Fertility and Female Labor Supply: Evidence from USA IPUMS of 2009, 2010, and 2014

Yining Gao, Yanhuan Qiu
School of Mathematics, Sichuan University of Arts and Science, Dazhou, Sichuan, China

Abstract: This paper investigates the effect of fertility on female labor supply using U.S. IPUMS data from 2009, 2010, and 2014, replicating the approach of Angrist and Evans's study. This paper utilizes the sex composition of the first two children as an instrumental variable to address the endogeneity of fertility decisions. Results indicate a negative relationship between having a third child and women's labor force participation, hours worked, and income. While these findings align with previous research, some variables—such as annual income—are less significant in the recent data. Additionally, the analysis extends to examine the relationship between fertility and husbands' labor supply, finding a smaller but still notable negative effect on their participation and working hours. Overall, the results suggest that fertility continues to impact female labor supply more strongly than male labor supply, with demographic shifts and evolving family dynamics contributing to variations in labor market outcomes. This paper concludes with a discussion of the limitations and implications for future research, particularly considering changing societal norms and economic conditions.

Keywords: Fertility; Female Labor Supply; Instrumental Variables; Labor Participation; Family Size; Two-Stage Least Squares

1. Introduction

The relationship between fertility and female labor supply attracts much attention in economics, and a lot of studies suggested the negative relationship between fertility and female labor supply. However, there are few research supports with the similar identification strategy. Therefore, it is necessary to do a replicate analysis for the relationship between fertility and female labor supply by using larger data sets.

This paper will follow Angrist and Evans's IV strategy to estimate the effect of fertility on female labor supply with the sex composition of the first two children. The same as Angrist and Evans, this paper focuses on the family with at least two children and uses whether or not the first two children were of the same sex as an instrument for the decision to have a third child. Moreover, this paper chooses to analyze the relationship between husbands' labor supply and fertility, which is also an interesting topic.

As a result, compared with the Angrist and Evans's study, this paper finds a similar result that there the fertility and labor supply have a negative relationship, however, some variables are not significant in the recent datasets. In addition, this paper explores the error reasons and find further relationship from women's husbands' sample.

The rest of this paper is organized as follows. Section 2 presents the relative references from early negative correlations to recent studies on income and policy impacts. Section 3 presents data and descriptive statistics, and shows the basic information and characteristics from the current dataset, and compares with Angrist and Evans's data to see whether there are some differences. Section 4 presents the empirical strategy of Wald estimate and Two-Stage Least-Squares Estimation (2SLS). Section 5 analyzes the main results from the estimations to clarify the relationship between fertility and labor supply, and to analyze the difference between this paper and Angrist and Evans's study, the validity of the instruments, and also further exploit the relationship between husbands' labor supply and fertility. Finally, Section 6 presents the conclusion.

2. Literature Review

There are many papers the relationship between fertility and female labor supply. Felmlee's early research using simple regression found a negative relationship between women's employment rates and fertility [1]. Angrist and

Evans later improved on this with an instrumental variable (IV) approach, using the sex of the first two children to account for endogeneity, and reached similar conclusions. [2]. Aguero and Marks further noted that because fertility and labor supply decisions are simultaneous, endogenous factors, such as talent, could bias results. To address this, most studies chose to analyze the exogenous variation in family size to estimate this casual effect, for example, Bronars and Grogger included twins in the first birth of children, and Aguero and Marks treat the infertility factor as the exogenous variation in family size [3,4]. In conclusion, these strategies make the research method more complete.

Recent studies continue to explore this relationship. For example, Aaronson compiled data from 103 countries over the last two centuries, showing that fertility's impact on labor supply grows as incomes increase [5]. More specifically, Tumen and Turan presented evidence on how fertility affects informal female employment in Turkey. The findings showed that women reduce labor supply after childbirth, especially in informal jobs, while fathers increase labor supply in response to higher fertility [6]. With the replicate method, Jakobsen showed how fertility adjustments, in response to tax reforms, affect women's labor supply. Fertility adjustments increase labor supply responsiveness by 28%, having long-term effects on the gender wage gap [7]. In OECD countries, Law and Wye examined the role of education and health investments in moderating the negative effect of fertility on female labor force participation [8]. Similarly, Milovanović re-evaluated the relationship between fertility and female labor participation in OECD countries from 2000 to 2020, confirming a persistent negative trend [9]. At last, Murshid et al. emphasized high rates of primary infertility driven by female factors and offer insights into outcomes from assisted reproductive technologies among 82 couples in Western Iraq [10].

In conclusion, this paper will discuss the relationship between fertility and female labor supply using 2009, 2010, and 2014 Integrated Public Use Microdata Series (IPUMS) data in USA, comparing the findings with Angrist and Evans's 1998 study.

3. The Data

This paper uses the data from the USA Integrated Public Use Microdata Series (IPUMS) of 2009, 2010, and 2014. The data includes information on household weight, person weight, number of families, couples, and children in the household, age of children, marital status, race, employment, work hour, and incomes. The same as Angrist and Evans's study, this paper restricts the sample with married women aged 21-35 who are either the household head or spouse of household head in a one-couple or one-family household, with the reported number of children of her own is at least two, and also restricts that the number of children reported by sample female, her husband, and the actual number in the household have coincided.

Therefore, after drop households with more than one couple or one family, define the dummy to worked year, father, mother, children, and whether a mother has more than two kids, define the number of children reported by both parents is consistent with the actual computed number of children, define the age of the mother when she had her first-born, and find first and second sex of children. At last, the final estimating sample contains 81128 observations, the sub-sample of each year only contains 28386, 28015, and 24727. Therefore, to get a more accurate estimation result, this paper chooses the larger combined sample with more observations to process the estimation.

3.1 Descriptive Statistics

The descriptive statistics and variable definitions are presented in Table 1. Among the restricted sample women with two children, about 42% considered having a third child, which is represented by the *morethan2kids* variable, and this proportion is similar to Angrist and Evans's result of 1980 PUMS. In addition, just 50% of all two-child families had children of the same sex. However, the frequency of two boys (27%) is slightly higher than two girls (24%), which is still coincided with the result in Angrist and Evans's paper. Moreover, the mean age is about 31 years old for sample women, which is similar to the mean age (30) from Angrist and Evans, which means that the age of becoming a mother did not change a lot. About 65% of the mothers with at least two children were working in the previous year, and the average working hours per week is about 22.54, so, compare with the Angrist and Evans's discussion, women's labor-force participation rate increases over time.

Finally, women's average earnings are about19072.4 and the average family total incomes are about 73659.1, and both of them increased dramatically compared with the Angrist and Evans's results.

Table 1. Descriptive Statistics for Sample Women in 2009, 2010, and 2014

Variable	Mean	Standard Deviation	Min	Max
morethan2kids (=1 if mother had more than 2 kids, =0 otherwise)	0.42	(0.49)	0	1
firstsex1 (=1 if first child was a boy, =2 was a girl)	1.48	(0.50)	1	2
secondsex1 (=1 if second child was a boy, =2 was a girl)	1.49	(0.50)	1	2
twoboys (=1 if first two children were boys)	0.27	(0.44)	0	1
twogirls (=1 if first two children were girls)	0.24	(0.42)	0	1
samesex (=1 if first two children were the same sex)	0.50	(0.50)	0	1
AGE	31.21	(3.17)	21	35
age1st (mother's age when she had her first-born)	22.38	(4.11)	-31	34
worklastyr (=1 if the person worked in the previous year)	0.65	(0.48)	0	1
UHRSWORK (usual hours worked per week)	22.54	(19.12)	0	99
INCWAGE (wage and salary income)	18072.42	(26195.35)	0	591000
FTOTINC (total family income)	73659.10	(61745.43)	-19600	1253000

3.2 Instrumental Variables

To avoid the selection bias problem in family size, Angrist and Evans chose *twins birth* and *same sex* as instruments for the number of children. In Table 2, it divided the children sample according to the sex of the first two children, and it shows that women with two children of the same sex are more likely to have a third child than women with two different sex children. For example, there are 22.45% of women with two girls or two boys have a third child, while there are only 19.57% of women with one boy and one girl have a third child, and that is a significant difference of 2.9% points.

Therefore, this paper chooses to use the randomly assigned *same sex* variable as the instrumental variable, which can affect the willingness of childbearing of women.

Table 2. Fraction of Families That Had Another Child (81128 Observations)

Sex of first two children in families with two or children	Fraction of sample	Fraction that had another child
(1) one boy, one girl	0.4977	0.1957
(2) both same sex	0.5023	0.2245
difference (2) – (1)	—	0.0288

4. Empirical Strategy

4.1 Wald Estimates

Similar to Angrist and Evans's study, this paper uses the following two-stage least squares (2SLS) regression model. Firstly, labor supply (Y_i) is explained by fertility (S_i) in the following equation:

$$Y_i = \alpha + \beta_1 S_i + \varepsilon_i \quad (1)$$

Where Y_i measures the labor supply, and this variable can be explained by using the *worklastyr*, *UHRSWORK*, and *INCWAGE* variables. Besides, S_i represents the fertility, which can be explained by the *more than 2 kids* and *NCHILD* variables. However, the ordinary least square estimates of β_1 do not provide unbiased estimates of the impact of fertility on labor supply decisions if fertility is endogenous. Just as the situation mentioned before, mothers always do the decisions of childbearing and labor supply together, moreover, these two decisions can also affect each other. Therefore, instrumental variables are used to correct this endogeneity. In this paper, the instrumental variable denotes to Z_i, is the *same sex* variable. As Z_i is a dummy variable, and it equals 1 when women i's first two children are of the same sex, this paper use Wald estimates to

conduct the IV estimation. So, it is known that the first-stage model with Z_i, is:

$$S_i = \beta_2 + \pi_1 Z_i + \varepsilon_{1i} \quad (2)$$

The reduced-form model is:

$$Y_i = \beta_3 + \pi_2 Z_i + \varepsilon_{2i} \quad (3)$$

The Wald estimator for a dummy instrument is:

$$\beta_{IV} = \frac{E[Y_i|Z_i=1]-E[Y_i|Z_i=0]}{E[S_i|Z_i=1]-E[S_i|Z_i=0]} = \frac{\overline{Y_1}-\overline{Y_0}}{\overline{S_1}-\overline{S_0}} = \frac{\pi_2}{\pi_1} \quad (4)$$

Which indicates the average effect of fertility (S_i) on labor supply (Y_i) for individuals whose fertility is affected by their children's sex.

The result of Wald estimation with the *same sex* instrument showed in Table 3. The denominator of the Wald estimator $(\overline{S_1} - \overline{S_0})$ is shown in the first two columns of the table, one is the number of total children in the household (*NCHILD*), and the other is the indicator of having more than two children (*morethan2kids*). The effect of the same sex instrument on *NCHILD* is 0.069 and on *morethan2kids* is 0.054, which means that women with two children of the same sex are able to have more children than women with one boy and one girl. The next three columns from (3) to (5) of Table 3 show the numerator of the Wald estimator $(\overline{Y_1} - \overline{Y_0})$ by using the *same sex* instrument. The results show that compared to the women with one boy and one girl, women with two children of the same sex are able to have a lower labor supply participation, lower working hours per week, and lower annual incomes. In addition, despite the women's annual year (*INCWAGE*), all other results are statistically significant in the test.

Finally, the Wald estimates for the sample calculated by the equation (4), the results are shown from column (6) to column (11). For example, with the *NCHILD* variable, the corresponding results in columns (6), (8), and (10) mean that with a greater number of children, women's labor supply will reduce 12.2% (-0.0085/0.069), working hours per week will reduce about 5.4 hours, and annual income will drop $2723. Moreover, there is a similar negative effect of women have more than two children (morethan2kids) on women's labor supply with 15.8% decreasing, worked about less than 7 hours per week, and earned less than $3525 per year.

In conclusion, the relationship between fertility and labor supply is negative, additionally, for *NCHILD* and *morethan2kids* variables, *NCHILD* is used to analyze the effect per child, while *morethan2kids* is used to analyze as a whole. Therefore, it is enough to choose only the *morethan2kids* variable out as the endogenous regressor, which causes the basic change of fertility by the condition of two or more children and the effect of morethan2kids can always be converted into per child estimates by multiplying the effect by 1.29.

4.2 Two-stage Least-squares Estimation

As Wald estimate is the special case when instrument estimator is a dummy, it only shows the very basic negative effect between fertility and labor. Therefore, the following part chooses a more accurate method, two-stage least-squares (2SLS), to estimate the causal effect of fertility on labor supply. The 2SLS method is useful because it can help control for exogenous covariates to avoid the omitted biases. Therefore, just as the Angrist and Evans's study [3], the 2SLS framework in this paper help us exploit the fact that the *same sex* instrument consists of two separate instruments, which indicate whether the first two children are two boys or two girls. In this way, it is possible to see whether the impact of the instrument, *two boys*, differs from that of *two girls* on the birth of more than two children.

The two-stage least-squares model consists of two stages, firstly, the first stage correlates the instrument to the endogenous regressor to see if there is a significant effect, then, the second stage correlates the predicted values from the first stage to the dependent variable. In this paper, to construct the two new separate instruments from the *same sex* instrument, the following formula is used:

$$same\ sex = s_1 s_2 + (1 - s_1)(1 - s_2) \quad (5)$$

Where the s_1 equals to 1 if the sex of the first child is male, and s_2 equals 1 if the sex of the second child is male. Next, using the same sex instrument, the first stage equation relating fertility and sex mix is:

$$x_i = \pi + \gamma(same\ sex_i) + \sigma w_i + \epsilon_i \quad (6)$$

In this model, x_i means the fertility, w_i is a vector that including the exogenous covariates to fertility, such as mother's age, age at the first birth, and race variables. If the $same\ sex_i$ is split into two separate instruments, the formulas will be:

$$two\ boys = s_1 s_2 \quad (7)$$

$$two\ girls = (1 - s_1)(1 - s_2) \quad (8)$$

Substituting the separated instruments into the first-stage equation, the true and complete first-stage equation is:

$$x_i = \pi + \gamma_1(two\ boys_i) + \gamma_2(two\ girls_i) + \sigma w_i + \epsilon_i \quad (9)$$

Then, the second stage correlates the labor supply (y_i) on the predicted value from the first stage, and the second-stage equation is:

$$y_i = \alpha + \beta x_i + \delta w_i + \varepsilon_i \quad (10)$$

Table 3. Wald Estimates of Labor-supply Models

	Dependent Variable:										
	NCHILD	Morethan2kids	worklastyr	UHRSWORK	INCWAGE	worklastyr		UHRSWORK		INCWAGE	
	OLS	OLS	OLS	OLS	OLS	Instrumental variable		Instrumental variable		Instrumental variable	
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)
samesex	0.069*** (0.006)	0.054*** (0.003)	-0.08** (0.003)	-0.377*** (0.134)	-189.200 (183.900)						
NCHILD						-0.122** (0.048)		-5.427*** (1.915)		-2,723 (2,630)	
More than 2kids							-0.158** (0.062)		-7.024*** (2.477)		-3,525 (3,402)
Constant	2.559*** (0.004)	0.393*** (0.002)	0.659*** (0.002)	22.73*** (0.095)	18,167*** (130.400)	0.972*** (0.123)	0.721*** (0.026)	36.62*** (4.968)	25.5*** (1.043)	25,134*** (6,803)	19,554*** (1,432)
observations	81,128										
R2	0.002	0.003	0.0001	0.0001	0.00001	0.019	0.017	0.017	0.019	0.019	0.015
Adjusted R2	0.002	0.003	0.0001	0.0001	0.00000	0.019	0.017	0.017	0.019	0.019	0.015
Res. Std. Er. (df=81126)	0.851	0.493	0.475	19.110	26,195	0.471	0.471	18.95	18.93	25,949	25,999
F Statistic (df=1;81126)	135.2***	240.5***	6.464**	7.889***	1.058						
Note:									*p<0.1; **p<0.05: ***p<0.01		

Firstly, the first-stage regression results are shown in Table 4, and it shows the causal effect of the first two children have the same sex on the number of the children. In this analysis, only the variable *morethan2kids* is studied, and the *same sex*, *two boys*, and *two girls* variables are all significant. Table 4 contains so much information and to understand that result deeply, we just treat the *AGE*, *age1st*, and *RACE* variables as the other covariates, and it is enough to mainly focus on the rest of the five variables. More details, women with the same sex first two children are more likely to have a third child by 5.4% with other covariates, which is the same result as the Wald estimate. Moreover, with column (3), it is clear that when two boys and two girls enter the regression separately, there is nearly no relationship (-0.4%) between *boy1st* and fertility. Also, in column (2), with the *same sex* variable, the *boy1st* (-1%) and *boy2nd* (-0.6%) have almost no influence on fertility. However, *boy1st* and *boy2nd* are not always significant in the regression, which is not the same as the Angrist and Evans's (1998) result. This difference will be discussed in the fifth part.

5. Main Results

Next, to estimate the effect of *morethan2kids* on labor supply by using the sex mix, there are OLS estimates and 2SLS estimates represented in Table 5, which is using the same sex, two boys and two girls as two groups of instruments. The exogenous regressors are the same in Table 4, and the *worklastyr*, *UHRSWORK*, and *INCWAGE* variables are treated as the dependent variables. It is worth noting that all coefficients in Table 4 are negative numbers, which indicate the negative relationship.

OLS estimates in column (1) suggest that with more than two children, the working probability reduces about 16.1%, worked hours reduce about 7.19 per week, and annual earnings reduce about $6513. Not surprisingly, all these three OLS estimates are statistically significant. However, in contrast with the results for married women, OLS estimates of the effect of *morethan2kids* on husbands' labor supply are small. For example, having a third child only reduces the husband's working probability by 0.5%, the husbands' worked hours only fall by less than 1, and the annual income increases by $81. So, married women always reduce more labor probability than their husbands when they have the third child.

The 2SLS estimates use *same sex* as an instrument in column (2) for married women and column (5) for husbands of married women. From column (2), the 2SLS estimates are very similar to the OLS estimates in *worklastyr* and *URHSWORK*, only the annual income reduces less under the 2SLS estimates, with about $3398. Therefore, the recent dataset gets a different opinion for the OLS and 2SLS estimates, with the similar results between these two estimates, one of the possible reasons is that the OLS

estimates have the same proper estimates of fertility on female labor supply, just as the 2SLS estimates. Another reason is that both OLS and 2SLS estimates are biases, which means that they are all misestimated with the causal effect of fertility on female labor supply.

Table 4. First-Stage Result Linking the Sex Mix and Fertility

	Dependent variable:		
	More than 2 kids		
	(1)	(2)	(3)
AGE	0.029*** (0.001)	0.029*** (0.001)	0.029*** (0.001)
age1st	-0.045*** (0.0004)	-0.045*** (0.0004)	-0.045*** (0.0004)
samesex	0.053*** (0.003)	0.054*** (0.003)	
boy2nd		-0.006* (0.003)	
twoboys			0.048*** (0.005)
twogirls			0.060*** (0.005)
boy1st		-0.010*** (0.003)	-0.004 (0.005)
factor(RACE)2	0.018*** (0.007)	0.018*** (0.007)	0.018*** (0.007)
factor(RACE)3	0.074*** (0.016)	0.074*** (0.016)	0.074*** (0.016)
factor(RACE)4	-0.077*** (0.022)	-0.076*** (0.022)	-0.076*** (0.022)
factor(RACE)5	-0.172*** (0.049)	-0.172*** (0.049)	-0.172*** (0.049)
factor(RACE)6	-0.088*** (0.009)	-0.089*** (0.009)	-0.089*** (0.009)
factor(RACE)7	0.012 (0.007)	0.011 (0.007)	0.011 (0.007)
factor(RACE)8	-0.005 (0.012)	-0.005 (0.012)	-0.005 (0.012)
factor(RACE)9	-0.017 (0.038)	-0.017 (0.038)	-0.017 (0.038)
constant	0.501*** (0.016)	0.509*** (0.017)	0.503*** (0.017)
observations	81,128		
R2	0.127		
Adjusted R2	0.127		
Residual Std. Error	0.461(df=81116)	0.461(df=81114)	0.461(df=81114)
F Statistic	1,071.415*** (df=11;81116)	907.658*** (df=13;81114)	907.658*** (df=13;81114)
Note:		*p<0.1;**p<0.05;***p<0.01	

Moreover, both OLS and 2SLS estimates with the annual earnings for both married women and their husbands change a lot, and the estimates of husbands group change the most, for example, $81 for OLS estimation, and $2336 and $3463 for 2SLS estimations. This result is not normal and stable at all, therefore, the annual income data is further processed, for example, it can be normalized or log processing. Besides, despite the annual earnings variables, the 2SLS estimates for the two instruments of the *same sex*, and *two boys* and *two girls* are similar, which means that in the recent datasets, the whole instrument and the separate instruments are not very different.

Table 5. OLS and 2SLS Estimates of Labor-Supply Models

	Married Women			Husbands		
	(1)	(2)	(3)	(4)	(5)	(6)
Estimation Method	OLS	2SLS	2SLS	OLS	2SLS	2SLS
Instrument for *morethan2kids*	—	*same sex*	*two boys, two girls*	—	*same sex*	*two boys, two girls*
Dependent variable:						
worklastyr	-0.161*** (0.004)	-0.164*** (0.061)	-0.165*** (0.060)	-0.005*** (0.002)	-0.022 (0.028)	-0.021 (0.027)
UHRSWORK	-7.190*** (0.142)	-7.210*** (2.455)	-7.272*** (2.402)	-0.199* (0.108)	-0.564 (1.886)	-0.191 (1.843)
INCWAGE	-6,513.116*** (192.519)	-3,398.265 (3342.665)	-4,345.809 (3269.086)	81.354 (364.526)	2336.338 (6381.770)	3463.290 (6237.027)

Note: The table reports estimates of the coefficient on the morethan2kids in the second-stage equation. Other covariates in the models are AGE, age1st, and RACE, which are not reported in the table.

5.1 Comparison with the Previous Study

Compare this paper's results with the Angrist and Evans's results, the main result is the same that there is still a negative relationship between fertility and female labor supply in the new dataset with the years 2009, 2010, and 2014. However, there are some small differences between the previous study and this paper.

Firstly, for the descriptive statistics, there is a similar possibility to have a third child, the similar average age to have the third child, and nearly the same average estimates for all instruments, additionally, the probability of labor supply and worked hours both increases compared with the previous one, however, as the economy develops, the individual incomes and family incomes both nearly doubled. Moreover, when analyzing the sex mix, it is clear that in recent years, there are fewer families that want a third child. Moreover, the difference value in Table 2, does not coincide with the value in Table 3, which is not the same as the previous study, and this means that there may have some biases with the *same sex* instrument. Finally, with the similar empirical strategy, this paper is able to get similar results, however, with the less sample, several variables are not significant in the regressions, for example, the annual income variable is not significant in every regression, including the Wald estimate and 2SLS estimates, and the *boy1st* and *boy2nd* variables are not always significant in the regression. One of the most obvious reasons is that the sample size is too small compare with the one that Angrist and Evans used. Therefore, with the smaller sample size, it is more possible to increase the margin of error and to produce a wider interval, which will lead the estimation result far away from the previous study. In addition, in Angrist and Evans's paper, the changes of the set of covariates will not influence the result for the regressions, however, as the sample size in this paper is smaller, the results of adding or eliminate covariates to explain the variables will lean to the insignificant and not be the same as before.

5.2 Validity of the Instrument

To test the validity of the *same sex* instrument according to the exclusion restriction and relevance, with the limited conditions, it is easier to choose to check the *same sex* instrument with the Wald estimates. Firstly, to check the exclusive restriction, the correlation between Z_i and ε_i needs to be calculated, so, we need to save the residuals from the OLS regression of labor supply on *morethan2kis*, and then calculate the correlation between the *same sex* and those saved residuals. The answer of 0.0148 is calculated by R. Secondly, to check the relevance, the correlation between Z_i and S_i needs to be calculated, and the answer is 0.054. In conclusion, the relevance condition holds because the correlation between Z_i and S_i is not zero (the correlation equals 0.054), the exclusive restriction condition does not hold because the correlation between Z_i and ε_i is not zero (the correlation equals 0.0148), which statistically equals zero. Therefore, there is no correlation between Z_i and ε_i, and it is believed that the *same sex* instrument is a valid instrument. In addition, the checking of that whether the *same sex* instrument is a weak instrument is a need in further study with the F test.

Table 6. Descriptive Statistics for Sample Women's Husbands in 2009, 2010, and 2014

Variable	Mean	Standard Deviation	Min	Max
morethan2kids (=1 if husband had more than 2 kids, =0 otherwise)	0.42	(0.49)	0	1
firstsex1 (=1 if first child was a boy, =2 was a girl)	1.48	(0.50)	1	2
secondsex1 (=1 if second child was a boy, =2 was a girl)	1.49	(0.50)	1	2
twoboys (=1 if first two children were boys)	0.27	(0.44)	0	1
twogirls (=1 if first two children were girls)	0.24	(0.42)	0	1
samesex (=1 if first two children were the same sex)	0.50	(0.50)	0	1
AGE	34.41	(5.28)	15	75
age1st (husband's age when she had her first-born)	25.58	(5.43)	0	64

worklastyr (=1 if the person worked in the previous year)	0.95	(0.21)	0	1
UHRSWORK (usual hours worked per week)	42.31	(14.30)	0	99
INCWAGE (wage and salary income)	47918.49	(49427.20)	0	591000
FTOTINC (total family income)	73659.10	(61745.43)	-19600	1253000

5.3 Respective from Husbands

Despite the married women's perspective, there are other interesting results from their husbands' perspectives. Firstly, from the OLS and 2SLS analysis, the husbands affected less by the fertility, including only reduce much less possibility of working, and only reduce less than one worked hour per week. In addition, compared with the husbands' descriptive statistics in Table 6, it is found that the average age for husbands to have a third child is a little older than married women. Besides, for the husbands' labor supply, the basic working probability, worked hours per week, and individual earnings are higher than women's, and then with the results in Table 5, it is clear that women scarify more than their husbands on the third child. However, from Table 5, the negative change on husbands decreases compared with Angrist and Evans's results, which may indicate that husbands join the childbearing gradually, therefore, it is interesting to further discuss the relationship between fertility and husbands' labor supply, or between fertility and the whole family.

6. Conclusion

In conclusion, in this paper, the negative relationship between fertility and female labor supply is tested again by using the data from IPUMS 2009, 2010, and 2014, which is the same as many previous studies show.

Following Angrist and Evans's study, the results in this paper are quite similar, for example, the OLS estimates indicate that women with more than two children are about 16.1% points less likely to work than women with two children for the sample of married women. Additionally, to estimate the causal effect of fertility on female labor supply more precious, the sex composition of the first two children is used as the instrumental variable. The first stage shows that married women with two boys or two girls are 4.8% and 6% points more likely to have a third child. With the answer, there is still little boy preference shown in the results. Finally, the 2SLS estimates indicate there is a similar casual impact of 16.4% points of decrease of female labor supply by having a third child in the married sample. There are also similar results for husbands, which means that the third child has less influence on husbands' labor supply than married women.

Be different from Angrist and Evans's results, there are some insignificant estimates and there are no significant differences by using OLS and 2SLS to analyze the fertility and female labor supply. For example, the boy1st and boy2nd variables in the 2SLS, and the husbands' labor supply variables in OLS and 2SLS estimates. There are several reasons, the most obvious one is that the sample size in this paper is much smaller than Angrist and Evans's, which can lead to an inaccurate estimation result. In addition, the demographic characteristics of families may change over time, for example, more and more families accept the notion that raising a child equally with mother and father, therefore, the effect of fertility on families' labor supply may change a lot over time. Moreover, in this paper, the instrument same sex, and the separate instrument two boys and two girls are not different, which is shown is the 2SLS estimates that both instruments get two similar significant results for married women's labor supply, for example, -16.4% compared with -16.5% for the working probability, and -7.21 compared with -7.27 for the worked hours per week.

For further improvement, results in this paper just refer to moving from 2 to 3 children but no result from 0 to 1, therefore, to understand more comprehensive and deeper for the fertility, the effect from 0 to 1 is needed to analyze. In addition, it is necessary to expand the sample size to improve the accuracy of the regression analysis.

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