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How children affect women's labor market outcomes: estimates from using miscarriage as a natural experiment

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Abstract

In this study, I empirically estimate the impact of children on women's labor market outcomes (such as work status, work hours and earnings). The identification in a female labor supply model where the fertility is endogenous comes from the assumption that a miscarriage – spontaneous loss of the pregnancy – occurs mostly randomly. Medical research in general provides supportive evidence for this assumption. One advantage of using the occurrence of a miscarriage to estimate the impact of children is that it allows one to estimate the impact of a first child versus no children at all, which is not possible when using other natural experiments such as twin births or the gender combination of the first two children. An instrumental variable based on the outcome of the first pregnancy is constructed and is used to estimate the coefficient of the endogenous fertility variable. The result shows that in general children have a modest negative impact on women's labor supply. It also shows that the IV estimates tend to be smaller in scale than the OLS estimates using the same data, which suggests it is indeed important to address the problem of endogenous fertility when estimating a female labor supply model.

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1. Introduction

The impact of children has always been an important factor in the study of female labor supply (for example, see Mincer (1962)). Including this factor has been well-motivated by the widely documented temporal and cross-sectional associations between the status and intensity of women's labor supply and their fertility rate (for example, see Lehrer and Nerlove (1986), Ahn and Mira (2002)). Even with this long line of study, however, measuring children's impact on women's labor outcomes has remained somewhat elusive. One difficulty in estimating this impact is the identification problem: The documented association between a woman's labor outcome and her fertility outcome is possibly generated by at least three channels: the actual impact of children on mothers, the existence of *observed* factors that are both associated with a woman's labor outcome and her fertility outcome, and the existence of *unobserved* (to researchers) factors that are associated with her labor and fertility outcomes. It is the last channel that creates the usual identification problem in estimating female labor supply models in which a fertility outcome variable is specified.

In this paper, I follow a line of research that attempts to solve the identification problem by using natural experiments to provide an exogenous shock to the woman's fertility outcome. For example, Rosenzweig and Wolpin (1980) used twin births as an exogenous factor affecting a woman's fertility outcome, which was followed by Bronars and Grogger (1994), Gangadharan and Rosenbloom (1996) and Jacobsen, Pearce, and Rosenbloom (1999). Angrist and Evans (1998) proposed another source of exogenous variation in fertility outcome: the gender mix of the first two children. Iacovou (2001) used both multiple births and children's sex combination.[1] A third natural experiment used by Cristia (2008) examined women seeking help to conceive.

In this study, I empirically estimate the impact of children on mother's labor outcome by using another source of exogenous shocks to a woman's fertility outcome: some pregnancies are lost spontaneously or naturally, while others are not. A spontaneous pregnancy loss, usually called a miscarriage, is shown to significantly affect a woman's fertility outcome: women who have a miscarriage have fewer children or a smaller chance of having any children. At the same time, medical literature suggests that many miscarriages (particularly early miscarriages) occur for no known reason. If miscarriages occur randomly, it means they do not correlate with factors that affect a woman's work-related outcome, *observed or unobserved* by researchers, while they do correlate with the woman's fertility outcome closely. This provides the basis for my identification strategy: I construct an instrumental variable based on whether or not the woman's first pregnancy ended in a miscarriage and use it to estimate children's impact in a female labor supply model[2] [3].

Previous studies have used miscarriage as a source of exogenous shocks to a woman's fertility outcome, for example, Hotz, McElroy, and Sanders (2005) and Miller (2011). Both of these studies used data from the National Longitudinal Survey of Youth 1979, whereas I use data from the National Survey of Family Growth series (see Section 3 for more details). An advantage of

[1] I thank Professor T. Paul Schultz for this reference.
[2] Hotz, McElroy, and Sanders (2005) is one of the first; they estimate the impact of teenage motherhood on the person's later lifetime outcomes. Miller (2011) studied the impact of motherhood timing on a woman's career path. will discuss in the next section the validity of using miscarriage as the basis for an instrumental variable.
[3] The reason why the instrumental variable is defined in this manner is given in Section 2.

using the instrumental variable (IV) estimation strategy based on the occurrence of miscarriages is that it allows me to estimate the impact of any children versus childlessness. O'Neill (2003) suggests that the persistent gender wage gap over the years is at least partly attributable to the employment gender gap that exists after men and women become parents. IV estimation based on twin births or the gender mix of the first two children does not allow one to estimate the effect of the first child. IV estimation based on the outcome of treatment for women seeking fertility help is able to measure the impact of a first child; however the sample and thus the interpretation of the estimate are somewhat specialized.

My estimation results show that children have a modest negative impact on mother's labor supply. Specifically, women with children are 13.6 percent less likely to work full time than women without children. Women with children work 6.79 hours less per week than women without children. The estimated impact of children on the work decision and annual earnings of women is not statistically significant. Moreover, the ordinary least squares (OLS) estimates are larger in magnitude than the IV estimates, suggesting that the fertility outcome is indeed likely to be endogenous in female labor supply models.

My estimates are highly comparable to the results of Bronars and Grogger (1994) and Angrist and Evans (1998) in terms of the magnitude of children's impact. My estimate is somewhat smaller in scale than Cristia (2008), which could be explained by the fact that my estimate accounts for the average impact of children of all ages while his estimate measures the impact of very young babies.

The rest of the paper is organized as follows. Section 2 presents the framework of my econometric analysis and discusses the validity of the identification strategy. Section 3 introduces the data used in this study and describes the sample. Section 4 presents the main estimation results and compares them to estimates from other studies. Section 5 concludes.

2. Model

2.1 Econometric Model

In this study, I assume that a woman's labor market outcomes, namely, her labor supply and earnings, are determined by a series of factors such as her education and age, as well as by the children-related outcome, namely, whether or not she has children or how many children she has. This children-related outcome is determined by a similar set of factors and by a woman's reproductive health status.

Based on this set of behavioral assumptions, I specify the framework for a statistical analysis of the data as follows:

$$y_i = \beta C_i + x_i \alpha + u_i \qquad (1)$$

$$C_i = \gamma z_i + x_i \phi + v_i, \qquad (2)$$

where y_i is the woman's labor market outcome. Empirically this can be measured by her labor force participation status, weekly hours worked, or annual labor income. The variable x_i is the set of factors that both affect the woman's employment and her fertility *and* that are observed by researchers (via information collected in the surveys); they can include the woman's age, race, education, and marital status.

The woman's fertility outcome is denoted by C_i is. It has two measurements: a dummy variable indicating if the woman has at least one child (=1 if yes) or the number of children she has. The woman's reproductive health variable is indicated by z_i. It is defined as a dummy variable indicating if the woman's first pregnancy ended in a miscarriage (=1 if yes).[4] [5] [6]

The variable u_i in equation (1) represents all factors that affect the woman's employment but are not observed by researchers. Similarly, v_i in equation (2) represents the factors that affect the woman's fertility outcome but are not observed by researchers. α, β, ϕ and γ are coefficients. The key assumptions of my econometric model are: (a) u and v are correlated; (b) z and u are independent; (c) γ is not zero.

2.2 Identification Strategy

In equation (1) β is the impact of children on women's labor supply and earnings. It is the parameter of most interest in this study. However, my specification of the model in the previous subsection shows that an OLS estimate of β based on equation (1) will be biased because C is correlated with u via v (according to assumption (a)).

However, when assumptions (b) and (c) hold, β can be identified by using IV estimation; namely, z can be used as an instrument for C in the estimation because z is correlated with C (due to assumption (c)) and is uncorrelated with u (due to assumption (b)). [7] [8]

2.3 Validity of Instrumental Variable

[4] Ideally, z should be an index of the woman's physiological ability to carry the pregnancy successfully to term (as opposed to having a miscarriage or a stillbirth). However, such a measurement is invariably latent, not only to researchers, but most of the time to the woman and her doctor. On the other hand, epidemiological evidence has shown that the outcome of a woman's first pregnancy is a significant indicator for whether any later pregnancies will be successful. The chance that a subsequent pregnancy will end in a miscarriage is much higher for a woman who has had a miscarriage than for one who has had a live birth. For more information, see Stabile, Grudzinskas, and Chard (1992).

[5] The instrumental variable is defined based on whether or not the first pregnancy ended in a miscarriage, rather than based on the total number of miscarriages a woman has had because the latter method suffers from the problem that a counter-intuitive and false *positive* relation between the number of miscarriages and the number of births given by a woman could exist. For example, on average women who have had two miscarriages could have more births than those who have not had any miscarriage. But this is not because miscarriages have a positive impact on fertility outcomes, but because the former group has had more pregnancies than the latter group.

[6] Besides live birth, miscarriage, ectopic pregnancy and stillbirth, a fifth possible outcome of a pregnancy is induced abortion. Even though this outcome comes from deliberate choices, it does not affect the validity of using the event of a miscarriage to construct an instrumental variable *as long as* miscarriages occur before the woman is able to have an abortion.

[7] Note that an IV estimate of β measures a *local average treatment effect* as defined in Imbens and Angrist (1994). Specifically, when C_i in equation (1) is the childlessness status dummy variable, the IV estimate of β measures the impact of having any children on those whose first pregnancy ended in a miscarriage and who do not have children but would have had a child if the first pregnancy had not ended in a miscarriage. Imbens and Angrist (1994) indicate that the identification of a local average treatment effect requires that the monotonicity condition be met. In the context of my study, this condition means the following has to hold: if a woman chose to have an abortion after the first pregnancy occurred and did not end in a miscarriage and she does not have children (at the time of the survey), she would not have any children if the first pregnancy had ended in a miscarriage – that is, she would not have continued to have any more pregnancies that would end in a live birth.

[8] I thank an anonymous referee for pointing out that the IV estimate will likely capture both fertility effects and fertility timing effects.

Clearly, the identification of β in the model depends on assumption (b) and (c), that is, z and u are independent, and γ is not zero. Is it justified to make these two assumptions?

First, in terms of data and agents' behavior, assumption (b) requires that the risk of a pregnant woman having a miscarriage cannot be associated with any factor that affects the woman's labor supply or earnings *and is unobserved by researchers*.

To investigate if assumption (b) holds or not, I first look at the factors that have been found by public health researchers that are correlated with the occurrence of miscarriages.[9] It is found that the most important risk factor is aberrant chromosomal constitution. Fetal malformation and sex of the fetus are two other important risk factors. The existence of these risk factors does not violate assumption (b), because even though they are unobserved by researchers, *they likely do not affect a woman's labor outcome except through their impact on her fertility outcome*.

On the other hand, researchers did find such risk factors as smoking and alcohol use that are behavioral factors which may be correlated with a woman's labor outcome directly. However, these associations are found not to be consistent across all studies.[10] I address this issue by controlling for smoker status of a woman whenever the information is available.

Yet another reason why the exclusion restriction on miscarriage can be violated involves a woman's fertility choice. For example, experiencing a miscarriage may be traumatic and change a woman's ambition or aspirations.[11] If this happens, miscarriages affect a woman's labor outcome not just through altering the woman's fertility outcome, but also directly through preference or behavioral changes.

Next, assumption (c) requires that miscarriages change a woman's fertility outcome significantly. The estimation results in the next section will show that indeed, other things being equal, women whose first pregnancy ends in a miscarriage on average are less likely to have children, or have fewer children than women otherwise.

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[9] For facts about miscarriages, including its possible causes, rate of occurrence, and so on, I mainly refer to Stabile, Grudzinskas, and Chard (1992) which is a collection of dozens of epidemiological studies on various issues about and possible treatments of miscarriages. Below I give a concise summary of some of the findings that readers may find useful in the context of this study.

First of all, in public health literature, miscarriages are defined to be the expulsion of a fetus without signs of viability before a certain time during the pregnancy (e.g., 28 weeks of a pregnancy in the United Kingdom.). The miscarriage frequency varies depending on what technique is used to detect the pregnancy. The miscarriage rate of clinically established pregnancies varies from about 10 to 16 percent depending on whether the statistic comes from a prospective study, a retrospective study, or hospital records.

As for the possible causes of miscarriages, chromosomal aberrations are the most significantly associated with miscarriage risk: about 30 to 50 percent of lost pregnancies have abnormal chromosomes. Other factors commonly associated with miscarriage risk are fetal malformation, sex of the fetus, multiple pregnancy, and previous pregnancy outcome. Also, environmental or occupational hazards, such as solvents, anesthetic gases, heavy lifting, and radiation, are found to increase miscarriage risk.

[10] The studies show that smoking and alcohol consumption are risk factors for some women, but not all of them. Specifically, they are risk factors for economically disadvantaged women but not for privately treated women.

[11] Yet another example is that miscarriage may affect marital stability. I thank an anonymous referee for both examples.

The statistical association between fertility outcome and first-pregnancy outcome can arise through at least two channels. First, miscarriage of a first pregnancy is a strong indicator that a woman is at higher risk of more pregnancy failures in the future. This inevitably will affect the woman's lifetime fertility outcome. Second, a miscarriage could deter women or their partners from having more pregnancies for fear of emotional stress or sense of loss.

3. Data and Sample

I use data from the National Survey of Family Growth (NSFG) series conducted under the direction of the U.S. Center for Disease Control and Prevention. The sample of women selected for interviews are representative of all the women between ages 15 and 44 in the continental United States. Survey questions include a woman's background information, family planning and infertility service use, history of pregnancies and births, and work status, hours and earnings. Six waves of surveys have been conducted[12]; in this study, I use data from the 1988, 1995, and 2002 surveys. Due to my empirical strategy, the sample I use consists of not all women, but women who have had at least one completed pregnancy at the time of the survey. The sample mean and standard deviation of the variables used in the regression analysis are presented in Table 1.[13]

In addition to examining the statistics of all women in the sample, I also divide the sample into two groups and compare their statistics: one group consists of those whose first pregnancy ended in a miscarriage and the other group otherwise. Recall that the instrumental variable in my estimation strategy is a dummy variable defined based on whether a woman's first pregnancy ended in a miscarriage or not. The requirement for the instrument being valid is that miscarriage risk is unrelated to any factor affecting a woman's labor outcome that is unobserved by researchers. As in many studies, it is difficult to directly test if this requirement is met or not. What I do next is to compare and see if women who suffer a miscarriage and those not differ in any systematic way in aspects that *are observed by researchers*. This may provide some indirect evidence on the likelihood that the instrument based on occurrence of miscarriages is valid.

Table 2 provides summary statistics of the two groups of women in the following aspects: age at the first pregnancy, education, mother's education, percentage of being white, and smoker status, work status and hours, and earnings. Last column of the table is the p-value of the t-test for the equalities of the variable's means for the two groups.

Overall, results in Table 2 indicate that miscarriage risk is associated with some observed characteristics of a woman, but not with all of them. For example, the results suggest that women whose first pregnancy ended in a miscarriage were older when pregnant, more educated and more likely to be white than women otherwise. On the other hand, the two groups are similar in terms of mother's educational level and smoker status.[14] This result seems to suggest that one should be cautious in interpreting the estimates, but in the mean time the estimates could be used as a reference for other studies on the topic of female labor supply and children's influence.

[12] Before 1982 the survey was only for married women or women who had children; after 1982 women of all marital status were included.
[13] The statistics are presented for each survey year separately because a few variables have missing values in one or two years of data.
[14] The woman is defined to be a smoker if she has smoked 100 cigarettes or more in her lifetime.

4. Estimation Results

4.1 Impact of miscarriage on a woman's fertility outcome

Table 3 provides the OLS estimates of the impact of miscarriage on a woman's fertility outcome. The results show that failure of the first pregnancy significantly affects a woman's fertility outcome. Specifically, women whose first pregnancy ended in a miscarriage are 19.4 percent less likely to have at least one child than other women in the survey. In terms of total number of children, the first pregnancy ending in a miscarriage reduces the average number of children a woman will have by 0.48. [15] [16]

4.2 Effect of children on women's labor market outcomes

I provide the OLS and IV estimates of children's impact on women's various labor market outcomes in Table 4.[17] The IV estimates suggest that children have a negative but modest effect on the mother's labor supply. Specifically, compared to women with no children, women with at least one child are 13.6 percent less likely to work full time,[18] and on average spend 6.8 fewer hours working per week. Alternatively, the birth of one more child reduces the likelihood of the mother working full time by 5.5 percent, and reduces the mother's working hours per week by 2.57 hours. The results do not indicate a noticeable impact of children on the mother's employment status (working for pay vs. not working), or the amount of her annual earnings.[19] [20]

I test the exogeneity of the fertility variable in equation (1) and report the results in Table 4.[21] [22] The maintained hypothesis that fertility is exogenous is only rejected in a few cases. However, failure to reject the hypothesis may be due to the relatively large standard errors of the IV estimates.

4.3 Comparing results with other studies

I compare my results with estimates from three other studies that investigate the impact of children on women's labor supply and earnings. All three studies use cross-sectional data and

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[15] I do not report the whole set of OLS estimates of equation (2) in the text. They are available upon request. In general, the OLS estimates indicate that older women, black women, and those whose spouses are more educated if they are married have more children on average. On the other hand, more educated women and smokers on average have fewer children.

[16] When the dependent variable in equation (2) is whether or not the woman has at least one child (that she gave birth to), it is a linear probability model. The result will not be significantly changed when logit or probit models are used.

[17] As before, I do not report the whole set of OLS and IV estimates of equation (1). They are available upon request. In general, older women, married women and more educated women work more and earn more. On the other hand, married women whose spouses are more educated work and earn less.

[18] Here the conclusion is also based on a linear probability model, and it will not change for logit or probit models.

[19] Considering that many women with one child work part time, the birth of a second child may affect the decision to work or not more significantly. For interesting reading, see Anna Quindlen's book *Living Out Loud* (1988), which mentions that the second child tended to affect the mother's career more significantly than the first.

[20] I have also tried to separately estimate the impact of children for women according to three educational levels: high school dropouts, high school graduates or those with some college, and college graduates and above. Probably due to sample size, of the 12 IV estimates of children's impact (four labor market outcomes for each educational group), only one is statistically significant. Therefore I do not present the results as part of my main findings.

[21] The test is to insert the residual from estimating equation (2) by using OLS method to the OLS estimation of equation (1). The exogeneity of the fertility variable is rejected if the t statistics of the residual term is large. As reference for this test see Wooldridge (2001).

[22] Note that this test is only valid when the exclusion restriction on miscarriage is true.

resort to a certain natural experiment during a woman's fertility history to provide an exogenous shock to the woman's fertility outcome. However, the specific natural experiment used in each study is different and the precise interpretation of the estimates will differ accordingly.

Bronars and Grogger (1994) use the event of a twin birth as the source of exogenous shocks to a woman's fertility outcome. Their results show that, for unmarried women who have had at least one child, one more child reduces the likelihood of working for pay by 4.7 percent and reduces annual earnings by 1053 dollars. Angrist and Evans (1998) point to parents' preference for having a boy and a girl rather than two children of the same gender to the extent that the gender mix of a couple's first two children becomes a factor affecting a woman's fertility outcome exogenously. Their results show that for women who have at least two children, having a third child reduces the probability of working for pay by 9.2 percent, reduces weekly work hours by 4.08 hours, and reduces annual earnings by 2100 dollars.

Cristia (2008) studies a group of women who have sought fertility treatment where treatment's success is considered to be random. His result shows that having a first child reduces a woman's likelihood of working afterward by about 27.7 percent. This estimated impact is significantly larger than my results as well as those of Bronars and Grogger (1994) and Angrist and Evans (1998). This larger estimated impact of a first child is consistent with the fact that Cristia's estimate involves very young babies while my results are for the average impact of children of all ages.

In general, my findings on the size of the impact of children on mothers' labor supply and earnings are comparable with other similar studies, even though those studies have used very different sources of exogenous shocks to women's fertility. This result provides some support for the validity and usefulness of the instrumental variable technique in the empirical study of children's labor supply effect on women.

5. Conclusion

In this study I empirically estimate the extent to which the presence of children affects a mother's labor supply and earnings. To deal with the endogeneity problem in the econometric analysis, I resort to the fact that miscarriages are largely random events that provide an exogenous shock to the presence or the number of children for a woman.

The estimation result shows that there is a modest negative impact of children on a mother's employment and income. For example, a woman with children is 13.6 percent less likely to work full time than a woman with no children. In general, the IV estimates I obtain are smaller in scale than OLS estimates, suggesting that the endogeneity problem indeed is likely to exist. One contribution of this paper is that it estimates the impact of having a first child, which is not possible for some of the other identification strategies that have been used in the literature.

I should note that the estimate obtained from estimating a reduced-form regression model cannot be interpreted as easily as one obtained from a structural model. The estimate from a reduced-form model is expected to change when any factor that is relevant to a woman's optimization decision changes. However such an estimate from a reduced-form model is useful as documented evidence of the effect family responsibilities have on a mother's labor supply at a specific period of time.

References

Ahn, Namkee and Pedro Mira (2002) “A Note on the Changing Relationship between Fertility and Female Employment Rates in Developed Countries” *Journal of Population Economics* **15(4)**, 667-682

Angrist, Joshua D., and Williams N. Evans (1998) “Children and Their Parents’ Labor Supply: Evidence from Exogenous Variation in Family Size” *The American Economic Review* **88(3)**, 450 – 477

Bronars, Stephen G., and Jeff Grogger (1994) “The Economic Consequences of Unwed Motherhood: Using Twin Births as a Natural Experiment” *The American Economic Review* **84(5)**, 1141 – 1156

Cristia, Julian (2008) “The Effect of a First Child on Female Labor Supply: Evidence from Women Seeking Fertility Services” *Journal of Human Resources* **43(3)**, 487-510

Gangadharan, Jaisri, Joshua L. Rosenbloom (1996) “The Effects of Childbearing on Married Women’s Labor Supply and Earnings: Using Twin Births as a Natural Experiment” *NBER Working Paper 5647*

Hotz, V. Joseph, Susan Williams McElroy, and Seth G. Sanders (2005) “Teenage Childbearing and Its Life Cycle Consequences: Exploiting a natural Experiment” *Journal of Human Resources* **40(3)**, 683 - 715

Iacovou, Maria (2001) “Fertility and Female Labor Supply” *Working Papers and the Institute for Soocial and Economic Research,* paper 2001-19. Colchester: University of Essex.

Imbens, Guido W., and Joshua D. Angrist (1994) “Identification and Estimation of Local Average Treatment Effects” *Econometrica* **62(2)**, 467 – 475

Jacobson, Joyce P., James Wishart Pearce, and Joshua L. Rosenbloom (1999) “The Effects of Childbearing on Married Women’s Labor Supply and Earnings: Using Twin Births as a Natural Experiment” *The Journal of Human Resources* **34(3)**, 449 – 474

Lehrer, Evelyn, Marc Nerlove (1986) “Female Labor Force Behavior and Fertility in the United States” *Annual Review of Sociology* **12**,181-204

Miller, Amalia (2011) “Effects of Motherhood Timing on Career Path” *Journal of Population Economics* **24 (3)**, 1071 - 1100

Mincer, Jacob (1962) "Labor Force Participation of Married Women" in H. Gregg Lewis (ed.), *Aspects of Labor Economics*

O’Neill, June (2003) “The Gender Wage Gap in Wages, circa 2000” *American Economic Review, Papers and Proceedings* **93(2)**, 309-314

Rosenzweig, Mark, and Kenneth Wolpin (1980) “Life-Cycle labor Supply and Fertility: Causal Inferences from Household Models” *The Journal of Political Economy* **88(2)**, 328 – 348

Stabile, Isabel, Gedis Grudzinskas, and Tim Chard (Ed.). *Spontaneous Abortion: Diagnosis and Treatment*. Springer-Verlag, London, 1992

Wooldridge, Jeffrey (2001), *Econometric Analysis of Cross Section and Panel Data,* 1st edition, *The MIT Press*

Table 1: Summary Statistics

Variable	1988	1995	2002
Age	33.3 (6.8)	33.8 (6.9)	33.7 (7.1)
Black	.14	.15	.15
Hispanic	.11	.12	.16
Education	12.8 (2.3)	12.9 (2.4)	13.1 (2.6)
Spouse's education (if married)	13.4 (2.5)	13.4 (2.5)	13.5 (2.6)
Married	.69	.65	.62
Mother's Education	11.0 (3.3)	11.1 (3.5)	-
Total family income (in 1995 dollars)	38751 (20867)	42032 (26935)	33409 (19847)
In poverty	.15	.15	.23
Smoked during the last pregnancy	.29	-	-
Drank during the last pregnancy	.13	-	-
Used medication during the last pregnancy	.03	-	-
Smoked 100 cigarettes or more	-	.49	-
Have at least one child (birth)	.90	.89	.90
Number of children	1.95 (1.23)	1.89 (1.23)	1.98 (1.29)
Age at the first pregnancy	21.9 (4.3)	21.9 (4.7)	22.2 (5.1)
First pregnancy ended in miscarriage	.11	.11	.13
Work for pay (last week)	.67	.69	.72
Full time worker	.47	.50	.55
Hours worked per week	24.2 (19.5)	26.0 (20)	-
Annual earnings (in 1995 dollars)	13879 (15137)	14866 (16850)	-
Sample size	5778	7660	4945

Note: The numbers in table cells are sample mean except for the last row. Standard deviations are in parentheses. – indicates that the information is not available in that year.

Table 2: Test of Mean Equality of Women Who Miscarried and Who Did Not[1]

	First pregnancy ended in miscarriage	First pregnancy did not end in miscarriage	p-value of t-test [2]
Age at pregnancy	21.93 (5.13)	21.67 (4.64)	**0.014**
Education	12.93 (2.40)	12.75 (2.39)	**0.001**
Mother's education [3]	8.36 (5.00)	8.54 (4.91)	0.115
White	0.62 (0.48)	0.55 (0.50)	**0.000**
Has smoked 100 cigarettes or more	0.30 (0.01)	0.29 (0.46)	0.499
First pregnancy ended in miscarriage	1.00	0	-
Have at least one child	0.73 (0.45)	0.93 (0.26)	**0.000**
Number of children	1.44 (1.23)	2.01 (1.23)	**0.000**
Work for pay	0.68 (0.46)	0.68 (0.47)	0.448
Full time worker	0.55 (0.50)	0.53 (0.50)	0.104
Hours worked per week	25.50 (20.74)	24.38 (20.07)	**0.049**
Annual earnings (in 1995 dollar)	14566 (16210)	13852 (15513)	0.106
Number of observations	2088	16294	

Note:

1. The numbers in the second and third columns are sample means and the numbers in the parentheses are standard deviations. The calculations are based on the same sample as summarized in Table 1.
2. The maintained hypothesis of the t-test is that the means of the variable for the two groups are equal, and the alternative hypothesis is that the means are unequal.
3. The calculation only uses data from 1988 and 1995 as mother's education is not available in the 2002 survey.

Table 3: Effect of Miscarriage on Woman's Fertility Outcome

Dependent Variable of the Regression	Estimated impact of first pregnancy ending in a miscarriage	R^2	Marginal contribution of miscarriage to R^2	Incidence of Miscarriages	Number of Observations
Have at least one child	-.194 (.009) **	.14	.045	2088	18323
Number of children	-.481 (.026) **	.25	.011	2088	18323

Notes:
1. The control variables in the regression are: age, Black, Hispanic, education, married, spouse education (if married), smoked 100 cigarettes or not, year dummies and a constant term.
2. The numbers in the parentheses in the second column are standard errors.
3. ** indicates the coefficient is significantly different from zero at 1 percent level.

Table 4: Impact of Children on Woman's Employment Outcomes

	OLS Estimate	IV Estimate	Test of Exogenous Children	Number of Observations
Effect of Having Children vs. Childlessness				
Work for pay	-.166 (.010) **	-.059 (.054)	-.113 (.055) *	18323
Full time worker	-.172 (.012) **	-.136 (.058) *	-.038 (.059)	18232
Hours worked per week	-9.56 (.57) **	-6.79 (2.90) *	-2.83 (2.90)	13176
Annual earnings (in 1995 dollar)	-6362 (497) **	-2729 (2191)	-3692 (2200)	12976
Average Effect per Child				
Work for pay	-.075 (.003) **	-.024 (.022)	-.052 (.022) *	18323
Full time worker	-.084 (.003) **	-.055 (.023) *	-.030 (.023)	18232
Hours worked per week	-4.00 (.15) **	-2.57 (1.09) *	-1.52 (1.14)	13176
Annual earnings (in 1995 dollar)	-2629 (107) **	-1028 (823)	-1602 (863)	12976

Notes:
1. The control variables in the regression are the same as in Table 3.
2. The numbers in the parentheses in Column 2 to Column 4 are standard errors.
3. * indicates the coefficient is statistically significant at 5 percent level, ** indicates the coefficient is statistically significant at 1 percent level.
4. The test of exogenous children is based on the t statistic of the residual term in the second stage regression, where the residual term comes from the first stage regression.
5. Hours worked per week and annual earnings are not available in 2002 survey.