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Abstract

Using population census data, this paper examines the causal effect of childbearing on married women's labor force participation in urban China. To ameliorate the endogeneity of fertility, we exploit twin births as the instrument for the number of children. While the ordinary least squares estimates indicate that having one more child reduces female labor force participation by 6.7% and 8.5% in 1990 and 2000 respectively, the instrumental variable estimates suggest very small and insignificant effects for both years.

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1 Introduction

From the late 1980s, the growth rate of Chinese population began to fall in the wake of the "One Child Policy" initiated in 1979.[1] It is believed that one of the Chinese panacea of long-lasting rapid economic growth is the population control policy which has successfully maintained a low total dependency ratio in the last three decades (Wei and Hao, 2010). While other emerging economies admire China's great achievement, China is recently facing an unprecedented challenge of population ageing. A shrinking young cohort due to tight fertility control post to 1979 contributed to a lower total dependency ratio that benefited China's economic growth in the past thirty years. However, the low fertility rate along with the improvement of Chinese life expectancy caused current aging dilemma. Precisely, elder people aged above 65 accounted for 8.87% of total population in 2010 while the figure was 6.96% in 2000 (National Bureau of Statistics China, 2011). The demographic transition with more elder dependents but less prime-age labor leads to potential labor shortage and growing pressure on China's sustainable development, which again raises the debate whether the "One–Child Policy" should be relaxed. From the policy perspective, a key concern is that whether more children discourages female labor force participation.

Though the question is important, the answer is not yet clear-cut as the interpretation of the relationship between the number of children and mother's work is complicated by endogenous fertility decisions. Ignoring individual unobserved heterogeneity such as preferences for childbearing and career ambition, ordinary least squares (OLS) regressions may overestimate the impact of fertility on female labor force participation (Agüero and Marks, 2008). In addition, the effect running from female labor force participation to fertility decisions

[1] During 1979–2008, the birth rate fell from 1.78% to 1.21%, while the natural population growth rate declined from 1.16% to 0.05% (National Bureau of Statistics China, 2009). The total fertility rate turned to be below the average replacement level 2.1 from the 1990s (Cai, 2008).

indicates the presence of reverse causality (Mishra and Smyth, 2010).

This paper contributes to the debate in the current literature that whether there is a causal link between female labor supply and fertility (Angrist and Evans, 1998; Jacobsen *et al.*, 1999; Cruces and Galiani, 2007; Agüero and Marks, 2008), and also complements to the recent studies examining the determinants of female participation in the labor force in China (Maurer-Fazio *et al.*, 2011; Liu, 2012). Exploiting twin births as the source of exogenous variation in family size, we investigates the causal effect of having an extra child on female labor force participation in urban China. While the ordinary least squares estimates indicate that having one more child reduces female labor force participation by 6.7% and 8.5% in 1990 and 2000 respectively, the instrumental variable estimates suggest very small and insignificant effects for both years.

The remainder of the paper is organized as follows. Section 2 is a description of the data sets. The following section presents the empirical approach taken. In Section 4, we present and discuss the regression results. Section 5 concludes.

2 Data

We use the 1% sample of the 1990 Chinese Population Census and the 0.095% sample of the 2000 Chinese Population Census for this analysis. The data sets contain the information for all residents in each sampled household. Children and their parents are matched according to the within-household relation identifier in the data. Following Li *et al.* (2008), twins are defined as children born in the same year and month belonging to the same mother.

To facilitate the analysis, we apply a few sample restrictions. First, we only focus on women in urban China as female labor force participation in rural areas can be quite different (Barrett *et al.*, 1991). Second, only married mothers aged between 30 and 50, whose co-residency children are 16 or younger and

whose husbands living in the same households, are used. Third, we only include the mothers with one or two children in the final sample, not only because having three or more children in a family is rare in urban China nowadays, but also because we are specifically interested in examining the potential effect of relaxing the "One–Child Policy" on female labor force participation.

Table 1: Summary Statistics for Married Women in Urban China

	1990		2000	
	Twins	Non-Twins	Twins	Non-Twins
Labor force participation	0.93 (0.25)	0.93 (0.25)	0.81 (0.39)	0.80 (0.40)
Number of Children	2.00 (0.00)	1.30 (0.46)	2.00 (0.00)	1.17 (0.38)
Age	35.97 (3.97)	36.62 (4.22)	36.17 (3.68)	36.49 (4.35)
Schooling	7.10 (3.15)	7.16 (3.23)	10.96 (2.46)	10.94 (2.77)
Husband schooling	6.70 (4.13)	7.40 (4.07)	10.69 (4.41)	10.99 (3.75)
Ethnic minority	0.04 (0.20)	0.04 (0.20)	0.03 (0.18)	0.06 (0.24)
Elder co-residents (age≥65)	0.05 (0.22)	0.06 (0.23)	0.08 (0.27)	0.06 (0.23)
Young children (age≤6)	0.17 (0.38)	0.19 (0.39)	0.08 (0.27)	0.16 (0.37)
Observations	469	187,365	90	24,930

Note: Standard deviations are reported in parenthesis.

Table 1 displays the summary statistics for married women with and without twin births respectively, which confirms that the birth of twins is random as the covariates are very similar for the two types of mothers in each year. female labor force participation rates are found to be declining over time in urban China, consistent with the findings in Maurer-Fazio *et al.* (2011) and Liu (2012). For mothers with non-twin births, the average number of children had decreased from 1.30 in 1990 to 1.17 in 2000, and this can be interpreted as a consequence of the well-implemented "One–Child Policy" in urban areas.[2]

3 Empirical Methodology

To explore the causal link between fertility and female labor force participation, following Agüero and Marks (2008), we employ the following linear model

[2]The census data shows that in 2000 one-child households accounted for about 80% of all households in urban China, while this figure was only 55% in 1990.

where the dependent binary variable LFP_i is equal to one if a woman is in the labor force, and zero otherwise. Besides, the endogenous explanatory variable $Children$ is the number of children in each household.

$$LFP_i = c_1 + \alpha Children_i + \gamma' X_i + u_i \tag{1}$$

$$Children_i = c_2 + \beta Twins_i + \delta' X_i + v_i \tag{2}$$

The parameter α indicates the marginal effect of having one more child on women's labor force participation. Z_i is a vector of control variables including mother's age, years of schooling, ethnicity dummy, elder co-residents dummy, young children dummy, husband's schooling and occupation, and province fixed effects. c_1 and c_2 are constants. u_i and v_i represent error terms.

A wife's education and her husband' education are used as exogenous controls as most people in China usually complete their formal education before giving birth to children. The data does not have the information on husbands' income, which is highly likely to affect marred women's participation decisions. We use husbands' schooling and occupation information as the proxy for husbands' income instead. We also control for the presence of elder co-residents because Maurer-Fazio *et al* (2011) have shown that it affects women's decision of participating in the labor force. While the birth of twins is random, the inclusion of these additional controls in the regressions can increase the precision of our estimates (Angrist and Pischke, 2009).

The ordinary least squares (OLS) estimation of equation (1) will bias the coefficient estimate of α beacuse of the endogeneity of fertility resulting from unobserved heterogeneity and reverse causality. We exploit a binary variable $Twins_i$ as the instrumental variable for $Children_i$ in equation (2) (Angrist and Evans, 1998; Jacobsen *et al.*, 1999). Our identification strategy relies on, first, the exogenous variation of family size that a twins shock generates; second, the

exclusion restriction that having twins is most unlikely to be associated with female labor force participation decisions directly (namely, only through the channel of family size); and last, the validity of monotonicity assumption where in this case the effect of twin births on the number of children in a family is always positive.

The IV regressions estimate the local average treatment effect of fertility on female labor force participation for *compliers*, a subgroup of mothers whose number of children would otherwise be induced to vary with the values of the instrument $Twins_i$ (Imbens and Angrist, 1994). In our case, the *compliers* consist of the mothers with one child and the mothers who would have only one child had they not given birth to twins. As our central interest is to examine the potential impact of relaxing the "One–Child Policy" on the labor force participation of mothers with one child, the *compliers* actually constitute the group of women we care about most.

4 Results

Table 2 shows the ordinary least squares (OLS) regression results. In urban China, having one more child significantly reduces the female labor force participation by 6.7 and 8.5 percentage points in 1999 and 2000 respectively. This is consistent with the well-established negative correlation between fertility and mother's work in the existing literature for both developed countries (Angrist and Evans, 1998; Jacobsen *et al.*, 1999) and developing economies (Cruces and Galiani, 2007; Agüero and Marks, 2008). However, one should interpret the negative effect with caution as ignoring the endogeneity of fertility in women's work decisions is likely to bias such estimates.

We report the instrumental variable (IV) regression results in Table 3. The presence of twin births is used as the instrumental variable for the number of

Table 2: OLS Estimation Results

	1990	2000
Number of children	–0.067***	–0.085***
	(0.002)	(0.008)
Age	0.068***	0.045***
	(0.002)	(0.009)
Age squared/100	–0.093***	–0.063***
	(0.003)	(0.012)
Schooling	0.015***	0.033***
	(0.000)	(0.001)
Husband Schooling	0.003***	0.005***
	(0.000)	(0.001)
Ethnic minority	–0.018***	0.000
	(0.003)	(0.011)
Having elder co-residents (age≥65)	0.005**	0.021**
	(0.002)	(0.011)
Having young children (age≤6)	–0.016***	–0.026***
	0.002	0.008
Husband occupation	Yes	Yes
Province fixed effects	Yes	Yes
R-squared	0.012	0.011
Observations	187,834	25,020

Note: *** $p<0.01$, ** $p<0.05$, *$p<0.1$. The dependent variable is women's labor force participation. Standard errors correcting for heteroscedasticity of unknown forms are reported in parentheses.

children in a family. The first stage results show that for both 1990 and 2000 the instrument $Twins$ is significantly correlated with the number of children a woman has. The F-statistics on the excluded instrument in the first stage regressions for both years far exceed the Staiger and Stock (1997) rule-of-thumb threshold of 10. This indicates that the instrument is not weak and has sufficient power in our specifications, which is further confirmed by the Kleibergen and Paap (2006) test results.

The second stage regressions show that the coefficients of *Number of children* are close to zero and statistically insignificant for both 1990 and 2000, suggesting that the OLS parameters might be overestimated, hence there is actually no evidence of a significant causal impact of fertility on female labor force participation in urban China. Our results herein are consistent with the findings for

Table 3: Instrumental Variable Estimation Results

	1990		2000	
	1st stage	2nd stage	1st stage	2nd stage
Number of children		–0.009		–0.004
		(0.016)		(0.058)
Twins	0.728***		0.774***	
	(0.010)		(0.028)	
Age	0.084***	0.064***	0.041***	0.042***
	(0.004)	(0.003)	(0.009)	(0.009)
Age squared/100	–0.045***	–0.090***	–0.021*	–0.061***
	(0.005)	(0.003)	(0.011)	(0.012)
Schooling	–0.024***	0.016***	–0.026***	0.035***
	(0.000)	(0.000)	(0.001)	(0.002)
Husband Schooling	–0.004***	0.004***	–0.004***	0.005***
	(0.000)	(0.000)	(0.001)	(0.001)
Ethnic minority	0.150***	–0.027***	0.138***	–0.011
	(0.005)	(0.004)	(0.010)	(0.014)
Having elder co-residents (age≥65)	0.059***	0.002	0.030**	0.019*
	(0.004)	(0.003)	(0.010)	(0.011)
Having young children (age≤6)	0.232***	–0.029***	0.137***	–0.037***
	(0.003)	(0.004)	(0.007)	(0.011)
Husband occupation	Yes	Yes	Yes	Yes
Province fixed effects	Yes	Yes	Yes	Yes
F-statistic on the instrument	2556.45	—	790.55	—
Kleibergen-Paap Wald statistic	750.55	—	4483.91	—
Observations	187,834		25,020	

Note: *** $p<0.01$, ** $p<0.05$, *$p<0.1$. The dependent variable for the first–stage estimations is the number of children. The dependent variable for the second–stage regressions is women's labor force participation. Standard errors correcting for heteroscedasticity of unknown forms are reported in parentheses.

other developing economies such as Peru, Guatemala, Colombia and Bolivia, as documented in Agüero and Marks (2008).[3]

Linking our findings to China's current fertility control policies, we argue that the potential influence of bearing a second child on female labor force participation would be insignificant if the "One–Child Policy" was relaxed. Given the trivial and insignificant causal effects in Table 3 and the extremity of having

[3]Cruces and Gliani (2007) find that women in Argentina and Mexico are less likely to participate in the labor force when they have more children. These different findings amongst developing countries may be explained by heterogeneous traditions and fertility policies, which are not of our central interest.

two children simultaneously, the actual impact of a second child on mother's work decision could be negligible. Unlike a mother with twin children who is more likely to quit the labor market as more time is needed for childcare, a women gives a non-twin birth may smooth the second-child shock by rationally lengthening the birth spacing. Thus, our IV estimates actually constitute the upper bound of the effect of fertility on female labor force participation, which strengthens our conclusions. Intuitively, the negative correlation between fertility and mother's LFP in urban China, as indicated by the OLS estimates, can be misleading.

A battery of sensitivity tests shows our findings are robust. First, we use Probit and IV–Probit to redo the estimation. Second, we further restrict mother's age to 40 or younger to rule out the possibility that some adult children may have moved out of the household before the time of surveys. The main results from these sensitivity analysis resemble those reported in Table 3. These results are available upon request.

5 Conclusion

This paper investigates the relationship between fertility and female labor force participation in urban China. By exploiting twin births as the source of exogenous variation in the number of children, our IV estimates show no evidence that having one more child constitutes a barrier to women's job participation, implying that the relaxation of the "One–Child Policy" will not significantly reduce the female labor force participation in urban China.

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