30%	2.06% 22.35% 8.20%	1.52% 16.50% 7.19%	0.49% 5.33% 6.37%	0.79% 8.62% 9.44%	9.21% 100.00% 9.21%
1950-1954	158,620 371 19,046	203,878 439 19,575	278,956 594 25,898	424,535 708 18,794	567,053 818 7,716	874,816 932 11,811	355,854 708 102,210	1950-1954	2.44% 18.63% 12.58%	2.51% 19.15% 13.75%	3.32% 25.34% 13.21%	2.41% 18.39% 11.38%	0.99% 7.55% 12.82%	1.43% 10.94% 17.01%	13.09% 100.00% 13.09%
1955-1959	139,808 356 19,032	187,481 519 22,037	248,367 517 35,904	361,693 644 28,675	486,184 729 11,858	787,611 894 15,697	331,896 676 133,203	1955-1959	2.44% 14.29% 12.57%	2.82% 16.54% 15.48%	4.60% 26.95% 18.31%	3.67% 21.53% 17.36%	1.52% 8.90% 19.69%	2.01% 11.78% 23.89%	17.06% 100.00% 17.06%
1960-1964	122,770 329 18,750	168,567 410 20,662	220,530 438 39,786	312,694 545 35,744	430,642 654 14,072	729,718 902 14,626	295,641 624 143,660	1960-1964	2.40% 13.05% 12.39%	2.65% 14.40% 14.53%	5.09% 27.69% 20.29%	4.58% 24.88% 21.64%	1.80% 9.80% 23.37%	1.87% 10.18% 22.26%	18.40% 100.00% 18.40%
1965-1969	108,726 288 14,773	145,446 364 16,498	197,221 416 30,187	281,815 535 29,551	385,364 602 10,752	702,822 944 8,960	259,462 605 110,721	1965-1969	1.89% 13.34% 9.76%	2.11% 14.90% 11.59%	3.87% 27.26% 15.39%	3.78% 26.69% 17.89%	1.38% 9.71% 17.86%	1.15% 8.09% 13.63%	14.18% 100.00% 14.18%
1970-1974	102,280 275 8,468	130,828 385 10,033	184,503 426 17,071	265,304 437 17,969	360,100 580 6,555	665,029 913 3,455	232,156 547 63,551	1970-1974	1.08% 13.32% 5.59%	1.26% 15.79% 7.05%	2.19% 26.86% 8.70%	2.30% 28.27% 10.88%	0.84% 10.31% 10.89%	0.44% 5.44% 5.26%	8.14% 100.00% 8.14%
1975-1979	102,704 291 3,770	125,280 304 4,486	164,536 414 7,514	243,837 479 6,616	303,070 511 2,044	540,807 698 251	184,513 444 24,681	1975-1979	0.48% 15.27% 2.49%	0.57% 18.18% 3.15%	0.96% 30.44% 3.83%	0.85% 26.81% 4.01%	0.26% 8.28% 3.39%	0.03% 1.02% 0.38%	3.16% 100.00% 3.16%
1980-1984	98,677 405 1,128	112,169 305 1,019	130,634 339 1,389	184,724 311 328	246,163 385 40	-	122,309 358 3,904	1980-1984	0.14% 28.89% 0.75%	0.13% 26.10% 0.72%	0.18% 35.58% 0.71%	0.04% 8.40% 0.20%	0.01% 1.02% 0.07%	0.00% 0.00% 0.00%	0.50% 100.00% 0.50%
Total	143,955 494 151,386	188,842 520 142,354	245,453 544 196,121	350,118 638 165,147	466,626 725 60,210	796,203 926 65,718	300,992 665 780,936	Total	19.39% 19.39% 100.00%	18.23% 18.23% 100.00%	25.11% 25.11% 100.00%	21.15% 21.15% 100.00%	7.71% 7.71% 100.00%	8.42% 8.42% 100.00%	100.00% 100.00% 100.00%

^a Each cell contains: Average Labor Income, Variance and Frequency.

^b Each cell contains: Sample Share, Cohort Share and Education Level Share.

Table A.3. HECKMAN SELECTION MODEL FOR WOMEN

(Regression Model with Sample selection)

Returns to Education by Year				Returns to Education by Cohort			
Variable	Coefficient	Statistic Z		Variable	Coefficient	Statistic Z	
Schooling	0.074	13.591	***	1915 - 1919	-0.126	-3.593	***
Age	0.038	42.906	***	1920 - 1924	-0.199	-6.050	***
Age ²	0.000	-41.131	***	1925 - 1929	-0.294	-9.026	***
1977	0.258	13.845	***	1930 - 1934	-0.336	-10.126	***
1978	0.547	26.652	***	1935 - 1939	-0.434	-12.494	***
1979	0.849	44.502	***	1940 - 1944	-0.523	-14.328	***
1980	1.076	55.875	***	1945 - 1949	-0.589	-15.267	***
1981	1.292	69.706	***	1950 - 1954	-0.605	-14.882	***
1982	1.410	87.557	***	1955 - 1959	-0.516	-12.017	***
1983	1.551	96.935	***	1960 - 1964	-0.306	-6.771	***
1984	1.669	103.490	***	1965 - 1969	-0.061	-1.279	
1985	1.802	105.725	***	1970 - 1974	0.194	3.847	***
1986	1.948	113.665	***	1975 - 1979	0.652	12.093	***
1987	2.112	121.514	***	1980 - 1984	1.307	21.767	***
1988	2.231	127.387	***	(1915 - 1919)*	0.005	0.807	
1989	2.466	136.756	***	(1920 - 1924)*	0.013	2.208	**
1990	2.663	140.432	***	(1925 - 1929)*	0.016	2.963	***
1991	2.828	147.410	***	(1930 - 1934)*	0.013	2.444	**
1992	3.001	154.684	***	(1935 - 1939)*	0.015	2.842	***
1993	3.258	163.847	***	(1940 - 1944)*	0.014	2.642	***
1994	3.440	169.899	***	(1945 - 1949)*	0.013	2.524	**
1995	3.543	169.692	***	(1950 - 1954)*	0.010	1.839	*
1996	3.659	174.465	***	(1955 - 1959)*	-0.002	-0.409	
1997	3.704	171.458	***	(1960 - 1964)*	-0.017	-3.244	***
1998	3.862	176.383	***	(1965 - 1969)*	-0.031	-5.878	***
1999	4.054	137.025	***	(1970 - 1974)*	-0.044	-8.388	***
1977*Schooling	-0.006	-2.325	**	(1975 - 1979)*	-0.073	-13.473	***
1978*Schooling	-0.010	-3.975	***	(1980 - 1984)*	-0.108	-17.431	***
1979*Schooling	-0.009	-3.872	***	Constant	7.621	144.201	***
1980*Schooling	-0.009	-3.821	***				
1981*Schooling	-0.009	-4.198	***				
1982*Schooling	0.000	-0.256					
1983*Schooling	0.004	2.267	**				
1984*Schooling	0.007	3.476	***				
1985*Schooling	0.005	2.731	***				
1986*Schooling	0.008	3.934	***				
1987*Schooling	0.010	5.226	***				
1988*Schooling	0.015	8.074	***				
1989*Schooling	0.015	7.587	***				
1990*Schooling	0.017	8.566	***				
1991*Schooling	0.021	10.999	***				
1992*Schooling	0.022	11.610	***				
1993*Schooling	0.023	11.789	***				
1994*Schooling	0.028	14.728	***				
1995*Schooling	0.034	17.575	***				
1996*Schooling	0.037	19.115	***				
1997*Schooling	0.042	21.945	***				
1998*Schooling	0.043	22.405	***				
1999*Schooling	0.037	14.262	***				

Number of Observations 1,363,064
Censored Observations 922,412
Uncensored Observations 440,652
Wald chi2(77) 1,290,000
Prob > chi2 0
Log likelihood -1,211,479

Table A.4.

PROBIT EQUATION OF WOMEN LABOR FORCE PARTICIPATION

Variable	Coefficient	Statistic Z	
People < 6	-0.037	-27.714	***
People (6 -11)	-0.013	-10.017	***
People (12 - 17)	-0.073	-71.240	***
People (18 - 29)	-0.005	-6.065	***
People (30 - 41)	-0.005	-3.842	***
People (42 - 54)	-0.034	-21.252	***
People >= 55	0.039	20.361	***
Barranquilla	0.093	29.355	***
Bogota	0.303	114.198	***
Medellin	0.172	62.466	***
Cali	0.252	78.478	***
Average Household Schooling	0.040	108.340	***
Average Household Age	-0.004	-35.690	***
Non-Labor Income	-0.030	-85.940	***
1977	-0.006	-0.532	
1978	-0.011	-0.873	
1979	0.013	1.121	
1980	0.051	4.446	***
1981	0.032	2.967	***
1982	0.059	6.358	***
1983	0.043	4.720	***
1984	0.066	7.221	***
1985	0.096	10.185	***
1986	0.100	10.685	***
1987	0.149	15.988	***
1988	0.190	20.617	***
1989	0.215	23.019	***
1990	0.254	26.340	***
1991	0.304	31.629	***
1992	0.381	39.798	***
1993	0.416	43.445	***
1994	0.427	44.777	***
1995	0.452	47.005	***
1996	0.522	54.876	***
1997	0.617	63.855	***
1998	0.680	70.747	***
1999	0.628	44.546	***
1915 - 1919	0.116	5.847	***
1920 - 1924	0.280	15.426	***
1925 - 1929	0.480	27.743	***
1930 - 1934	0.700	41.662	***
1935 - 1939	0.913	54.963	***
1940 - 1944	1.126	68.375	***
1945 - 1949	1.284	78.500	***
1950 - 1954	1.368	84.227	***
1955 - 1959	1.351	83.529	***
1960 - 1964	1.189	73.703	***
1965 - 1969	0.972	60.077	***
1970 - 1974	0.763	46.586	***
1975 - 1979	0.392	23.349	***
1980 - 1984	-0.241	-13.018	***
Constant	-1.849	-102.812	***
athrho	-1.309992	-331.248	***
rho	-0.8642735		

Table A.5 Changes in the Return to Education by Year and Cohort (Men)

Changes by Year ¹			Changes by Cohort ¹		
Year	Coefficient	Returns	Cohort	Coefficient	Returns
1976	0.0246	0.0940	1910-1914	0.0500	0.1194
1977	0.0194	0.0888	1915-1919	0.0457	0.1151
1978	0.0134	0.0828	1920-1924	0.0413	0.1107
1979	0.0093	0.0788	1925-1929	0.0378	0.1072
1980	0.0058	0.0753	1930-1934	0.0353	0.1047
1981	0.0004	0.0698	1935-1939	0.0338	0.1032
1982	0.0051	0.0745	1940-1944	0.0323	0.1017
1983	0.0058	0.0753	1945-1949	0.0288	0.0982
1984	0.0034	0.0728	1950-1954	0.0217	0.0911
1985	0.0045	0.0739	1955-1959	0.0103	0.0797
1986	-0.0001	0.0693	1960-1964	0.0000	0.0694
1987	0.0000	0.0694	1965-1969	-0.0086	0.0608
1988	0.0015	0.0710	1970-1974	-0.0187	0.0507
1989	0.0030	0.0725	1975-1979	-0.0370	0.0324
1990	0.0049	0.0743	1980-1984	-0.0399	0.0296
1991	0.0063	0.0757			
1992	0.0097	0.0791			
1993	0.0095	0.0790			
1994	0.0073	0.0767			
1995	0.0111	0.0805			
1996	0.0174	0.0868			
1997	0.0214	0.0908			
1998	0.0308	0.1002			

¹ The Return to Education by year or cohort is the sum of the average return (0.06942) and the specific coefficient by year and cohort

Table A.6 Changes in the Return to Education by Year and Cohort (Women)

Changes by Year ¹			Changes by Cohort ¹		
Year	Coefficient	Returns	Cohort	Coefficient	Returns
1976	0.0342	0.1442	1910-1914	-0.0076	0.1024
1977	0.0260	0.1361	1915-1919	0.0095	0.1195
1978	0.0233	0.1333	1920-1924	0.0164	0.1264
1979	0.0134	0.1234	1925-1929	0.0117	0.1217
1980	0.0074	0.1174	1930-1934	0.0104	0.1205
1981	-0.0009	0.1091	1935-1939	0.0120	0.1220
1982	-0.0012	0.1089	1940-1944	0.0109	0.1209
1983	0.0017	0.1117	1945-1949	0.0107	0.1207
1984	0.0056	0.1156	1950-1954	0.0072	0.1173
1985	0.0015	0.1115	1955-1959	0.0031	0.1131
1986	0.0006	0.1106	1960-1964	0.0000	0.1100
1987	0.0000	0.1100	1965-1969	-0.0004	0.1096
1988	-0.0013	0.1087	1970-1974	-0.0029	0.1071
1989	-0.0007	0.1093	1975-1979	-0.0211	0.0890
1990	-0.0009	0.1092	1980-1984	-0.0551	0.0549
1991	-0.0013	0.1087			
1992	0.0011	0.1111			
1993	-0.0021	0.1079			
1994	-0.0007	0.1093			
1995	-0.0001	0.1099			
1996	0.0031	0.1131			
1997	0.0126	0.1226			
1998	0.0175	0.1275			

¹ The Return to Education by year or cohort is the sum of the average return (0.1100) and the specific coefficient by year and cohort

Table A.7

Average Income and Differential by Gender and Educational Level

Level	Years of Schooling	Men	Increase ^a	Women	Increase ^a	Increase ^b
Incomplete Primary	0-4 años	270,496		143,955		87.9%
Complete Primary	5 años	328,484	21.4%	188,842	31.2%	73.9%
Incomplete Secondary	6-10 años	364,159	10.9%	245,453	30.0%	48.4%
Complete Secondary	11 años	504,759	38.6%	350,118	42.6%	44.2%
Incomplete College	12-15 años	659,785	30.7%	466,626	33.3%	41.4%
Complete College and more	16+ años	1,315,170	99.3%	796,203	70.6%	65.2%
	Total	466,998		300,992		55.2%

Source: DANE, Household Surveys. Authors' Estimates.

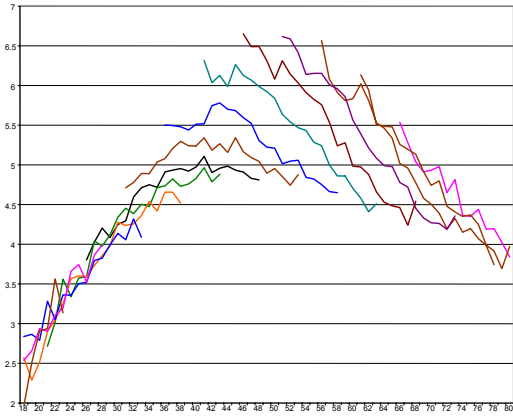
^a Calculated as the percentage increase between on level and the next.

^b Calculated as the percentage difference between the labor income of men and women.

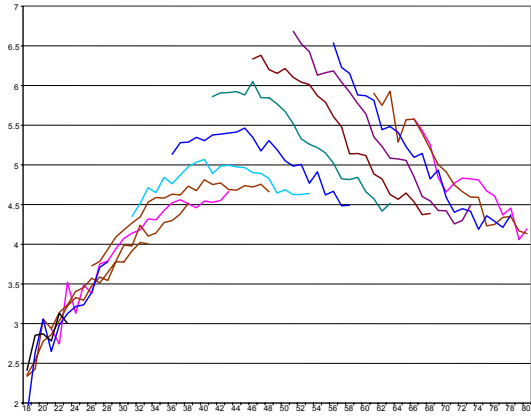
Table A.8
Time Dummies of the Determinants of School Enrollment and Years of Schooling

	Schooling	Enrollment
1977		0.054
1978		0.038
1979		0.082
1980	-1.771	0.114
1981	-4.999	0.164
1982	-1.594	0.169
1983	-1.938	0.170
1984	-1.915	0.199
1985	-1.941	0.289
1986	-1.955	0.313
1987	-1.960	0.352
1988	-1.944	0.398
1989	-1.914	0.462
1990	-1.838	0.511
1991	-1.987	0.587
1992	-2.113	0.322
1993	-2.011	0.372
1994	-1.922	0.454
1995	-2.025	0.515
1996	-0.775	0.683
1997		0.934
1998		1.032

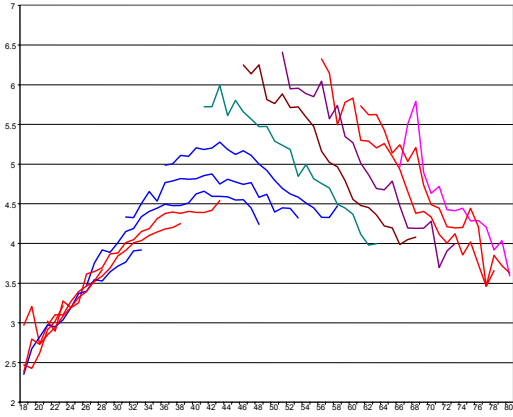
Family Size by Cohort and Schooling of the Household Head



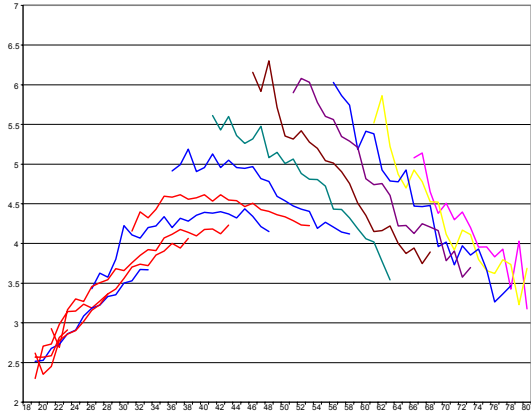
Graph A.1. 0-4 years



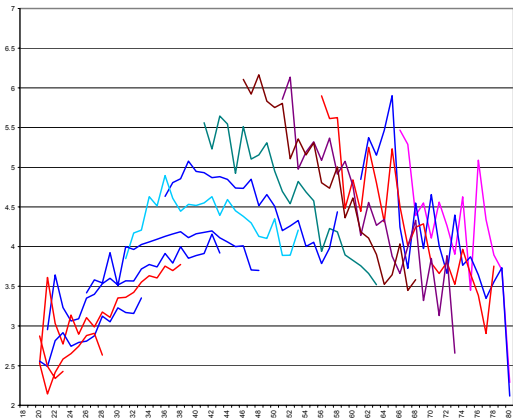
Graph A.2. 5 years



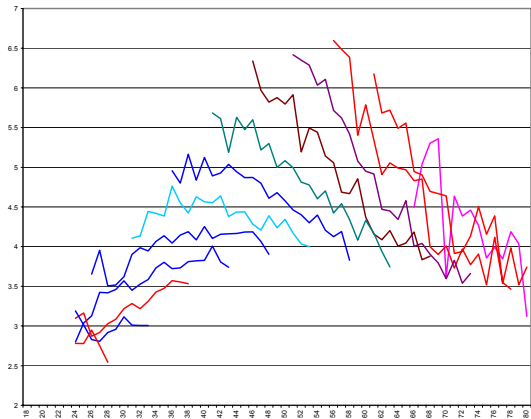
Graph A.3. 6-10 years



Graph A.4. 11 years

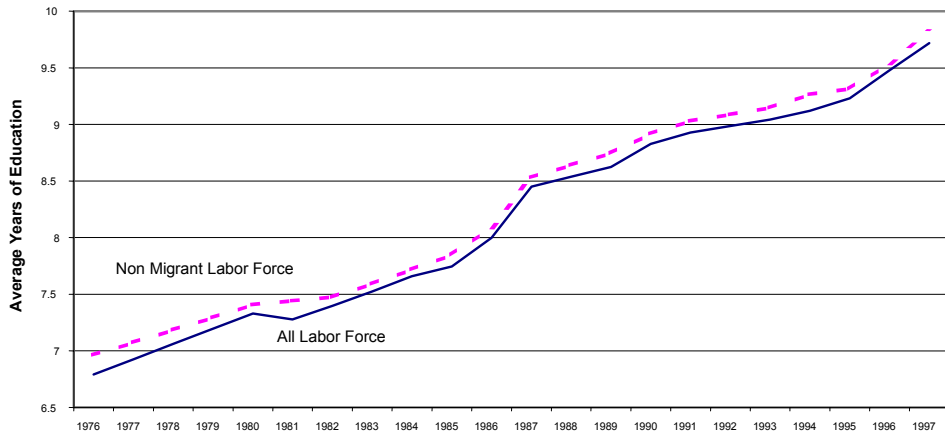


Graph A.5. 12-15 years

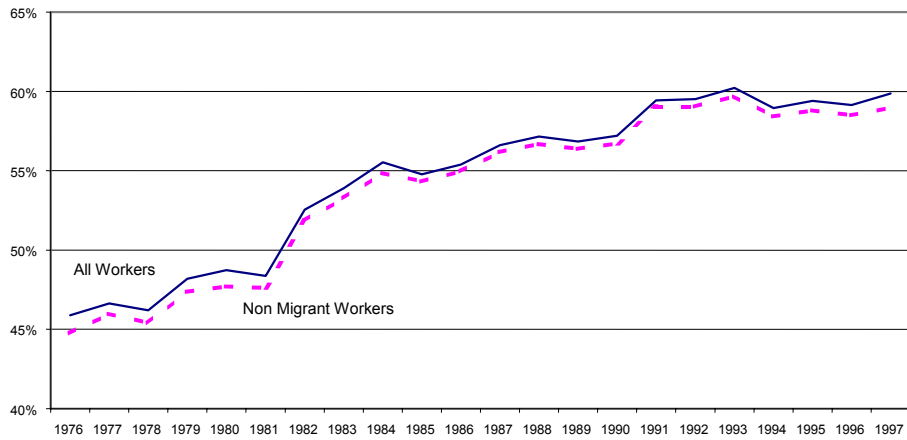


Graph A.6. 16+ years

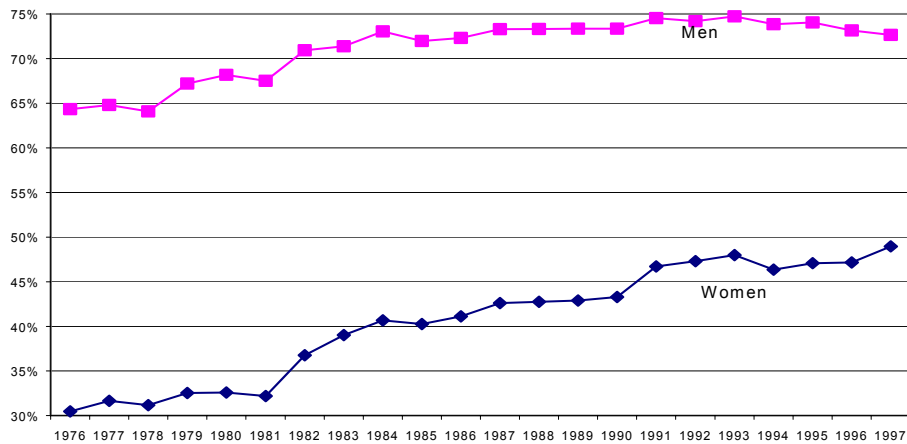
Graph A.7
Years of Education for Migrant and Non-Migrant Workers



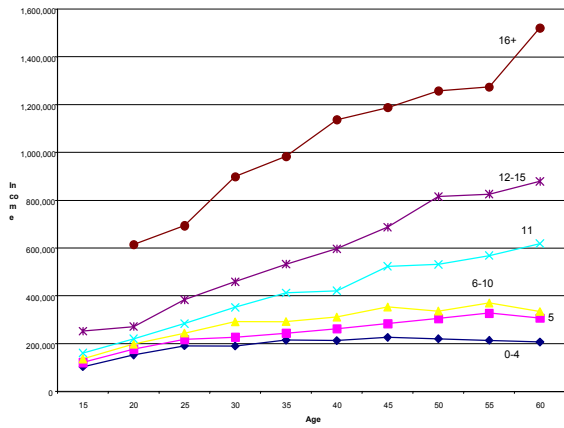
Graph A.8
Labor Force Participation for Migrant and Non-Migrant Workers



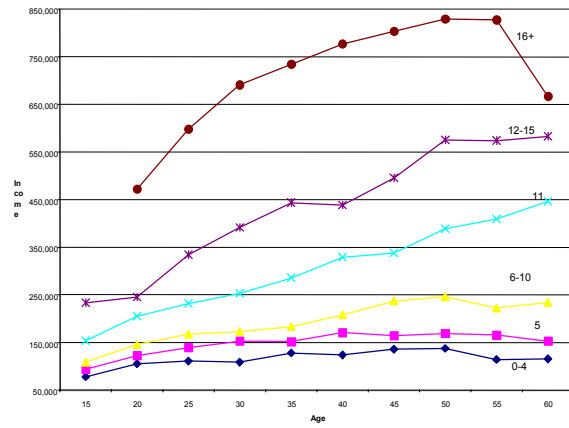
Graph A.9
Labor Force Participation



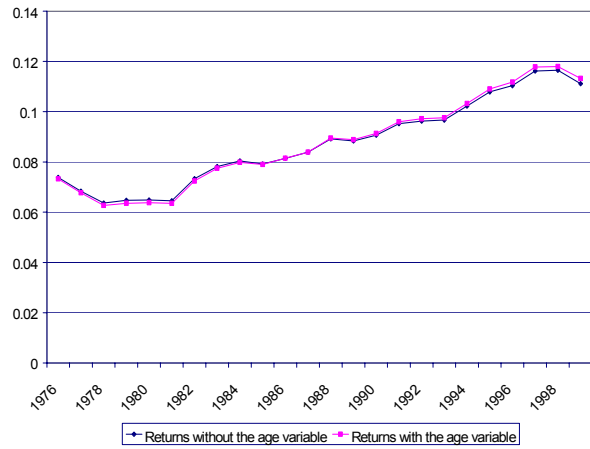
Graph A.10
Men Income Profile by Educational Level



Graph A.11
Women Income Profile by Education Level



Graph A.12
Heckman's women return to education by year



Graph A.13
Heckman's women return to education by cohort

