

Having Kids is not good for Kids- or Babies. The Colombian Case

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Having Kids is not good for Kids- or Babies. The Colombian Case Abstract

Although Colombia's overall fertility rate has decreased steadily since 1960, adolescent fertility has increased during the past 15 years. Previous studies have focused on cross-sectional effects, thereby biasing the results. This paper constructs a pseudo panel using DHS data from 1995 to 2005 (pooling cohorts born between 1964 and 1974) and measures the effects of adolescent childbearing on the economic, educational and health outcomes of Colombian women and on the health of their children, in their early childhood (ages 1 to 5). The results revealed practically no effects on the education or employment rates of adolescent mothers and no social stigma regarding the marriage market. However, there were important effects on their partner's quality as these women tended to suffer more abuse at the hands of their partners. Infant health problems and infant mortality are more prevalent among children born to adolescent mothers, which requires special attention and targeted public policies.

I. Introduction

Although Colombia's overall fertility rates have steadily decreased since the 1960s, an unexpected increase in adolescent fertility has been observed during the past 15 years. According to data from Demographic and Health Surveys (DHS) carried out in Colombia, age-specific fertility rates (ASFR) for females aged 15 to 19 have increased from 73.4 per thousand women in 1986 to 90 per thousand women in 2005. Interestingly, this increase has been observed in both rural and urban areas, among educated and uneducated females and among married and unmarried women. It is thought that adolescents today have more options in life than adolescents had in the past; the potential effects of adolescent childbearing on educational, work and marriage markets could thus be linked to the creation of cycles of poverty, as opposed to older generations when it was customary for Colombian women to marry young and soon become involved in motherhood at early ages.

Little research has dealt with the socio-economic consequences of the increase in adolescent childbearing, partly due to the lack of available data. For instance, two studies, using cross-sectional information, have found that adolescent mothers in Colombia had lower educational levels and their early motherhood perpetuated poverty in already poor families (Gaviria, 2000), or they had lower school enrollment rates and fewer possibilities of getting a job (Barrera and Higuera, 2003). The lack of longitudinal surveys in Colombia has not allowed the long-term consequences of early pregnancies to be studied, thereby biasing the effects of adolescent fertility as these authors have mentioned regarding their own studies. Indeed cross-sectional studies on this topic have accounted for dropping out of school by teen girls when they become pregnant and miss detecting the possibility that girls may reenter school in the (near) future. Moreover, cross-sectional data do not account for differences in family background and heterogeneity across a range of females who have babies at different ages. The true effects of adolescent childbearing have thus not been fully accounted for in Colombia and that is the main interest of this research.

This study empirically measures the long-term effects of adolescent childbearing and motherhood by determining the patterns of education, employment and marriage of adolescent mothers and the health of children born to teenage women. Three recent DHS studies carried out in Colombia (1995, 2000 and 2005) were used for constructing a pseudo-panel.³ The birth cohorts of females born between 1964 and 1974 were pooled and followed

³ DHS-1986 had a very different sampling design from the subsequent DHS surveys, as it was implemented by an agency other than Profamilia. Also, DHS-1990 posed two problems for designing this study: it oversampled urban areas, as has been stated by Profamilia (the Colombian agency in charge of survey fieldwork and

up through each DHS if the women bore their first child when aged 15 to 22. This allowed us to follow all mothers until they reached at least 30 years of age, which is a desirable age for the purpose of this study since the vast majority of Colombian women do not increase their educational levels after the age of 27 (less than 3% according to DHS data), and 90% of women stop having children at age 29.

As the treatment group for this study consisted of adolescent mothers, the challenge lay in finding an appropriate control group. This study made three contrasts between females who became mothers at different ages: those who became mothers at ages 15 to 17 (group 1); those who bore their first child at 18 or 19 (group 2) and those who had their first child at age 20 or 21 (group 3).

Women in each group were interviewed at age 30. The contrast between group 2 and group 3 led to a comparison of much more similar treatment and control groups, as coming of age in Colombia is 18 and coincides with the end of secondary education, making them closer in educational attainment and other socioeconomic indicators to those slightly older mothers (i.e., as opposed to younger adolescents). The contrast between group 1 and 2 was intended to include all adolescent mothers, and presented closer control of the youngest adolescent mothers. The contrast between group 1 and group 3 presented extreme cases between the youngest and oldest mothers considered in this study. Although the differences between both groups were obvious (i.e. lower educational attainment, legal access to the job market, longer periods of exposure to the risk of a second pregnancy), the comparison of the two produced information about the different outcomes from postponing motherhood by at least five years without biasing the results heavily regarding all older mothers.

Our findings show that, after controlling for pre-existing socioeconomic status, differences in educational attainment and unemployment narrowed and became practically non-existent; however, younger mothers had worse quality jobs. We also find that there was no stigma in the marriage market; as adolescent mothers' marriage or union rates were even higher than those of nonadolescent mothers. However, their unions were more unstable and their partners were definitely worse quality as measured by lower educational level, worse job quality and, more importantly, they tended to be more abusive towards their wives. Important negative effects were seen regarding infant mortality and infants' health.

processing since 1990), and it produced very small-sized cells which did not provide the large numbers required for this research.

II. Literature review

Rodríguez (2008) has shown that there has been no reduction in adolescent fertility trends in recent decades in Latin America, and this correlates strongly with poverty and low educational levels. The author associated the failure to diminish adolescent fertility rates with the reduced average age of menarche, adolescents' earlier initiation of sexual activity and low contraceptive usage rates. The socioeconomic impact of adolescent fertility has captured the attention of scholars around the globe who have studied the phenomenon using different approaches from a range of social sciences: economics, epidemiology, sociology, anthropology, public health and demography. In general terms, researchers share a view in which adolescent fertility has been highly correlated with pre-existing poverty conditions. However, testing the effects on socioeconomic performance is extremely hard with most secondary data, and the main challenge lies in the proper design of control and comparison groups. The literature review is summarized in this section presenting first longitudinal data results and then cross-sectional data.

Geronimus and Korenman (1992) compared sets of sisters in which one timed her first birth as a teenager and the other postponed it. The analysis used data from National Longitudinal Survey Young Women's Sample (NLSYW) -1982, the Panel Study of Income Dynamics (PSID) -1985, and the National Longitudinal Survey Youth Sample (NLSY) -1988. Controlling for family background decreased the effects of socioeconomic outcomes related to a teen birth, and the research design allowed controlling for unobserved characteristics regarding family background which lowered the negative outcomes of adolescent motherhood.⁴ Thus, the differences between sisters proved to cause little or no difference in outcomes such as finishing high school, reaching tertiary education, current income and being married. However, authors have pointed out that the differences between the educational outcomes of cousins born to sisters who timed births differently seemed to favor children born to older mothers.

Burgos and Carreño (1997) collected retrospective information in Argentina from nulliparous pregnant women who gave birth, and used their clinical records to contrast health outcomes regarding babies born to adolescents and all other women as controls. The sample was collected between 1993 and 1995 at “*Las Mercedes*” hospital in rural Tucumán; it included 9,002 females, of which 4,896 were adolescents. The “*Durand*” hospital in Buenos

⁴ The authors studied: total family income, the income-to-needs-ratio, poverty status, welfare status, whether or not a woman completed high school, whether she completed at least one year of post-secondary schooling, her current employment status, and her marital status.

Aires (BsAs) reported on 1,069 women, of which 409 were adolescents. The risk factors were estimated separately for each dataset and showed that being a single mother for adolescents in BsAs increased the risk of damage to newly-born babies (as shown by low scores at birth in Apgar test #1) while in Tucuman it was associated with a higher risk of low birth weight and preterm births, compared to babies born to women aged over 20. Illiteracy and C-sections were good predictors of low birth weight and preterm births in both hospitals.

Buvinic (1998) reviewed four studies in Latin America and found that teenage childbearing did not affect women's marital prospects negatively. The Barbados study used a sample of 303 women who gave birth between 1983 and 1984; they were interviewed six to eight years after giving birth. A study in Chile used a representative household survey carried out in Santiago in 1990 to draw a sample of 505 women. It compared women who had a child when aged 19 or younger to those who bore their first child at age 20 or older. A study in Guatemala used 850 females' retrospective life histories and followed them up in three rounds of surveys: 1967, 1974 and 1987, comparing women who had their first child at age 19 or younger, and women who became mothers at age 20 or older. The Mexican study followed up a sample of 462 women who had given birth in a major hospital between 1987 and 1989. The women were interviewed four years after their child was born, comparing those who had given birth before age 18 with those whose first birth had occurred at age 21 or older.

The results showed that adolescents in the four countries who bore children were not more or less likely than adult mothers to be married four years after childbirth. Yet, while adolescent motherhood did not seem to carry a social stigma which would affect females' likelihood of finding partners and marrying, it did seem to be associated with differences in family size (larger families) and family arrangements (more adolescent mothers as boarders, fewer biological fathers as heads of family and taking financial responsibility for and forming attachment to a child and more grandparents taking over responsibility for children). Also, the children of adolescent mothers were less likely to attend pre-school or child care and had lower scores on language development tests and more behavioral problems. As a result, the teen motherhood cycle tended to repeat itself. A majority of adolescent child bearers in Mexico and Chile had themselves been born to adolescent mothers. Fully two-thirds of adolescent mothers in Mexico were daughters of mothers who had also given birth during their teen years, suggesting that adolescent motherhood can be learned and transmitted within families.

Hogan, Sun and Cornwell (2000) followed three cohorts of adolescents from the National Survey of Family Growth-Cycle V from 1985 to 1995 in the United States and exploited the women's life histories data to apply a Weibull hazard model for the timing of first sexual intercourse and first pregnancy among sexually active adolescents. They found that, along with the increase in teenage pregnancy came important changes in sociological variables including an increase in single heads of households and other non-conventional household living arrangements and unstable family life.

Levine and Painter (2003) compared pairs of classmates in the same high school and applied matching techniques to find that adolescent mothers were more prone to having lower educational outcomes. However, most of that effect was explained by pre-existent conditions, such as lack of knowledge about sexuality and pregnancy. Ermisch and Pevalin's (2003) results suggested little adverse impact from teenage motherhood on females' labor qualifications, employment or pay at age 30 in English society; however, the study indicated that the partner the teen mother was with at age 30 (if they had one) was more likely to be unemployed. By using data from the British 1970 Cohort Study and following the methods developed by Hotz *et al.*, (1997), it was found that women who became mothers in their teens appeared to fare worse in the 'marriage market', in the sense that they partnered with men who were more likely to become unemployed. Having been a teenage mother also tended to reduce the probability that a woman would become a homeowner by age 30.

Hotz, McElroy and Sanders (2005) compared women who had a miscarriage as teens to teen mothers using an instrumental variable approach to calculate unbiased estimates of the impact of teenage childbearing. Their study used data from the U.S. National Longitudinal Survey of Youth, 1979 (NLSY79). Their results showed that the negative effects of adolescent motherhood were of lower magnitude than those found in previous studies using alternative methodologies, and that teenage mothers had higher incomes at older ages than they would have had by postponing motherhood.

Sánchez, *et al.*, (2006) tracked 84 pregnant adolescents who attended the "*Diana de Especialidades*" prenatal clinic in Oaxaca, Mexico. Short interviews were conducted to record information given by the women at every visit during pregnancy, and the women were followed up for several months after giving birth. The authors found that 60.7% of these adolescents were single and had unstable relationships which did not last more than a year; and they found positive correlations with low grades in school. Many of these mothers had dropped out of school before becoming pregnant. The authors speculated that, for these

women, pregnancy was probably the only chance they had to define their lives. Being an early drop-out also increased the probability of a second pregnancy.

Other studies exploited only cross-sectional data. Although the authors were aware that this would bias the results, their main findings still pointed out that adolescent mothers tend to self-select due to several socioeconomic factors. Gaviria (2000) used information from Social Survey-2000 in urban Colombia and applied a linear probability model to measure the role of socioeconomic characteristics in the probability of becoming pregnant. He found that teenage childbearing reduced educational attainment and that teens who became pregnant and bore children had low expectations regarding social mobility. His results suggested that differences between poor and non-poor teenagers in urban Colombia were not associated with knowledge of or access to birth control, but rather with more deliberate decisions associated with low socioeconomic expectations. Other factors, including sociological characteristics, have been shown to influence adolescent fertility. The literature review for Latin America by Pantelides (2002) identifies access to information, age at first sexual intercourse and family environment as important determinants of adolescent fertility. Flórez and Núñez (2002) examined teenage fertility trends using DHS surveys for Bolivia, Brazil, Colombia, the Dominican Republic, Guatemala and Peru for the second half of the 1990s. They found different teenage fertility (TF) trends in countries and in regions. Rural areas experienced increased TF in all countries, but TF did not necessarily rise in urban areas. Bolivia and Guatemala, the two countries with the highest TF levels, showed little change over time in both urban and rural areas. The proximate determinants of TF varied between countries. In Peru, for example, patterns of intercourse, high acceptability and use of contraceptive measures and postponing marriage have helped to lower TF. Although contraceptive use is widespread among adolescents in Brazil and Colombia, TF, mostly before marriage, has increased steadily. However, marriage market patterns have had no effect on TF. For instance, the marriage market has changed since the mid-1980s so that consensual unions have become the predominant marriage arrangement in Colombia. Despite this shift in the marriage market, the adolescents' fertility rates have continued to increase for women who are married, unmarried or in a union.

Flórez, *et al.* (2004) followed Simmons' (1985) conceptual framework and studied socioeconomic and contextual factors which affected both the rate and timing of adolescent fertility through proximate determinants, including the influence of peers, couples, parents, teachers and the media regarding sexual activity, dating and pregnancy. The study focused on decisions adolescent girls made about becoming sexually active, and the age at first

pregnancy and first birth for two Colombian cities, Bogotá and Cali. Their data showed that adolescents from high socioeconomic strata spent most of their teenage years studying, while most adolescents from low socioeconomic strata started engagements (marriage or consensual unions), became mothers and became employed at early ages.

Their study also showed that teenagers held unfounded beliefs about the use of contraceptive measures, reflecting the lack of knowledge on the topic, and the misconceptions were more widespread and pronounced in females from disadvantaged households. The authors did not find any effect from exposure to sexual education in schools. Contextual household factors--such as previous teenage fertility in a household, sexual abuse, physical and/or verbal abuse, poor communication with their mothers, lack of supervision and a favorable perception of early sexual activity--all had a positive effect on the likelihood of starting sexual relations as adolescents in both Bogotá and Cali.

A follow-up of this study by Flórez (2005) used survival analysis to evaluate the main characteristics associated with first pregnancy in Bogotá and Cali. The results showed that adolescents from disadvantaged homes were more likely to become mothers, which also coincided with the fact that broken families, or families in which mothers of adolescents were absent, or did not talk to their daughters about sexuality, increased the risk of adolescent motherhood. In contrast, having access to sexual education and family planning methods (either obtained from parents or school) reduced the probability of becoming pregnant.

For Colombia and Brazil, di Cesare and Rodríguez Vignoli (2006) have used a logit model to determine the probability of becoming an adolescent mother. The authors found that probability of teen motherhood decreases with age at first union, educational attainment, contraceptive use and belonging to a traditional family with both parents in the household. As with other studies, once social class was controlled for, education has no effect over adolescent fertility.

Núñez and Cuesta (2006) used instrumental variables for estimating the potential effects of adolescent fertility on educational outcomes, a simultaneous equations model to estimate the effects on and propensity score matching to identify the effects on adolescents' children by surveying women who had been mothers at ages 22 to 30 by 2005 using DHS-2005. They found that adolescent childbearing reduced average education and job market outcomes and was also positively correlated to formation of unstable families. The study also detected very negative health and educational outcomes for adolescents' children, shown in a low incidence of vaccination, poor health status and fewer years spent in school.

To examine health outcomes of babies born to adolescent mothers, Fernández, *et al.* (2004) collected data between June and December 2001 at “*Julio Trigo López*” hospital in Havana, Cuba. The authors pointed out that the current literature shows no significant differences in health outcome for babies born to adolescents compared to babies born to older women. The main findings in the literature indicted that babies of teen mothers had a poorer health status due to low nutritional status and fewer prenatal medical consultations while being carried by their mothers. Yet, the data collected by Fernández, *et al.* showed that one third of adolescent mothers were undernourished, and this was highly correlated to babies born with a low birth weight. They also found that the infant mortality rate (IMR) was twice as high for adolescent mothers (9.7 per thousand) than for mothers who gave birth at age 20 and above (4 per thousand).

Auchter, *et al.* (2005) reviewed previous literature that pointed out that the higher health risks for babies of teen mothers were related to less frequent attendance at prenatal control visits and at pediatric check-ups once the babies had been born. In addition, when compared with women who became mothers between ages 20 and 30, more adolescent mothers suffered from anemia and malnutrition and teen mothers produced higher percentages of babies with low birth weight and preterm pregnancies, and even higher infant mortality rates. The authors also collected information on mothers and babies at a prenatal clinic in Corrientes, Argentina, and concluded that there was a the lesser the number of prenatal visits the higher the probability of having complications at birth, and that fewer prenatal visits were also related to higher percentages of babies born with low birth-weight and preterm deliveries.

Perdomo, *et al.* (2005) conducted a case study in Cartagena, Colombia, which focused on adolescent females’ nutritional outcomes. Biometric measurements and urine and blood samples were taken of pregnant adolescents in the *Juan Felipe Gómez Escobar* program between March and April 2005. The authors found a direct correlation between malnutrition and a higher probability of complications during delivery, and babies having low birth-weight and preterm deliveries.

Studies for Uruguay (Gerstenblüth, *et al.*, 2009) and Brazil (Berquo and Cavenaghi, 2005) have shown that it is very hard to determine an unequivocal effect on educational outcomes, although both studies concluded that educational outcomes and school enrollment were negatively affected by adolescent fertility.

Teenage fertility literature has followed several methodological approaches for determining the impact of adolescent childbearing on the lives of mothers and has reached

consensus on two issues. First, most of the effects on education and income are attributable to socioeconomic background characteristics or self-selection; therefore, these women would still be worse off if they had not had a baby during their adolescence. Secondly, cross-sectional data increases this bias even further. Nonetheless, several critiques are made claiming the control groups used in the studies cited above are inadequate. For instance, choosing sisters or comparing miscarriages produce scant reporting because it is very hard to match this type of pair in sample surveys, so very little observation matches the criteria results for the analysis. Finally, there is little research in Latin America in general, and in Colombia in particular, on health outcomes. All the studies cited here were case studies carried out in hospitals or clinics which, by definition, are self-selected populations. Even so, all these studies identified that malnourishment is highly correlated with complications at delivery and low birth-weight among newborn babies.

In order to overcome the limitations of the research summarized here, this study chooses a more refined control group and builds a pseudo-panel with all possible observations matching the criteria of mother's age at first birth.

III. Research strategy

Our approach consisted of constructing a pseudo-panel from random samples of women in their reproductive years, drawing on DHS surveys carried out in Colombia at 5-year intervals from 1995 to 2005. A follow-up study was made of cohorts of women born between 1964 and 1974 and those who gave birth to their first child between the ages of 15 to 22. Table 1 gives details of the females in each group that allowed three possible contrasts.

In an attempt to control for pre-existing conditions stemming from the low socioeconomic status of these women during adolescence, we included the height of women which was measured at the moment of the survey. This anthropometric measurement does not change over time since women on average do not grow more than two centimeters after the date of their menarche. Also, below-average height is highly correlated with low quality nutritional intake and therefore with lower income. Taller people usually come from higher income families. This is true even across countries where average height also provides a good proxy for income levels (see Meisel and Vega, 2006; Fogel, 2000; Fogel, 1997). This direct relationship between height and income levels has also been observed in Colombia in the past (Meisel and Vega, 2004; Ribero, 2000). Using the entire sample of the DHS under study, we also found the same relationship for all women as presented in Figure 1. Having this in mind, the following expression captures the effects on women's outcomes of the reduced model:

Equation 1: Womens' outcomes

$$\text{Womens' outcome}_{i(t)} = \alpha_{i(t)} + \theta a_{i(t)} + \beta x_{i(t)} + \varepsilon_{i(t)} \quad (1)$$

for $i(t)=1, 2, \dots, N_t$ and $t=1, 2, \dots, T$, where subscript $i(t)$ refers to cells and the number of cells N_t may vary in each year t . In this equation, the dependent variables (*Womens' outcome*) could be educational, job market and marriage market outcomes. Each depends on the fact that mother i , who belonged to cohort t , had her first child while an adolescent--captured by estimator θ --controlling for other individual characteristics included in vector x and captured by estimators β . Disturbance term $\varepsilon_{i(t)}$ also includes a time-invariant individual effect, $f_{i(t)}$, which characterized the pseudo-panel data. It was only through using pseudo-panel data that the cohort (part of the fixed effects) could be disentangled from age and year effects of becoming a mother. This would not have been possible if only cross-sectional data from only one of the pooled surveys had been used because for any chosen year there would have been perfect collinearity between age and years.

Estimators from pseudo-panels were consistent (see Mora 2006) if the original samples were large enough, as in our case, and if each cell had sufficient observations. Standard regression analyses are linear estimations for all continuous dependent variables while regressions follow a logit model for grouped data with dichotomous dependent variables.

Equation (1) included a "constant" term, $\alpha_{i(t)}$, which was definitely non-constant because it varied over time and could be correlated with independent variables. Deaton (1985) showed that whenever there were large numbers in the original sample, the best estimation for this constant term, alpha, was an approximation to its mean value, $\alpha_{i(t)}$. This value could be approximated by including a series of dummies per cohort in all cohorts included in the pseudo-panel. A series of dummies was thus included in all estimations, allowing for consistent and unbiased estimators as well as presenting a control for each cohort's fixed effects.

Educational attainment was the first women's outcome to be considered. It is not only a job market indicator, but also a proxy for the individual's income which was not recorded in the survey. The next two outcomes examined were unemployment and job quality for those with jobs. The measure of job quality was formality of the current job. More formal jobs-- technical, managerial, clerical, sales and skilled manual workers--were considered to be high quality, and informal jobs--independent workers with low educational levels,

unremunerated family workers, domestic workers, unskilled manual workers and agricultural jobs--were classified as being lower quality.⁵

The last set of women's outcomes related to the marriage market. Marital status accounted for success- or failure regarding family formation for adolescent mothers and the stability they may have for their children and themselves, so current marital status and the number of partners they have had was the method for quantifying stability. Even if women lived in stable relationships, the quality of the partners differed between adolescent mothers and their counterparts who became mothers at 20 or older. The quality of partners was measured by two proxies: (1) the current partner's job quality, using the same definitions as for women's employment, and (2) if women had been physically abused by their partners. The richness of the data allowed for estimating two proxies of physical abuse: less severe domestic violence (being pushed, slapped, punched or kicked) or more severe domestic violence (attempted strangling or burning or threats or attacks by the partner using a weapon).⁶ As for children's outcomes, they were measured by Equation (2).

Equation 2: Children's outcomes

$$Health_{i(t)j} = \alpha_{i(t)} + \theta m_{i(t)j} + \alpha z_{i(t)j} + \beta x_{i(t)} + \varepsilon_{i(t)j}$$

Those outcomes were basically health indicators of children i born to mother j belonging to cohort t . Two indicators were available from DHS data: infant mortality and birth-weight. The incidence of infant mortality was taken from the women's entire fertility history, while the birth weight was only available for children born during the five years prior to the survey.⁷ As with Equation (1), the effect of teenage motherhood was captured by θ , controlling for individual characteristics of child i , measured by characteristics vector z and captured by estimators α ; and the mother's individual characteristics were summarized by vector x and captured by estimators β . The main indicators from the DHS questionnaire led to constructing mortality indicators and birth-weight which is one of the best predictors of future health and even motor and intellectual development of children in future years (see Douglas, *et al.*, 2005). As younger mothers could be exposed to the risk of having additional

⁵ Women occupied under the category of "services" were classified as holding formal jobs if they worked outside their households and received payment; and otherwise were considered as informal.

⁶ Categorizing formal and informal jobs for women's partners differed only in the sense that those men working in the category of "services" could not be reassigned since men were not questioned regarding place of work and payment. Thus, three categories of employment were created for partners: formal, informal and services.

⁷ The definition of children born dead or alive in Colombian DHS followed international standards for census questionnaires; the literal question was, "Is your child (name) dead?", and was applied to all children ever born to the women surveyed. Instead, birth weight was the weight registered at birth and collected for children born during the five years prior to the moment of the survey.

children for longer periods than their counterparts, and may report more children having differing health qualities, for birth weight we controlled for the order in which the babies were born.

A. The data

The DHS has been designed to capture information on health programs, contraceptive use, fertility, infant and maternal mortality and nutritional status. The DHS survey targeted households, collecting information about women in their reproductive ages (12 to 50 in Colombia) and their children born in the previous five years. It also collected several anthropometric measurements--vaccination coverage and nutritional status of both mothers and their children--all of which are very relevant for this study. Colombia has run five DHS since 1990. This allowed us to construct a pseudo-panel and satisfy the requisite statistical conditions (Deaton, 1985), given that the samples for each survey were large enough both for women and their children. Measurement error was assumed to be normal, independent and homoscedastic in pseudo-panel data. All measurements captured the cohort's mean measures instead of individual means. Thus, it could be assumed that measurement errors were distributed with zero mean and were independent of true values, so remaining econometric estimations followed standard statistical models and the only difference would be that matrices are used instead of independent and identically distributed vectors.

B. Treatment and control groups

The models were run for two contrast groups at a time for all econometric models proposed in Equations (1) and (2). Contrast one (C1) exploited natural discontinuity around age 20, comparing the outcomes of interest for older teenage mothers (18 to 19) and their children to those who became mothers between 20 and 21. Contrast two (C2) presented the differences between the youngest adolescents (15-17) and slightly older ones (18-19). Contrast three (C3) presented the differences between the youngest and the oldest mothers: (15 to 17 versus 20 to 22). The purpose of the three different contrasts was to have the best control group for each treatment, trying to homogenize both socioeconomic and fertility characteristics.

The pseudo-panel added up to a total of 6,554 observations and 44 groups for a panel of 132 observations in the case of C1. C2 had 6,440 observations and 55 groups for a panel of 163 observations and C3 consisted of 7,503 observations and 66 groups to form a panel of 195 observations. The cells were built from birth cohorts of women born from 1964 to 1974

and the ages at which the women became mothers. All the following econometric exercises included estimations of fixed effects by cohorts, by including each cohort's effects, following Deaton (1985), which is a valid estimator for the fixed parameter, $\alpha_{i(t)}$, in Equations (1) and (2). As a result, the estimators were consistent for continuous and categorical variables (as proved by Deaton, 1985). Including such dummies helped to reduce the bias of individual selection and transformed it into cohort selection bias, and all estimations were proved to meet the statistical needs of traditional models.

IV. Results

The classic t-test was used for the observable outcomes regarding the women aged 25, 30, 35 and 40 for each contrast group. For educational and labor market outcomes, we find that women who became mothers at earlier ages had average lower educational attainment although the gap closed slightly by age 40. Such differences in means did not show a significant difference between younger and older mothers in the quality of jobs, but the percentage of good jobs among all age cohorts displayed an inverted U pattern for the two extremes, e.g., the lowest percentages of women holding quality jobs appeared among women who became mothers at the youngest and oldest ages of the range studied. There was no difference in means between younger and older mothers regarding the percentage of those employed, except for the C3 group when they reached age 30, and then the oldest mothers reached, on average, lower unemployment rates by a significant difference.

Marriage market outcomes showed a similar pattern in that C3 results indicated a statistically significant difference in proportions of women living with a partner at all ages; among the youngest mothers, the percentage of women living with partners increased with age.⁸ The percentage of women who never got married is lower for younger mothers. The age of 40 marks a threshold for both C1 and C2 groups because a majority of these women have a significant increasing proportion of married at that age. For C3, however, the difference between women with partners and never married women was significant at ages 25 and 30 but disappeared at 35. The percentage of women who had had more than one union tended to be higher among younger mothers, and reached the highest percentage in the C1 group. The difference between women in unions and never married women was significant only by age 30 in both C1 and C2, while for C3 women giving birth at ages 15 to 17, a

⁸ Marital status is defined as follows: Living with a partner as opposed to being married, divorced, widowed, or single; the category "never married" is defined as not ever having had a partner.

higher percentage had had more than one union when compared to women who became a mother between ages 20 and 22.

The means of “quality” of partners showed significant differences for most ages in C3 and C1; partners of the youngest mothers attained lower levels of education. However, when partner’s quality was proxied by job quality, these differences were insignificant, with one exception: among women in C1, by the time they reached age 40, the partners of women who had been the youngest mothers had a higher share of good jobs. In the case of physical violence, as defined in the previous section, the percentage of women suffering from severe violence was higher among those who became mothers at the youngest ages, and the percentage of them suffering violent abuse appeared to increase with age. In the case of less severe violence, results were weaker, except that C3 manifested the same pattern described above, with a much higher proportion of women who had become mothers earliest inflicted with less severe violence. Indeed, nearly 50% of the youngest mothers were victims of less severe violence.

Outcomes for children as defined in the previous section, in general showed significant differences at a particular age but these differences then vanished at other ages in the same group. For example regarding child mortality, for C1 there was one statistically significant difference at age 30, which then disappeared at ages 35 and 40. Similarly to C2, the sole significant difference regarding child mortality was for the group of women age 25; the difference disappeared at ages 30 and 35 and then reappeared at age 40. In the case of C3, a significant difference existed at age 25 but was not present at age 30 and reappeared again at 35 and 40. No differences were found between contrast groups or ages of mothers for low birth weight in terms of the means for children born weighing less than 2,500 grams.

A. Estimation results

As stated before, all of the following estimations included the approximation of constant parameter $\alpha_{i(t)}$ in Equations (1) and (2) by including fixed cohort effects produced by consistent estimates. Tables 2 to 4 show the results regarding educational attainment and job market, the marriage market and infant mortality. The three panels have the results for each contrast described above and include women’s height as a control for pre-existing socioeconomic characteristics.⁹

⁹ These estimations do not include as independent variables those that are outcomes to avoid endogeneity. For instance, the equation that measures the probability of being employed does not include as a co-variate education.

In Table 2, the first column shows the negative and significant effects of adolescent motherhood on years of education in all cases; however, the magnitude of the effects varied by contrast group. The first contrast (C1) had the smallest effect—less than one year of difference in schooling--and the difference was between the oldest adolescent mothers (17-18) and the youngest adults (20-21). Similarly, for women in C2, the difference in schooling was just over one year. With the C3 group, the difference was almost two and a half years. These results showed the importance of the contrast group in the analysis. The choice of C1, where women were all legally considered to be adults (over age 18), and had reached the average age for finishing secondary education, making both groups more homogeneous regarding this particular outcome. The opposite was true for the group that displayed the widest contrast, C3. The youngest adolescent mothers in C3 had, on average, at least five years less schooling than the women who became mothers at the age of 20. Over time, these very young mothers showed a definite tendency to catch up with their older counterparts, although in the long run they still lagged two years behind the older C3 mothers in years of education. In all cases, these results showed the negative effect of adolescent motherhood on the accumulation of human capital.

Table 2 also shows women's outcomes in the labor market. The second column shows the odds ratios of being employed in a formal job at the time of the survey. In all cases, women who became mothers during adolescence had a lower probability of having a better job in contrast with their counterparts. In both C1 and C3, the effects were significant, and teen mothers had a lower probability of formal employment of about 30% in each case. However, for C2 women, the effect was non-significant; the probability of having a formal job was only 3% lower for the youngest mothers (15-17), than for slightly older adolescent mothers (18-19). Since the available data could only take into account women currently employed at the time of the survey, these results were not fully conclusive. However, the result does suggest that the youngest mothers had lower job quality compared to women who postponed motherhood until after their teenage years. Column 3 shows the effects on the probability of being employed at the time of the survey. In all contrasts, the effects were non-significant and odds ratios were very close to one in all cases. These findings support the previous results showing the negligible effect of adolescent motherhood on the probability of working in the long run, and point to a potential reason for this labor market outcome, which is that young mothers likely feel additional pressure to find and sustain a job after motherhood in order to provide for their children.

The second set of outcomes for women was related to the marriage market. The first and second columns of Table 3 showed no segregation regarding this matter. The coefficients were significant in all measures and contrasts and had a lower probability for the youngest of never marrying. Once again, magnitude changed with the contrast made, the most dramatic being the effect on C3, where the youngest adolescent mothers had a 50% lower probability of never marrying compared to young adult mothers. This result simply reflected that, as in other Latin American countries, no stigma seems to be attached to adolescent mothers in the marriage market. This makes sense considering the fact that most couples live in informal arrangements, and marriage is no longer viewed as a condition for starting a family in Colombian society.

An explanation for the performance of youngest mothers in the marriage market is suggested by the proxy for stability of unions in contrasted groups, proxied by the number of unions women have had. The proxy revealed that the youngest mothers always had a significant and higher probability of being in more unstable unions, as the odds ratios showed a greater probability of having more than one partner between 20 and 30 years after they became mothers. The larger the difference between treatment and control group, the larger this probability. For instance, the probability that an adolescent mother of 18-19 in C1 was in an unstable union was about 40 percent greater than for a mother aged 20-21, and when contrasting youngest adolescent and oldest mothers, this probability for younger mothers shot up to over 100%. In C1, this difference is explained both by the event of interest, and because becoming a mother at young ages increases exposure to the risk of becoming involved in unstable relationships, as there was no social stigma in the marriage market for these women in Colombia and having a baby pressured a young couple to stay together, even if the relationship was not definitely the best equilibrium for both partners in the marriage market.

The remaining columns in Table 3 present results about the partner's quality. Column 4 shows slight and significant difference in years of education for partners of the youngest mothers: less than a year for the first two contrasts (C1 and C2) and almost two years for the extreme contrast (C3). However, it is highly probable that there was assortative mating regarding this issue, leading to spurious results. Consequently, analysis was then shifted to focus on the following columns. Indeed, column 5 showed that the youngest mothers' partners had significantly lower probabilities of having a good job, 10% in C2 to 25% in C3. Moreover, the last two columns showed a much higher and significant probability for these

women to become victims of domestic violence at the hands of their partners. The odds ratios showed, again, that the bigger the age difference between treatment and control groups (C3), the greater the probability for the youngest mothers to have an abusive partner in the long run. The effects were more dramatic for severe violence, e.g., physical abuse, than for less severe physical violence, with odds ratios showing higher probabilities of this victimization pattern, 34% for C1, 43% for C2 and 100% for C3. Many different factors could account for this particular result of severe violence, including lower educational attainment, the need for economic support, and sociological and even psychological differences of the youngest mothers compared to their older counterparts. The path to these results is untraceable with the current data and lies outside the objectives of the present study. However, these results are very suggestive and pose an interesting research question worth pursuing in the future about early adolescent motherhood and quality of partners and treatment of women.

Table 4 presents the results regarding infant mortality and low birthweight for the children of the mothers being studied. We also tried to measure the incidence of malnutrition among children aged five, but the numbers are too small to make sound contrasts. Infant mortality is measured as the number of children who died per each mother. Low birthweight corresponds to being born weighing less than 2,500 grams, and birth order is controlled by adding a dummy with the order of the baby. The results showed that the number of children who died in the first year of life was higher for adolescent mothers, and the incidence of deceased infants increased from C1 to C3. A sharp and long-lasting reduction in infant mortality has only been (or can only be) accomplished with large and well distributed social investment that increases the average number of years of education among females and provides sanitary services to homes including clean piped water, sewerage and access to toilets. (See medical literature review by Miller and Urdinola, 2010.)

Unfortunately, the sample did not allow for a follow-up of other health outcomes among children at older ages since the questionnaire for children was geared for five years of age and less. Thus, the sample design may have produced larger errors when constructing a pseudo-panel for children than those that apply to the mothers (i.e., the sampling target). Despite this, a pooled sample regression for children born to teenage mothers was estimated, as expressed in Equation 2. Table 4 also shows the results of these estimations restricting the sample to children born in the previous five years, but controlling for birth order using dummy variables, where the first birth was the base category. The results showed that the likelihood of having a child suffering low birthweight was 4.4% higher for women who had their first- and second-born babies at ages 18 and 19 compared to women who had them at

ages 20 and 21. The effect was positive and significant only for this first contrast, although all other coefficients were also positive.

This research strategy showed the differences between purely descriptive cohorts and estimations by constructing a pseudo-panel and pointing out the importance of choosing an appropriate contrast group. The results between adolescents (C2) did not show very important differences in the outcomes being studied. However, the contrast with the slightly older mothers, for youngest and oldest adolescents, had important differences in outcomes regarding job quality, partner's quality and infant health and survival. The results regarding infant mortality, educational attainment and effects on domestic violence proved a clear drawback on human capital both for these mothers and their children, thereby perpetuating cycles of poverty in Colombia.

C. Validity tests

The same exercises presented in Tables 2 to 4 were carried out as an additional check of our proposed methodology, contrasting slightly older women, aged 25-26, against mothers aged 27-28, and the first-time mothers, aged 25-27, against mothers aged 28-30. The results are presented in Tables 5 to 7 and show no significant effects in most cases, except for partner's education and less severe violence for the second contrast, which could be explained by assortative mating effects, as couples tend to match their educational attainment.

V. Conclusions

Our results show that women who gave birth during adolescence did not always end up having worse socioeconomic results than their counterparts who became mothers a couple of years later. Yet, the contrast group was definitive regarding measurement of these results. The younger the age at which a woman became a mother, the worse her outcomes in contrast with women who postponed motherhood by one or two years after adolescence. There were no effects of teenage motherhood on occupational status or having a partner; the latter reflects major social changes in Colombia and wider acceptance of adolescent motherhood in society. This fact, as pointed out by Johnson-Hanks, *et al.*, (2002) may be an important determinant in the increase of adolescent fertility in Colombia that cannot be reversed and is leading the composition of families and the nature of society to another state.

However, the quality of occupation and partner's quality showed worse outcomes for adolescent mothers, and among this group, larger percentages of women were physically

abused by their partners. Similarly, their children were in poorer health at birth and had greater probabilities of dying as infants. These results suggested lower human capital accumulation for these women and their children. As stated before, adolescents who come from more disadvantaged households are more prone to becoming mothers and, even after controlling for these variables, the results regarding quality of jobs and partners and health of infants held. Thus, increased adolescent fertility simply perpetuates cycles of poverty that need to be broken by generating incentives for adolescents to postpone their first birth. The logical solution is to create programs targeted at adolescents from the more disadvantaged households that promote school enrollment and provide access to technical or higher education, requiring no more than one or two additional years of schooling after high school. However, in practical terms, this is a difficult task as these adolescents do not perceive that they may have a future. The main challenge, then, would be to retain them in the educational system.

Sexual education must also be reinforced, and should include teaching what is required to raise a baby. This means offering practical lessons that expose adolescents to the great demands of newborns in terms of time, health care and money. Revealing all or most of the costs involved in having and raising a baby may help prevent adolescents from engaging in risky behavior since teenagers are less prone than adults to think in the long run (Rabin and O'Donoghue, 2000). This kind of “exaggerated” education could provide minimum knowledge for raising a baby, and teach adolescents when to look for medical help during pregnancy and the first year of life in order to reduce infant mortality.

Other policy implications arising from these results should be addressed, perhaps, through implementing or expanding coverage of programs aimed at allowing young mothers to return to school (CCT programs, public daycare centers). Finally, programs are needed that make it compulsory for young mothers to take their children to regular and compulsory medical check-ups, at least during the first year of life when mortality is highest.

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Tables

Table 1. Distribution of females in pseudopanel by cohort and age at first birth

Source: Own Calculations from DHS data

Table 2. Estimated Results on Education and Labor Market

Source: Own Calculations from DHS data

Table 3. Estimated Results on Marriage Market

Source: Own Calculations from DHS data

Table 4. Estimated Results on Children

Source: Own Calculations from DHS data

Table 5. Internal validity Test on Education and Labor Market

Source: Own Calculations from DHS data

Table 6. Internal validity Test Marriage Market

Source: Own Calculations from DHS data

Table 7. Internal validity Test on Children's Outcomes

Source: Own Calculations from DHS data