Intra- and intergenerational consequences of teenage childbearing in two Brazilian cities: exploring the role of age at menarche and sexual debut[1]

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Introduction

A major difficulty in studying "intra" or "inter" generational consequences of teenage childbearing is to disentangle the difference between correlation and causation regarding the empirical evidences. This is a particular concern among the economists that see the possibility of an endogeneity bias in the estimations obtained. This is so because teenage childbearing and some of the observed outcomes – for example, women's educational attainment – might be simultaneously determined. If they are simultaneously determined, then the estimated impact of teenage childbearing on educational attainment obtained from a ordinary least squares regression will be potentially biased. The literature on causal modeling and impact evaluation suggest several procedures to obtain an unbiased estimator, all associated with an attempt to obtain a good proxy for the counterfactual experiment. In observational studies, such as the ones associated with teenage pregnancy, it is very difficult to perform an experiment with treatment and control groups. Several approaches are suggested to overcome this shortcoming. The literature mentions propensity score matching techniques, regression discontinuity techniques, natural experiments, and instrumental variables, among others.

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The literature on the determinants of teenage childbearing suggests that young women's sexual debut is an important predictor of teenage childbearing. If sexual debut were completely independent of teenage childbearing, it could be a good predictor of the later. There is reason to suspect that sexual debut is also simultaneously determined both with teenage pregnancy and women's intragenerational outcomes such as education. It is true that sexual debut occurs temporarily prior to teenage pregnancy, and that teenage pregnancy can be temporarily prior to the end of women's educational career. Even if we accounted for this fact, the simultaneity bias could still occur due to the fact that some unobserved fixed or time varying heterogeneity may be affecting simultaneously all the decisions taken by a young woman.

It turns out that a woman's age at menarche is not endogenous, to the extent that the date of the first menstruation is not chosen by the young woman. In this sense, the age at menarche is a potential good instrument for age at first sex. An instrumented age at first sex can be a good instrument for teenage pregnancy. At least this sequence of events is certainly time recursive and the most precedent event (age at menarche) is likely to be exogenous.

Our purpose in this paper is to explore the likelihood of a causal effect on the consequences of teenage pregnancy, using age at first sex as an instrument for the former, while age at first sex will be instrumented by age at menarche, which is a non-voluntary phenomenon strongly dictated by biological aspects.

Results indicate that in the Brazilian case here studied, both intra- and intergenerational impacts of teenage childbearing are negative and significant. The results become stronger once heterogeneity and endogeneity are controlled in the estimations.

Literature Review

We focus this review on two aspects. First, in order to justify the methodology, we review the relationship between age at menarche, age at first sex, and teenage pregnancy. Second, we review the literature on the consequences of teenage childbearing in the developed countries (several applications in the case of the United States) and developing countries. This is a short review with emphasis on the economic literature, but not exclusively focused on it.

- Age at menarche, age at first sex, and teenage pregnancy

A vast literature associates early sexual initiation with teenage childbearing, followed or not by marriage, depending on the cultural characteristics of the society being analyzed. Economists consider that both age at sexual debut and teenage childbearing are likely to be correlated with each other as well as with some outcome variables such as mothers' educational attainment and labor market performance. A causation mechanism cannot be inferred from this correlation, since all these variables are likely to be endogenous. A recursive chain that includes age at menarche might suggest an exogenous starting point that follows the path below:

Age at menarche $\Rightarrow$ *Age at Sexual Initiation (debut)* $\Rightarrow$ *Age at first child (1).*

Some sociological approaches relate sexual initiation with age at marriage and age at first childbearing, as we will discuss below. Prior to this discussion, we recover some biomedical and bio-social references that relate age at menarche with age at sexual initiation.

On the biomedical side, Deardorff et al. (2005) suggest that early pubertal timing predicts early sexual intercourse, therefore increasing the risk for teenage pregnancy. The authors stress that early maturing girls (early puberty) are the ones at risk of early sexual initiation. The lack of social preparation regarding peers is likely to stimulate alcohol use in addition to early sexual behavior.

Ramakrishnan et al. (1999) relate early childhood nutrition with lower age at menarche. A major point of the is precisely to deal with the impact of early childhood nutrition on early fertility “milestones” (age at menarche, sexual initiation, first pregnancy, first birth). Although the authors recognize the driving force of this vector, they also highlight a countervailing force associated with the link between early childhood development and education attainment. If it were not for the educational connection, the early childhood nutrition would enhance teenage childbearing.

Zabin et al. (1986) review some works of Udry to present evidences on the impact of ages of physical maturation on first intercourse of black teenage males and females. The relationship between age of puberty and the sexual onset becomes more relevant as the long run trend displays a decline in the age at menarche of girls that coincides with trends of increasing sexual activity. It was also shown and suggested that early sexual onset was associated with higher risk of conception. The authors mention that menarche is a clear identifiable event with high recall among women interviewed. It is also a late event in the sequence of pubertal changes, marking the onset of fertility. This reasoning leads precisely to the path portrayed in expression (1) and that is important for our methodological perspective.

In many papers, co-authored by several colleagues, J. R. Udry connects biological, medical, and social factors in order to model the onset of sexual activity, adolescent sexual behavior, and early pregnancy. We do not intend to test Udry’s models nor the relative impact of biological and social factors on sexual behavior. Our review is just to highlight the importance of age at menarche in the determination of sexual debut among teenage girls. Our focus in this paper is on age at menarche, although Udry also deals more broadly with sexual hormones and pubertal development. Udry et al. (1982)

argue that linking ages at menarche, intercourse, marriage, and first birth is pervasive in several cultures. The authors suggest two biological and two social process mechanisms. The first biological mechanism links the increased release of sex hormones with early intercourse via increased libido. The second biological mechanism links early puberty with early fecundity. The first social mechanism links pubertal hormones with attraction providing early opportunities for sexual debut and union formation. The second social mechanism interacts a woman's early age at menarche with parents and peers mechanisms of incentives for early sexual initiation. These four mechanisms allow some cultural variation in the proposed path among societies, but it warrants the role of age at menarche on sexual initiation, age at first union, and age at first birth. Udry et al. (1986) study and model the role of hormones in stimulating sexual behavior in adolescence, suggesting a theoretical path model that clarifies the differences between a pure biological and a pure sociological model, including a life course perspective and the importance of pubertal development as mediating aspects. A pure biological model directly states that hormones stimulate sexual behavior by increasing libido. A pure sociological model equates hormones with pubertal development, but the role of pubertal development on sexual behavior is socially determined by encouragement. The life course of an individual captured by age is also associated with normative sexual behavior. The hormone effect is more direct among young men and more indirect via motivation among young women. Another theoretical framework on the determinants of sexual initiation is developed by Udry and Billy (1987). The proximate determinants of age at first sex are motivation, social controls, and attractiveness. The authors find important gender and race differentials. In the case of white males, hormone effects and social attractiveness are the mechanisms, with no role for social controls, while for white females the important factor is social control. In the case of sexual debut among black females, attraction dominates with the level of pubertal development.

Mott (1996) reviews the paths to the onset of sexual activity, mentioning the work of Udry. His focus is on the negative social consequences of early sexual initiation. He mentions the difficulty of interpreting causality with the use of data with dependent and independent variables collected at the same time. Based on a longitudinal survey, he found that mother's age at menarche is associated with her own age at first sex and her daughter's age at menarche. Maternal age at first sex is associated with several children's early social behavior and early sexual debut (before age 14), thus indicating an intergenerational channel.

We now move to review the literature following the economic tradition. Our focus is on papers that have used the age at menarche variable. Ribar (1994) looked at the relationship between teenage pregnancy and education completion. Following the instrumental variable approach, he considered three potential instruments that are correlated with fertility and not with education: age at menarche, availability of obstetricians and gynecologists, and the local abortion rate. Staiger (2002) models reproductive maturity as a binding constraint on the optimal timing of having the first birth when this optimal age is below the reproductive maturity. Biological factors determine woman's readiness to have birth. Age of menarche is an important factor in this determination, although other aspects such as race and ethnicity are also important. He qualifies the importance of age at menarche in a longitudinal perspective, because there is a catching-up phenomenon. Thus the impact of age at menarche is strong on birth timing only at young ages. The observed differences reduce a great deal after age 20 is reached. Weil (2007) intended to study the impact of health on output. He suggested that age at menarche is a good exogenous proxy for the impact of health on productivity, since delayed age at menarche is an indicator of malnutrition at early childhood. Thus, age at menarche affects current wage negatively. Klepinger et al (1995 and 1999) use age at menarche and other state level variables as instruments for the determination of early childbearing, whereas Field and Ambrus (2008) treat age at menarche as an instrumental variable for age of first marriage. Their estimates indicate that each additional year in age at menarche postpones marriage by 0.67 years. In addition, more than 70% of first marriages take place less than two years after the age at menarche. Using this instrument the authors go on to estimate the effect of early marriage on adult outcomes. The instrumental variable strategy requires that age at menarche affects adult outcomes only through age at first marriage. The authors argue that genetic factors determine random variation, although the literature recognizes that nutritional problems at early childhood delay age at menarche. They discuss the potential bias on adult outcomes that could be derived from the positive impact of low family income on the age at menarche. If there is a bias, this would attenuate the impact of early marriage or teenage childbearing on adult outcomes. Chevalier et al (2001) rely on age at menarche as the instrument for teenage motherhood presenting an inverse relationship. Teenage motherhood has a negative impact on education, labor market attachment, and pay in Britain.

We reviewed biological, social, and economic models regarding the impact of age at menarche on sexual initiation. The link between sexual initiation and marriage, as well as between sexual initiation and first birth, was less emphasized in the review. Bozon et al (2009) access modern Latin American sexual behavior in a life course perspective. They show a gender specific teenage sexual socialization, in which young men are encouraged to sexual initiation as early as possible, while social control is focused on young females. Postponement of sexual debut is valued. The valuation of virginity would imply sexual debut in the timing of first union. This sexual double standard is a cultural characteristic prevalent in Latin American and Mediterranean countries. The authors state clearly the connection (path) among first intercourse, union formation, and birth of the first child. Social differences in the timing of female sexual debut are connected with the same differences in first union. A separation between sexual debut and first union is growing in some Latin American countries analyzed by the authors. The authors mention a Latin American paradox: fertility has declined historically in the region, moving towards replacement level in several countries, but without clear delayed childbearing. Age at first child is persistently low and stable among age cohorts. The authors indicate that the more educated group of women is starting to show some postponement behavior with an increase of childless women.

In a short note, Bozon (2003) reviews the importance of sexual debut studies, a theme neglected due to the fact that it was generally assumed that for many women this debut would coincide with the timing of first union. As cohabitation and the postponement of age at first union become more prevalent in several countries, sexual initiation becomes more important. He suggests the existence of three traditional models of sexual initiation. First, family strategies favor entry in first union as near puberty as possible (prevalent in Sub-Saharan Africa and the Indian subcontinent). The second traditional model was just reviewed in the previous paragraph. Social control forces the delay of union formation and sexual debut with the valuation of virginity (prevalent in Latin America and southern Europe). The third traditional model is comprised by countries with low gender differences on sexual initiation, probably associated with a later marriage pattern.

- The Consequences of Teenage Childbearing

There is a vast literature on the consequences of teenage childbearing both for the own woman's adult outcomes (intra-generational consequences) as well as for their children (intergenerational consequences). The literature can be divided between the ones applied to developed countries, and the others applied to developing countries. In addition to economic aspects, culture and geography may also play an important role explaining the different consequences of teenage childbearing. As we are primarily concerned with the role of age at menarche as an instrument variable solving the causality issue of teenage pregnancy, we will review primarily the economic literature, with few exceptions. In the case of economic literature, the microeconomic model is basically the same for developed and developing countries. That is not to say that cultural aspects are irrelevant in determining sexual debut and early childbearing in the several regions of the world, as the review of Bozon's papers above clearly demonstrate. The review suggested here is limited to the research question of our paper.

Greene and Merrick (2005) review separately both the literature applied to the consequences of teenage childbearing in developed and developing countries. We benefited from their review, but as we mentioned above, our focus is centered on the issues associated with the economic applications. As the authors indicated, the research on teenage childbearing in the United States is highly developed, such that studies applied to other regional contexts can benefit from the debate.

An important issue mentioned by Greene and Merrick (2005) is that teenage childbearing is likely to be both cause and effect of poverty. Our purpose in this paper is precisely to apply a specific solution to the endogeneity problem of teenage childbearing, following the debate in the economic literature, aiming to discuss its intra- and intergenerational impact.

The issue of unobserved heterogeneity is clearly related with the endogeneity problem discussed by the economists. The estimated impacts of teenage childbearing on women's outcomes in adulthood or their children are likely to be biased. Geronimus and Korenman (1992) try to control for unobserved background characteristics by comparing sisters who experienced their first births at different ages. A sister with different first birth age would be the perfect counterfactual for teenage childbearing. They find that cross-sectional evidences controlling for mothers' observed characteristics tend to overstate the negative impact of teenage childbearing on other outcomes. The control for mothers' family background reduces that impact, but the impact is "dramatically" reduced when sisters are used as counterfactual. Geronimus et al. (1994) also found that the impact of teenage childbearing on offspring is not negative when cousins are compared. These findings challenged a large variety of econometric applications, some using the "national longitudinal survey" (NLSY), in order to obtain the accurate impact of early childbearing on woman's own outcomes and their offspring.

Hotz et al. (2005) use miscarriage as a “natural experiment” to solve the endogeneity problem. They were inspired by Grogger and Bronars´ (1993, apud Hotz et al., 2005) “natural experiment” for twins during teenage childbearing. The so called “natural experiment” is an econometric solution to the causality problem, although this is a solution sometimes questioned with respect to external validity. They conclude that the negative consequences of teenage childbearing on educational and economic attainment have been overstated by the literature. The results are more associated with the outcome of economic circumstances than the consequence of teenage childbearing. These findings are consistent with the ones obtained by Geronimus and Korenman (1992) and discussed above.

Hotz et al (2005) mention an approach performed by Ribar (1994) and Klepinger et al (1999) as example of joint decision regarding teenage childbearing and another maternal or offspring outcome. They argue that these studies are based on rational choice models that impose assumptions to identify the effects of teenage childbearing. In fact, the assumptions imposed by estimations stemming from these models related to the possibility of simultaneity bias, the correction in the estimation being pursued by the method of instrumental variable. When the instrumental variable is age at menarche, it is assumed that this is a “natural experiment” instrumental variable, if the argument that age at menarche has a random component.

Ribar (1994) estimate the impact of teenage childbearing on high school completion under the hypothesis that teenage childbearing is exogenous to be tested against the endogenous possibility. Age at menarche is utilized as one of the instruments for teenage childbearing. He found that teenage childbearing is endogenous, but that treating this variable as exogenous overstates the negative impact of teenage childbearing on woman’s high school completion. Klepinger et al (1999) also instrument teenage childbearing on age at menarche and a large set of instrumental variables. Contrary to the findings of Hotz et al (2005) and Ribar (1994), they found support to the early finding of the negative consequences of teenage childbearing on socio-economic variables.

Aschraft and Lang (2006) review the literature above. They consider that the results from Hotz et al (2005) and Ribar (1994) capture the impact of teenage childbearing among those women who would choose not to have an abortion. The estimations of Donohue and Levitt (2001) indicate a stronger negative impact of teenage childbearing. Aschraft and Lang (2006) criticize Hotz et al's natural experiment. They agree that miscarriages are random, but they argue that, with the availability of abortion, teenagers who have miscarriages are the ones less likely to practice abortion. Thus, this instrumental variable will underestimate the impact of teenage childbearing. Their alternative estimations did not find positive impact of teenage childbearing, but they are consistent with the findings of a modest impact of teenage childbearing on outcomes.

It would appear that the debate in the US points to the attenuation of the negative impact of teenage childbearing on adult and offspring outcomes, once endogeneity and unobserved heterogeneity are accounted. Chevalier and Vittanen (2001) also found some impact attenuation in comparison with the previous literature, once they try to account for these effects. Nevertheless, they still conclude that teenage childbearing reduces the chances of post-compulsory schooling and deteriorate labor market outcomes. Field and Ambrus (2008) apply this framework to Bangladesh. They conclude that early marriage has a negative impact on schooling, health complications, and gender equality.

Although this review has not mentioned the Brazilian literature on sexual debut and teenage pregnancy, there are two studies of adolescents in Belo Horizonte and Recife and one for Belo Horizonte alone.

Moore´s (2006) qualitative study of gender role beliefs and sexual debut in Belo Horizonte and Recife reinforces Bozon´s argument regarding the dual gender roles of man and women. According to Moore, in sexual debut women had to be (or pretend to be) passive and should say no in order to protect their reputation.

França (2008) investigates the associate factors to sexual and reproductive initiation during adolescence. "This work aims to identify by discrete-time hazard models the factors associated with sexual initiation and fertility among teenagers based on the Reproductive Health, Sexuality, and Race Research (Saúde Reprodutiva, Sexualidade e Raça/cor - SRSR) carried out in Belo Horizonte and Recife in 2002. Education level and age were the factors associated with both final models. The variables age at menarche, race, and residence in slums correlated significantly with the occurrence of the first sexual intercourse. In the analysis of first childbearing in adolescence, besides education and age, only the use of contraceptives in the first sexual intercourse in adolescence showed an association with the risk of first childbearing in adolescence. In this study, adolescents with eight years of schooling or more had a risk of sexual intercourse or first childbearing in adolescence 60% lower when compared with young women with four or less years of schooling. From the viewpoint of public policies, promoting education is an essential aspect to take into consideration in public policy for the sexual and reproductive health of teenagers".

Simão et al (2006) studied age at first sex, age at first marriage, and age at first child in Belo Horizonte (Simão et al, 2006). The authors compared two cohorts of women (20-29 and 50-59) and found out that, although the median age at first union have been quite constant for the two cohorts (around 23 years-old), the sexual debut among women from the young cohort was at age 18, whereas those from the older cohort had their first intercourse three years later. Despite the decrease in age at sexual debut, young women are having their children a little later – the older women (50-59) had their first children at age 24, whereas the young women had their first babies at age 24.7. Both Simão and França use the same data set utilized in this paper.

Data and Methods

The Data Set

Data come from SRSR – *Saúde Reprodutiva, Sexualidade e Raça/Cor* (Reproductive Health, Sexuality, and Race/Color), a survey carried out by Cedeplar in 2002 and designed to collect information on race, reproductive health, and sexuality, representative at the municipality (city) level. It was conducted in two cities of Brazil: Belo Horizonte and Recife (Map 1). Belo Horizonte, with its 2,238,526 inhabitants in 2000, is the capital of the state of Minas Gerais (MG), located in the Southeast region, the richest in Brazil. Recife is the state capital of Pernambuco (PE), is located in the poorest region of the country – the Northeast – and had 1,422,905 inhabitants in 2000. The survey is similar to a DHS, but has an entire section devoted to race/skin color. Following a three stage sampling procedure, we randomly selected the census tracts, then the households in each census tract, and finally the eligible female in the household to be interviewed, yielding a total of 2,408 women interviewed in both sites – 1302 in Belo Horizonte and 1106 in Recife.

Map 1 - Brazil

Source: Perry-Castañeda Library, University of Texas at Austin (http://www.lib.utexas.edu/maps/cia03/brazil_sm03.gif, access on 2/27/04)

Variable Descriptions

The key variables utilized in our analysis are separated between dependent or endogenous and independent or exogenous variables.

- The endogenous variables for the first stage are:

  agefirst – Age at first sex or age at sexual initiation.

  firstch1- Teenage childbearing until age 17.

- The predicted endogenous variables for the first stage are:

  agfsthat –Predicted age at sexual initiation.

  fch17agfh – Predicted teenage childbearing at age 17.

- The natural experiment instrumental variable is:

  agemenar – Age at menarche.

The endogenous variables for the women's outcomes are:

  anestud – Completed years of schooling.

  v0157 – Total family income.

The endogenous variables for offspring's outcomes are:

  schogap – This variable measures the inverse of a child educational attainment by subtracting the ideal years of schooling given the child's age from the observed year of schooling.

  cmort0_4 - It is a dummy variable indicating all children in the birth history of the survey who died between age 0 and 4.

The exogenous control variables are:

  bh – Dummy variable for Belo Horizonte city as opposed to Recife.

  alwaysli – Dummy variable for always lived in the city of interview.

  black – Dummy variable for color of interviewed black (white=0).

  brown - Dummy variable for color of interviewed brown (white=0).

othnwhit - Dummy variable for color of interviewed other non-white (white=0).

fatherbl – Dummy variable for father's color black (father color's white/other=0).

fatherbr - Dummy variable for father's color brown (father color's white/other=0).

motherbl - Dummy variable for mother's color black (mother color's white/other=0).

motherbr - Dummy variable for mother's color brown (mother color's white/other=0).

raisednr – Dummy variable for raised with no religion (catholic=0).

raisedpr - Dummy variable for raised protestant (catholic=0).

raisedpe - Dummy variable for raised evangelic (catholic=0).

raisedot - Dummy variable for raised other religion (catholic=0).

age25to2 – Dummy variable for cohort aged 25-29 (20-24=0).

age30to3 - Dummy variable for cohort aged 30-34 (20-24=0).

age35to3 - Dummy variable for cohort aged 35-39 (20-24=0).

age40to4 - Dummy variable for cohort aged 40-44 (20-24=0).

age45to4 - Dummy variable for cohort aged 45-49 (20-24=0).

age50to5 - Dummy variable for cohort aged 50-54 (20-24=0).

age55to6 - Dummy variable for cohort aged 55-60 (20-24=0).

Sample Size

The own outcome sample is comprise by women in the 20 to 60 age interval that had ever had at least one child. This corresponds to 1582 women. When only women living in households with positive income are considered in the analysis for family income, than the sample size is comprised by 1357 women.

The sample size for the offspring, composed by the children aged 10 to 17 in the survey, is comprised by 826 children. The sample size of the offspring for all the children listed in the survey is 4132.

The Instrumental Variable Method and Endogeneity Test

As we discussed in the literature review, a major problem with several estimations of the impact of teenage childbearing on intra (woman's outcomes) - or intergenerational (offspring's outcomes) is that they regard teenage childbearing as exogenous while there is a strong possibility that this is an endogenous variable. A Hausman test (Cameron and Trivedi, 2009) can be performed to see if we can reject the null hypothesis that teenage childbearing is exogenous.

Following the literature review on sexual initiation and fertility, we utilize age at menarche as the natural experiment instrumental variable in the regressions, but we suggest that this impact is mediated by sexual debut (age at first sex). Sexual debut is thought to impact teenage childbearing, but it is also considered endogenous, so that the age at menarche is the ultimate exogenous mechanism is this path.

The main routines used in our estimations are from Stata10. In the case of two-stage least squares estimation, we have applied the ivregress command for continuous variables and ivprobit command for dependent discrete variables. When some performed tests were not compatible with the ivprobit command, we have estimated the ivregress command in a linear model with dichotomous dependent variable. When the first stage of a two-stage least squares is a binary response (dichotomous) variable, we have followed the estimation procedure suggested by Wooldridge (2002, pp.623-625).

Empirical Results

The results are presented in four sets. First, we present the results related with the connection between age at menarche and sexual initiation. Second, we move to instrument teenage childbearing using age at first sex, instrumented by age at menarche, as the main predictor of teenage childbearing. Third, we estimate the impact of instrumented teenage childbearing on woman's outcomes (intra-generational effect). Finally, we estimate the impact of instrumented teenage childbearing on their offspring (intergenerational effect).

- Results for "Instrumenting" Age at First Sex

The estimation presented in Table 1.A1 shows a positive and significant impact of age at menarche on sexual initiation. A one year decline in age at menarche would reduce the age at sexual initiation in 0.4 years. This result is compatible with the findings in the literature.

- <u>Results for "Instrumenting" Teenage Childbearing</u>

The estimation presented in Table 1.A2 presents a reduced form estimation of teenage childbearing. Age at menarche is a negative and significant predictor of teenage childbearing. The marginal effect of one year increase in the age at menarche on the predicted probability of teenage childbearing is minus 4.6 percent points. An alternative linear probability estimation gives a very similar marginal effect, minus 4.3 percent points (Table 2.A2). Tables 3.A2 and 4.A2 give the probit and linear probability instrumental variable estimations. It is important to notice that the ratio between the reduced form coefficient for age at menarche in the teenage childbearing and the age at sexual initiation equations should be similar to the instrumental variable estimation in the two-stage least squares. In the case of the linear probability model this ratio is -0.104, which is practically the same estimation obtained in Table 4.A2. This is the impact of postponing age at sexual debut on teenage childbearing until age seventeen. The hausman test rejects the null hypothesis that age at sexual debut is exogenous to teenage childbearing in both models (Tables 3.A2 and 4.A2). This result indicates that age at menarche is a good instrumental variable for the prediction of sexual initiation. Thus, sexual initiation has to be estimated before the variable is included in the prediction of teenage childbearing. It remains to be seen how endogenous teenage childbearing affects the woman's own outcomes. Table 5.A2 provides test statistics for age at sexual initiation as a weak instrument, it is rejected that this variable, predicted by age at menarche, is a weak instrument.

- <u>Intra-generational Consequences of Teenage Childbearing</u>

Tables 1.A3 and 2.A3 present the estimated impact of teenage childbearing on the mother's education attainment measured by completed years of schooling. The impact is negative and significant in both estimations, but it is around three times greater when endogeneity is controlled with the use of instrumental variable. The result goes from minus 2.2 years of schooling with teenage childbearing to minus 7 years of schooling when an instrument is used in the estimation. Hausman test (Table 2.A3) indicates that teenage childbearing is not an exogenous variable in education attainment. Table 3.A3 indicates that it can be rejected the null hypothesis that predicted teenage childbearing is a week instrument.

Tables 4.A3 and 5.A3 evaluate the impact of teenage childbearing on mother's total family income. The negative impact is substantial. It reduces 364 reais when endogeneity is not accounted for, while the impact goes to minus 1009 reais when teenage childbearing is considered endogenous. If these results prove to be robust, the intra-generational monetary penalty for teenage childbearing is quite high.

- Intergenerational Consequences of Teenage Childbearing

The impact of teenage childbearing on the offspring's educational attainment can be accessed in the comparison of Tables 1.A4 and 2.A4. The schogap is positive and significant when teenage childbearing is considered exogenous, but it is only 0.4 years of study. When teenage childbearing is considered endogenous and the equation is estimated with instrumental variable, then schogap is 1.8 years of study. Thus, teenage childbearing brings negative consequences to the mothers' offspring.

Tables 3.A4 and 4.A4 compare the estimation of cmort0_4 considering the possibility that teenage childbearing is endogenous or not. In a linear probability model, the positive marginal impact of teenage childbearing is 1.5% in infant-child mortality while the instrumental variable estimation increases the marginal impact to 3.5%.

Final Remarks

This first application of a structural estimation, using age at menarche as the basic instrumental variable on a recursive framework, and relating it with the woman's sexual initiation, while sexual initiation is also associated with teenage childbearing, suggests that there is a connection in this path.

Econometric tests on intra- and intergenerational impacts of teenage childbearing on outcome variables suggest that the control for endogeneity increases the magnitude of generally negative effects both on woman's outcome and their offspring. This result is in line with a few findings in developed countries, but it goes against a great deal of results recently obtained by the literature when heterogeneity and natural experiments have been employed. The few econometric results of similar estimations for developing countries seem to go in the same direction of the findings that we have shown.

Future studies applied to the Brazilian case should test the robustness of these results against other types of counterfactual estimations. This type of robustness test could clarify if the results here portrayed are true.

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APPENDIX 1

Instruments Age at First Sex

TABLE 1

Linear regression

Number of obs = 1582
F(21, 1560) = 21.11
Prob > F = 0.0000
R-squared = 0.1764
Root MSE = 3.9396

agefirst	Coef.	Robust Std. Err.	t	P>|t|	[95% Conf.	Interval]
agemenar	.4022201	.0549948	7.31	0.000	.2943485	.5100917
bh	1.091806	.2020766	5.40	0.000	.6954351	1.488176
alwaysli	.3651677	.210461	1.74	0.083	-.0476486	.777984
black	.1108335	.356155	0.31	0.756	-.5877596	.8094265
brown	-.1706699	.2644482	-0.65	0.519	-.6893813	.3480415
othnwhit	-.8138272	.4038576	-2.02	0.044	-1.605988	-.0216662
fatherbl	-.4309188	.29752	-1.45	0.148	-1.0145	.1526625
fatherbr	.2574964	.2464016	1.05	0.296	-.2258168	.7408096
motherbl	-.7696655	.3361453	-2.29	0.022	-1.42901	-.1103213
motherbr	-.1101008	.2465922	-0.45	0.655	-.5937879	.3735864
raisednr	-.6801712	.6332732	-1.07	0.283	-1.922328	.5619853
raisedpr	.1782091	.5821806	0.31	0.760	-.9637298	1.320148
raisedpe	-.4697765	.3129498	-1.50	0.134	-1.083623	.1440701
raisedot	-.0078277	.6003756	-0.01	0.990	-1.185456	1.169801
age25to2	1.123206	.2533809	4.43	0.000	.6262026	1.620209
age30to3	2.199596	.287991	7.64	0.000	1.634706	2.764487
age35to3	3.537317	.3283007	10.77	0.000	2.89336	4.181274
age40to4	3.764204	.3501591	10.75	0.000	3.077372	4.451036
age45to4	4.08543	.4059952	10.06	0.000	3.289076	4.881784
age50to5	3.536494	.4244718	8.33	0.000	2.703899	4.36909
age55to6	4.87137	.5802603	8.40	0.000	3.733198	6.009542
_cons	10.67414	.7548732	14.14	0.000	9.193467	12.15481

APPENDIX 2

Instruments Teenage Childbearing

TABLE 1

```
Probit regression                                 Number of obs   =       1582
                                                  Wald chi2(21)   =     142.00
                                                  Prob > chi2     =     0.0000
Log pseudolikelihood = -639.32765                 Pseudo R2       =     0.1037

------------------------------------------------------------------------------
             |               Robust
    firstch1 |      Coef.   Std. Err.      z    P>|z|     [95% Conf. Interval]
-------------+----------------------------------------------------------------
    agemenar |  -.2063496   .0237193    -8.70   0.000    -.2528387   -.1598606
          bh |  -.3485396   .0811068    -4.30   0.000     -.507506   -.1895733
    alwaysli |  -.0761503   .0817126    -0.93   0.351     -.236304    .0840034
       black |   .0153199   .1544856     0.10   0.921    -.2874664    .3181061
       brown |   .0879994   .1099621     0.80   0.424    -.1275224    .3035211
    othnwhit |   .1365236   .1774679     0.77   0.442    -.2113072    .4843543
    fatherbl |   .2128089   .1168545     1.82   0.069    -.0162217    .4418395
    fatherbr |   .0481787   .1044705     0.46   0.645    -.1565798    .2529372
    motherbl |   .2707152   .1347791     2.01   0.045     .0065529    .5348775
    motherbr |  -.0844793    .099726    -0.85   0.397    -.2799386      .11098
    raisednr |   .0109934   .2716662     0.04   0.968    -.5214625    .5434494
    raisedpr |  -.0574601   .2306279    -0.25   0.803    -.5094825    .3945623
    raisedpe |   .2361487    .131519     1.80   0.073    -.0216237    .4939212
    raisedot |  -.2474125   .2861851    -0.86   0.387    -.8083251       .3135
    age25to2 |  -.2628638   .1515672    -1.73   0.083    -.5599301    .0342025
    age30to3 |  -.4960743   .1551232    -3.20   0.001    -.8001102   -.1920384
    age35to3 |  -.5823278   .1558579    -3.74   0.000    -.8878037   -.2768519
    age40to4 |  -.6222147   .1671731    -3.72   0.000    -.9498679   -.2945614
    age45to4 |  -.7036721   .1713967    -4.11   0.000    -1.039604   -.3677407
    age50to5 |  -.2992322   .1799141    -1.66   0.096    -.6518574    .0533931
    age55to6 |  -.3490103    .184684    -1.89   0.059    -.7109843    .0129638
       _cons |   2.121452   .3279181     6.47   0.000     1.478745     2.76416
------------------------------------------------------------------------------
```

TABLE 2

Linear regression

Number of obs =	1582
F(21, 1560) =	7.12
Prob > F =	0.0000
R-squared =	0.0881
Root MSE =	.35857

firstch1	Coef.	Robust Std. Err.	t	P>|t|	[95% Conf.	Interval]
agemenar	-.0420389	.0046726	-9.00	0.000	-.0512042	-.0328736
bh	-.0773843	.0188265	-4.11	0.000	-.1143122	-.0404565
alwaysli	-.0137433	.0186171	-0.74	0.460	-.0502606	.0227739
black	.0039288	.0381732	0.10	0.918	-.0709474	.078805
brown	.0204889	.0249069	0.82	0.411	-.0283657	.0693434
othnwhit	.0327852	.0445234	0.74	0.462	-.0545467	.1201172
fatherbl	.0538812	.0300519	1.79	0.073	-.0050651	.1128276
fatherbr	.0118574	.0237755	0.50	0.618	-.034778	.0584928
motherbl	.0652668	.0357685	1.82	0.068	-.0048926	.1354261
motherbr	-.0206502	.0223544	-0.92	0.356	-.0644981	.0231976
raisednr	-.0016811	.066511	-0.03	0.980	-.1321416	.1287794
raisedpr	-.0084993	.0471027	-0.18	0.857	-.1008906	.083892
raisedpe	.0591886	.0370828	1.60	0.111	-.0135486	.1319259
raisedot	-.0512877	.0577935	-0.89	0.375	-.1646488	.0620734
age25to2	-.0823596	.0475041	-1.73	0.083	-.1755381	.010819
age30to3	-.1364796	.0454097	-3.01	0.003	-.2255501	-.047409
age35to3	-.1591917	.0445996	-3.57	0.000	-.2466731	-.0717103
age40to4	-.1645148	.0457366	-3.60	0.000	-.2542265	-.0748031
age45to4	-.1753613	.0453742	-3.86	0.000	-.264362	-.0863605
age50to5	-.0850376	.0514208	-1.65	0.098	-.1858987	.0158235
age55to6	-.1041502	.0527971	-1.97	0.049	-.2077109	-.0005894
_cons	.8475295	.0747143	11.34	0.000	.7009785	.9940805

TABLE 3 - PROBIT

Probit model with endogenous regressors

Number of obs = 1582
Wald chi2(21) = 287.60
Prob > chi2 = 0.0000

Log pseudolikelihood = -4809.7339

	Coef.	Robust Std. Err.	z	P>|z|	[95% Conf.	Interval]
agefirst	-.4659294	.0620773	-7.51	0.000	-.5875987	-.34426
bh	.1455329	.0837638	1.74	0.082	-.0186412	.3097071
alwaysli	.025245	.0768659	0.33	0.743	-.1254093	.1758993
black	.0800447	.145005	0.55	0.581	-.2041598	.3642492
brown	-.0023383	.0956754	-0.02	0.981	-.1898585	.185182
othnwhit	-.1333482	.1565473	-0.85	0.394	-.4401752	.1734789
fatherbl	-.0440842	.1159459	-0.38	0.704	-.2713339	.1831656
fatherbr	.1466243	.0967347	1.52	0.130	-.0429722	.3362208
motherbl	-.0480194	.1439069	-0.33	0.739	-.3300717	.2340329
motherbr	-.074045	.0872757	-0.85	0.396	-.2451022	.0970122
raisednr	-.3912801	.2567164	-1.52	0.127	-.8944351	.1118749
raisedpr	.1006969	.1957793	0.51	0.607	-.2830235	.4844172
raisedpe	.079817	.1186727	0.67	0.501	-.1527772	.3124112
raisedot	-.1944975	.2913444	-0.67	0.504	-.7655221	.3765271
age25to2	.2308141	.1180044	1.96	0.050	-.0004703	.4620985
age30to3	.4053527	.1402408	2.89	0.004	.1304858	.6802197
age35to3	.7037428	.1693978	4.15	0.000	.3717291	1.035756
age40to4	.7644544	.1674897	4.56	0.000	.4361807	1.092728
age45to4	.6695221	.1934402	3.46	0.001	.2903863	1.048658
age50to5	.907062	.1670023	5.43	0.000	.5797436	1.23438
age55to6	1.394627	.2059589	6.77	0.000	.9909551	1.798299
_cons	6.945318	.9496427	7.31	0.000	5.084052	8.806583
/athrho	.9622967	.2257969	4.26	0.000	.5197429	1.404851
/lnsigma	1.364065	.0248047	54.99	0.000	1.315448	1.412681
rho	.7452996	.1003732			.4775015	.8863956
sigma	3.912062	.0970377			3.726421	4.106952

Instrumented: agefirst
Instruments: bh alwaysli black brown othnwhit fatherbl fatherbr motherbl motherbr raisednr raisedpr raisedpe raisedot age25to2 age30to3 age35to3 age40to4 age45to4 age50to5 age55to6 agfsthat

Wald test of exogeneity (/athrho = 0): chi2(1) = 18.16 Prob > chi2 = 0.0000

TABLE 4 – LINEAR PROBABILITY

firstch1	Coef.	Robust Std. Err.	z	P>|z|	[95% Conf.	Interval]
agefirst	-.1045171	.0146143	-7.15	0.000	-.1331605	-.0758737
bh	.036728	.0272107	1.35	0.177	-.0166039	.09006
alwaysli	.024423	.0229632	1.06	0.288	-.020584	.0694299
black	.0155128	.0389228	0.40	0.690	-.0607745	.0918002
brown	.0026509	.0280584	0.09	0.925	-.0523425	.0576444
othnwhit	-.0522737	.0500708	-1.04	0.296	-.1504106	.0458633
fatherbl	.0088428	.0320789	0.28	0.783	-.0540306	.0717162
fatherbr	.0387702	.0271123	1.43	0.153	-.0143689	.0919092
motherbl	-.0151765	.0370351	-0.41	0.682	-.087764	.057411
motherbr	-.0321576	.0261877	-1.23	0.219	-.0834845	.0191692
raisednr	-.0727706	.0744797	-0.98	0.329	-.2187482	.073207
raisedpr	.0101266	.0631368	0.16	0.873	-.1136192	.1338724
raisedpe	.010089	.0367023	0.27	0.783	-.0618462	.0820242
raisedot	-.0521058	.069077	-0.75	0.451	-.1874942	.0832825
age25to2	.0350347	.0440175	0.80	0.426	-.0512381	.1213075
age30to3	.0934159	.0538628	1.73	0.083	-.0121532	.1989851
age35to3	.2105185	.0695286	3.03	0.002	.0742449	.3467921
age40to4	.228909	.0717873	3.19	0.001	.0882085	.3696095
age45to4	.2516361	.0789386	3.19	0.001	.0969193	.406353
age50to5	.2845866	.0738423	3.85	0.000	.1398584	.4293149
age55to6	.4049914	.0956708	4.23	0.000	.2174801	.5925027
_cons	1.96316	.232926	8.43	0.000	1.506633	2.419687

Instrumented: agefirst
Instruments: bh alwaysli black brown othnwhit fatherbl fatherbr motherbl motherbr raisednr raisedpr raisedpe raisedot age25to2 age30to3 age35to3 age40to4 age45to4 age50to5 age55to6 agfsthat

Tests of endogeneity
Ho: variables are exogenous

Robust score chi2(1) = 37.3399 (p = 0.0000)
Robust regression F(1,1559) = 39.6897 (p = 0.0000)

TABLE 5 – Test for Weak Instrument

```
( 1)  agfsthat = 0

       F(  1,  1560) =   53.49
            Prob > F =    0.0000

  First-stage regression summary statistics
  --------------------------------------------------------------------------
               |            Adjusted      Partial       Robust
      Variable |   R-sq.       R-sq.        R-sq.     F(1,1560)   Prob > F
  -------------+------------------------------------------------------------
      agefirst |  0.1764      0.1653       0.0308       53.4914    0.0000
  --------------------------------------------------------------------------


  Shea's partial R-squared
  --------------------------------------------------
               |     Shea's             Shea's
      Variable |  Partial R-sq.   Adj. Partial R-sq.
  -------------+------------------------------------
      agefirst |     0.0308             0.0184
  --------------------------------------------------


  Minimum eigenvalue statistic = 49.552

  Critical Values                      # of endogenous regressors:    1
  Ho: Instruments are weak             # of excluded instruments:     1
  ---------------------------------------------------------------------
                                     |    5%     10%     20%     30%
  2SLS relative bias                 |         (not available)
  -----------------------------------+---------------------------------
                                     |   10%     15%     20%     25%
  2SLS Size of nominal 5% Wald test  |  16.38    8.96    6.66    5.53
  LIML Size of nominal 5% Wald test  |  16.38    8.96    6.66    5.53
  ---------------------------------------------------------------------
```

APPENDIX 3

Intra-generational Consequences of Teenage Childbearing

TABLE 1

anestud	Coef.	Robust Std. Err.	t	P>|t|	[95% Conf.	Interval]
firstch1	-2.21251	.2315614	-9.55	0.000	-2.666714	-1.758306
bh	.3582028	.2091389	1.71	0.087	-.0520201	.7684257
alwaysli	1.114679	.2064952	5.40	0.000	.7096412	1.519716
black	-1.147692	.3475939	-3.30	0.001	-1.829493	-.4658919
brown	-.3442431	.2775795	-1.24	0.215	-.8887113	.2002251
othnwhit	-.6814175	.4514561	-1.51	0.131	-1.566942	.2041073
fatherbl	-.9607929	.2752539	-3.49	0.000	-1.5007	-.4208863
fatherbr	-.5171494	.2627263	-1.97	0.049	-1.032483	-.0018155
motherbl	-1.172831	.308736	-3.80	0.000	-1.778413	-.5672499
motherbr	-.7448929	.247059	-3.02	0.003	-1.229496	-.2602902
raisednr	-1.407726	.6561284	-2.15	0.032	-2.694713	-.1207397
raisedpr	.215691	.5491307	0.39	0.695	-.861421	1.292803
raisedpe	-.7977255	.3029879	-2.63	0.009	-1.392032	-.203419
raisedot	-.7595725	.6835979	-1.11	0.267	-2.10044	.581295
age25to2	-.4555143	.3366413	-1.35	0.176	-1.115831	.2048028
age30to3	-.3156862	.3354127	-0.94	0.347	-.9735934	.3422211
age35to3	.4320484	.3564071	1.21	0.226	-.2670391	1.131136
age40to4	-.634137	.3886511	-1.63	0.103	-1.396471	.1281966
age45to4	-.9067912	.3973355	-2.28	0.023	-1.686159	-.1274232
age50to5	-1.903589	.4475348	-4.25	0.000	-2.781422	-1.025755
age55to6	-2.193319	.5030535	-4.36	0.000	-3.180051	-1.206586
_cons	8.916706	.3702777	24.08	0.000	8.190411	9.643

TABLE 2

anestud	Coef.	Robust Std. Err.	z	P>|z|	[95% Conf.	Interval]
firstch1	-7.414562	.7069315	-10.49	0.000	-8.800122	-6.029002
bh	-.0615689	.2359531	-0.26	0.794	-.5240285	.4008906
alwaysli	1.043369	.2297915	4.54	0.000	.5929862	1.493752
black	-1.120129	.4129578	-2.71	0.007	-1.929511	-.3107465
brown	-.2320794	.3093236	-0.75	0.453	-.8383426	.3741838
othnwhit	-.4146583	.4922885	-0.84	0.400	-1.379526	.5502095
fatherbl	-.7019435	.3232548	-2.17	0.030	-1.335511	-.0683757
fatherbr	-.4782372	.28968	-1.65	0.099	-1.046	.0895252
motherbl	-.8048883	.3752779	-2.14	0.032	-1.540419	-.0693572
motherbr	-.7752477	.2765861	-2.80	0.005	-1.317347	-.2331489
raisednr	-1.535894	.7738245	-1.98	0.047	-3.052563	-.0192262
raisedpr	.1351166	.6380816	0.21	0.832	-1.1155	1.385734
raisedpe	-.464986	.3698501	-1.26	0.209	-1.189879	.2599069
raisedot	-1.040661	.7200329	-1.45	0.148	-2.4519	.3705772
age25to2	-.9585648	.4475535	-2.14	0.032	-1.835753	-.0813762
age30to3	-1.165548	.4386391	-2.66	0.008	-2.025265	-.3058312
age35to3	-.5253355	.4552827	-1.15	0.249	-1.417673	.3670023
age40to4	-1.607854	.4896007	-3.28	0.001	-2.567453	-.6482539
age45to4	-1.945972	.4943057	-3.94	0.000	-2.914794	-.9771509
age50to5	-2.544303	.5357828	-4.75	0.000	-3.594418	-1.494188
age55to6	-2.828387	.5847532	-4.84	0.000	-3.974483	-1.682292
_cons	10.60134	.4986198	21.26	0.000	9.624064	11.57862

```
Instrumented:  firstch1
Instruments:     bh  alwaysli  black  brown  othnwhit  fatherbl  fatherbr  motherbl
       motherbr raisednr raisedpr raisedpe raisedot age25to2
               age30to3 age35to3 age40to4 age45to4 age50to5 age55to6 fch17agfh

. estat endogenous

  Tests of endogeneity
  Ho: variables are exogenous

  Robust score chi2(1)            =  70.1528  (p = 0.0000)
  Robust regression F(1,1559)     =  70.1826  (p = 0.0000)
```

TABLE 3 – Test for Weak Instrument

```
( 1)  fch17agfh = 0

       F(  1,  1560) =  246.41
            Prob > F =    0.0000

  First-stage regression summary statistics
  --------------------------------------------------------------------------
               |            Adjusted      Partial       Robust
      Variable |   R-sq.       R-sq.        R-sq.     F(1,1560)   Prob > F
  -------------+------------------------------------------------------------
      firstch1 |  0.2277      0.2173       0.1871       246.408    0.0000
  --------------------------------------------------------------------------


  Shea's partial R-squared
  --------------------------------------------------
               |     Shea's             Shea's
      Variable |  Partial R-sq.   Adj. Partial R-sq.
  -------------+------------------------------------
      firstch1 |     0.1871             0.1767
  --------------------------------------------------


  Minimum eigenvalue statistic = 359.132

  Critical Values                      # of endogenous regressors:    1
  Ho: Instruments are weak             # of excluded instruments:     1
  ---------------------------------------------------------------------
                                     |    5%     10%     20%     30%
  2SLS relative bias                 |         (not available)
  -----------------------------------+---------------------------------
                                     |   10%     15%     20%     25%
  2SLS Size of nominal 5% Wald test  |  16.38    8.96    6.66    5.53
  LIML Size of nominal 5% Wald test  |  16.38    8.96    6.66    5.53
  ---------------------------------------------------------------------
```

TABLE 4

Linear regression

Number of obs	= 1357
F(21, 1335)	= 8.56
Prob > F	= 0.0000
R-squared	= 0.1209
Root MSE	= 1448.2

v0157	Coef.	Robust Std. Err.	t	P>|t|	[95% Conf.	Interval]
firstch1	-364.1771	68.94506	-5.28	0.000	-499.4295	-228.9246
bh	435.0788	77.03862	5.65	0.000	283.9488	586.2087
alwaysli	74.56027	83.64497	0.89	0.373	-89.52962	238.6502
black	-287.8785	102.0571	-2.82	0.005	-488.0883	-87.66862
brown	-114.8334	101.5884	-1.13	0.259	-314.1236	84.4568
othnwhit	-296.9316	207.3077	-1.43	0.152	-703.6159	109.7528
fatherbl	-441.7614	89.17071	-4.95	0.000	-616.6914	-266.8315
fatherbr	-354.9009	100.2412	-3.54	0.000	-551.5483	-158.2534
motherbl	-411.0313	84.17647	-4.88	0.000	-576.1639	-245.8987
motherbr	-241.9855	85.8976	-2.82	0.005	-410.4945	-73.47654
raisednr	-349.5081	118.0318	-2.96	0.003	-581.0562	-117.9601
raisedpr	391.1688	235.6478	1.66	0.097	-71.11156	853.4491
raisedpe	-316.2952	97.88526	-3.23	0.001	-508.3208	-124.2695
raisedot	-34.56149	168.7709	-0.20	0.838	-365.6466	296.5236
age25to2	148.3646	107.0285	1.39	0.166	-61.59768	358.3269
age30to3	325.9124	109.5215	2.98	0.003	111.0594	540.7654
age35to3	574.3316	126.8445	4.53	0.000	325.4953	823.1678
age40to4	280.6172	114.2528	2.46	0.014	56.48266	504.7518
age45to4	616.8509	159.8983	3.86	0.000	303.1715	930.5303
age50to5	300.6511	127.7801	2.35	0.019	49.97934	551.3229
age55to6	588.5077	182.611	3.22	0.001	230.2719	946.7435
_cons	979.3818	124.9677	7.84	0.000	734.2273	1224.536

TABLE 5

Instrumental variables (2SLS) regression

Number of obs = 1357
F(21, 1335) = 7.82
Prob > F = 0.0000
R-squared = 0.0968
Root MSE = 1467.9

v0157	Coef.	Robust Std. Err.	t	P>|t|	[95% Conf.	Interval]
firstch1	-1009.95	274.6145	-3.68	0.000	-1548.673	-471.2272
bh	388.3657	78.06226	4.98	0.000	235.2277	541.5038
alwaysli	64.81745	84.29227	0.77	0.442	-100.5423	230.1772
black	-277.2798	106.611	-2.60	0.009	-486.4232	-68.13639
brown	-97.5034	102.9933	-0.95	0.344	-299.5497	104.5429
othnwhit	-252.1543	207.63	-1.21	0.225	-659.4708	155.1623
fatherbl	-413.0058	93.90053	-4.40	0.000	-597.2145	-228.7972
fatherbr	-357.0292	101.4164	-3.52	0.000	-555.9821	-158.0763
motherbl	-360.514	92.76506	-3.89	0.000	-542.4951	-178.5328
motherbr	-253.3791	86.40625	-2.93	0.003	-422.886	-83.8723
raisednr	-367.6136	130.8908	-2.81	0.005	-624.3877	-110.8396
raisedpr	377.1804	236.9632	1.59	0.112	-87.68037	842.0411
raisedpe	-272.8504	104.4917	-2.61	0.009	-477.8362	-67.86471
raisedot	-89.4614	175.0479	-0.51	0.609	-432.8604	253.9376
age25to2	72.49586	122.9527	0.59	0.556	-168.7057	313.6974
age30to3	202.5177	129.8041	1.56	0.119	-52.12439	457.1599
age35to3	434.1782	151.2714	2.87	0.004	137.4226	730.9338
age40to4	136.5978	132.3738	1.03	0.302	-123.0855	396.2812
age45to4	467.2196	175.2415	2.67	0.008	123.4409	810.9983
age50to5	179.3524	142.1584	1.26	0.207	-99.52578	458.2307
age55to6	507.2139	182.5305	2.78	0.006	149.1361	865.2918
_cons	1211.756	150.2349	8.07	0.000	917.034	1506.479

Instrumented: firstch1
Instruments: bh alwaysli black brown othnwhit
fatherbl fatherbr motherbl motherbr
raisednr raisedpr raisedpe raisedot
age25to2 age30to3 age35to3 age40to4
age45to4 age50to5 age55to6 fch17agf2

APPENDIX 4

Intergenerational Consequences of Teenage Childbearing

TABLE 1

Linear regression

Number of obs	= 826
F(23, 802)	= 17.75
Prob > F	= 0.0000
R-squared	= 0.3461
Root MSE	= 1.3884

schogap	Coef.	Robust Std. Err.	t	P>|t|	[95% Conf.	Interval]
firstch1	.3782488	.1699578	2.23	0.026	.0446341	.7118634
agechild	.238711	.0271159	8.80	0.000	.1854845	.2919375
anestud	-.1241964	.0127199	-9.76	0.000	-.1491647	-.0992281
bh	-.9412598	.104538	-9.00	0.000	-1.14646	-.7360594
alwaysli	.0752795	.1033469	0.73	0.467	-.1275829	.2781419
black	.1616954	.1729955	0.93	0.350	-.177882	.5012728
brown	-.0439702	.1413109	-0.31	0.756	-.3213532	.2334127
othnwhit	-.2950444	.2006446	-1.47	0.142	-.6888949	.0988062
fatherbl	-.0886896	.1398603	-0.63	0.526	-.363225	.1858457
fatherbr	.0193116	.1314571	0.15	0.883	-.2387291	.2773522
motherbl	.0994083	.1659918	0.60	0.549	-.2264214	.425238
motherbr	.0477616	.1225955	0.39	0.697	-.1928843	.2884074
raisednr	.7491808	.4033317	1.86	0.064	-.0425297	1.540891
raisedpr	-.4761854	.2322069	-2.05	0.041	-.9319904	-.0203805
raisedpe	.0398047	.1474892	0.27	0.787	-.2497057	.3293151
raisedot	.3137487	.302868	1.04	0.301	-.2807588	.9082562
age25to2	-.7178702	.3909783	-1.84	0.067	-1.485332	.0495914
age30to3	-.6058213	.3234386	-1.87	0.061	-1.240707	.0290648
age35to3	-.5223302	.3294235	-1.59	0.113	-1.168964	.1243039
age40to4	-.616339	.3285427	-1.88	0.061	-1.261244	.0285661
age45to4	-.6769267	.3328312	-2.03	0.042	-1.33025	-.0236034
age50to5	.0473539	.4037078	0.12	0.907	-.7450946	.8398025
age55to6	-1.089627	.5665014	-1.92	0.055	-2.201628	.0223735
_cons	.5914748	.486567	1.22	0.224	-.3636203	1.54657

TABLE 2

Instrumental variables (2SLS) regression

Number of obs =	826
F(23, 802) =	17.18
Prob > F =	0.0000
R-squared =	0.2793
Root MSE =	1.4576

schogap	Coef.	Robust Std. Err.	t	P>|t|	[95% Conf.	Interval]
firstch1	1.762251	.4653035	3.79	0.000	.8488943	2.675607
agechild	.2167199	.0291457	7.44	0.000	.159509	.2739308
anestud	-.109971	.0139625	-7.88	0.000	-.1373784	-.0825636
bh	-.8249273	.1149043	-7.18	0.000	-1.050476	-.5993787
alwaysli	.1525523	.1125813	1.36	0.176	-.0684365	.3735411
black	.0499361	.187858	0.27	0.790	-.3188152	.4186875
brown	-.0984789	.1469954	-0.67	0.503	-.3870202	.1900623
othnwhit	-.3277437	.2126091	-1.54	0.124	-.7450797	.0895923
fatherbl	-.149496	.1500186	-1.00	0.319	-.4439714	.1449794
fatherbr	-.0060996	.1349472	-0.05	0.964	-.2709911	.2587919
motherbl	.0295704	.1735312	0.17	0.865	-.3110585	.3701994
motherbr	.1284701	.1307932	0.98	0.326	-.1282674	.3852076
raisednr	1.047767	.4600599	2.28	0.023	.1447033	1.950831
raisedpr	-.3442236	.2694025	-1.28	0.202	-.8730408	.1845936
raisedpe	-.0561101	.1580676	-0.35	0.723	-.3663851	.2541648
raisedot	.4135537	.3423974	1.21	0.227	-.2585472	1.085655
age25to2	-1.386762	.4903566	-2.83	0.005	-2.349296	-.4242284
age30to3	-.6766078	.3678398	-1.84	0.066	-1.39865	.0454346
age35to3	-.3424705	.3766576	-0.91	0.363	-1.081822	.3968807
age40to4	-.3458561	.3802382	-0.91	0.363	-1.092236	.4005235
age45to4	-.4076852	.3874492	-1.05	0.293	-1.168219	.3528489
age50to5	.3622494	.449559	0.81	0.421	-.5202019	1.244701
age55to6	-.9910514	.5914582	-1.68	0.094	-2.15204	.1699376
_cons	.3847787	.533706	0.72	0.471	-.6628468	1.432404

Instrumented: firstch1

Instruments: agechild anestud bh alwaysli black brown othnwhit fatherbl fatherbr motherbl motherbr raisednr raisedpr raisedpe raisedot age25to2 age30to3 age35to3 age40to4 age45to4 age50to5 age55to6 f17ch

TABLE 3

Linear regression

Number of obs	4138
F(22, 4115)	2.72
Prob > F	0.0000
R-squared	0.0217
Root MSE	.18359

cmort0_4	Coef.	Robust Std. Err.	t	P>|t|	[95% Conf.	Interval]
firstch1	.0148767	.0078256	1.90	0.057	-.0004657	.030219
anestud	-.0013263	.0006841	-1.94	0.053	-.0026675	.0000148
bh	-.0069469	.005889	-1.18	0.238	-.0184925	.0045987
alwaysli	-.0049773	.0058706	-0.85	0.397	-.0164868	.0065323
black	.0135296	.0105339	1.28	0.199	-.0071226	.0341818
brown	.0093204	.0069969	1.33	0.183	-.0043974	.0230381
othnwhit	.0457091	.0158025	2.89	0.004	.0147277	.0766905
fatherbl	.0063944	.008492	0.75	0.451	-.0102544	.0230433
fatherbr	.000106	.0068547	0.02	0.988	-.0133329	.0135449
motherbl	.0233767	.0107468	2.18	0.030	.0023073	.0444462
motherbr	-.0020991	.0066438	-0.32	0.752	-.0151245	.0109264
raisednr	-.0033062	.0186429	-0.18	0.859	-.0398564	.0332439
raisedpr	.0054279	.0158924	0.34	0.733	-.0257298	.0365856
raisedpe	-.0004573	.0091919	-0.05	0.960	-.0184783	.0175637
raisedot	-.0240767	.0123695	-1.95	0.052	-.0483276	.0001743
age25to2	.0046762	.0108157	0.43	0.666	-.0165285	.0258808
age30to3	.0039649	.0101581	0.39	0.696	-.0159505	.0238804
age35to3	.0013493	.0100882	0.13	0.894	-.018429	.0211276
age40to4	.0199625	.0115816	1.72	0.085	-.0027436	.0426686
age45to4	.0298229	.011854	2.52	0.012	.0065827	.0530632
age50to5	.0383805	.013345	2.88	0.004	.012217	.0645439
age55to6	.0493085	.0140011	3.52	0.000	.0218587	.0767583
_cons	.0134866	.0119693	1.13	0.260	-.0099798	.0369529

TABLE 4

Instrumental variables (2SLS) regression

Number of obs	= 4138
F(22, 4115)	= 2.79
Prob > F	= 0.0000
R-squared	= 0.0199
Root MSE	= .18377

cmort0_4	Coef.	Robust Std. Err.	t	P>|t|	[95% Conf.	Interval]
firstch1	.0349545	.0148903	2.35	0.019	.0057614	.0641476
anestud	-.0008892	.0007142	-1.24	0.213	-.0022895	.0005111
bh	-.0044924	.0059477	-0.76	0.450	-.0161531	.0071683
alwaysli	-.0046535	.0059046	-0.79	0.431	-.0162298	.0069227
black	.0138988	.0105011	1.32	0.186	-.006689	.0344866
brown	.0084463	.0070385	1.20	0.230	-.0053529	.0222456
othnwhit	.0438378	.0159151	2.75	0.006	.0126356	.0750399
fatherbl	.0051175	.0084981	0.60	0.547	-.0115434	.0217784
fatherbr	.0002826	.0068533	0.04	0.967	-.0131535	.0137187
motherbl	.0217679	.0107521	2.02	0.043	.0006879	.0428479
motherbr	-.0017195	.0066394	-0.26	0.796	-.0147363	.0112973
raisednr	-.0014228	.018504	-0.08	0.939	-.0377007	.034855
raisedpr	.0068526	.0159253	0.43	0.667	-.0243697	.0380749
raisedpe	-.0015091	.0092495	-0.16	0.870	-.0196431	.0166248
raisedot	-.0222429	.012454	-1.79	0.074	-.0466595	.0021736
age25to2	.0076723	.0110517	0.69	0.488	-.0139949	.0293395
age30to3	.0084816	.0106024	0.80	0.424	-.0123049	.029268
age35to3	.005904	.0104855	0.56	0.573	-.0146532	.0264612
age40to4	.0256218	.0121299	2.11	0.035	.0018406	.049403
age45to4	.035401	.0125858	2.81	0.005	.0107261	.060076
age50to5	.0427421	.0139862	3.06	0.002	.0153216	.0701626
age55to6	.0537305	.0141743	3.79	0.000	.0259411	.0815198
_cons	.0008318	.0138173	0.06	0.952	-.0262576	.0279212

Instrumented: firstch1

Instruments: anestud bh alwaysli black brown othnwhit fatherbl fatherbr motherbl motherbr raisednr raisedpr raisedpe raisedot age25to2 age30to3 age35to3 age40to4 age45to4 age50to5 age55to6 f17ch