Fertility and Female Labour Force Participation: Causal Evidence from Urban China

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Abstract

Using population census data, this paper examines the causal effect of a second child on married women's labour force participation in urban China. To ameliorate the endogeneity of fertility, we exploiting twin births as the source of variation in fertility. While the ordinary least squares estimates indicate that having one more child significantly reduces female labour force participation by around 6 and 9 percentage points in 1990 and 2000 respectively, our causal analyses suggest very small negative effect in 1990 (around 2 percentage points) and insignificant effect in 2000.

JEL classification: J13; J21

Keywords: Female labour force participation, Fertility, One-Child Policy

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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. It is believed that one of the Chinese panaceas 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 China's great achievement is admirable, China is recently facing an unprecedented challenge of population ageing. A shrinking young cohort due to tight fertility control post 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 leads to the current ageing 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 labourers leads to potential labour shortages and growing pressure on China's sustainable development. On December 28th of 2013, the Standing Committee of the National People's Congress of China passed a resolution on relaxing the One-Child Policy and allowing couples to have a second baby if either parent is an only child. A key policy concern is that whether more children discourages female labour force participation.

Though the question is important, the answer is not yet clear-cut as the relationship between the number of children and mother's work is confounded 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 labour force participation (Agüero and Marks, 2008). In addition, the effect running from female labour force participation to fertility decisions indicates the presence of reverse causality (Mishra and Smyth, 2010).

This paper contributes to the debate on whether there is a causal link between female labour supply and fertility (Bronars and Grogger, 1994; Angrist and Evans, 1998; Jacob-

[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).

sen *et al.*, 1999; Chun and Oh, 2002; Cruces and Galiani, 2007; Agüero and Marks, 2008; Caceres-Delpiano, 2009), and also complements to the recent studies examining the determinants of female participation in the labour force in China (Maurer-Fazio *et al.*, 2011; Liu, 2012). Exploiting twin births as the source of exogenous variation in family size, we investigate the causal effect of having a second child on female labour force participation in urban China. While the ordinary least squares estimates indicate that having one more child reduces female labour force participation by 6 and 9 percentage points in 1990 and 2000 respectively, our causal analyses suggest very small negative effect in 1990 (around 2 percentage points) and insignificant effect in 2000.

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 by the same mother.

To facilitate the analysis, we apply a few sample restrictions. First, we only focus on women in urban China as female labour force participation in rural areas can be quite different (Barrett *et al.*, 1991). Second, only married mothers aged between 20 and 50, whose co-residency children are 17 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 labour force participation.

[2]A second child is legally allowed in some cases (Short and Zhai, 1998 and Liu, 2014). For example,

Table 1: Summary statistics for married women in urban China

	1990			2000		
	One child	Two children		One child	Two children	
		Twins	Non-twins		Twins	Non-twins
Labour force participation	0.93	0.89	0.82	0.81	0.77	0.67
	(0.26)	(0.31)	(0.38)	(0.39)	(0.42)	(0.47)
Age	34.50	34.93	38.58	35.26	35.66	37.22
	(6.62)	(7.01)	(5.01)	(5.82)	(5.79)	(4.61)
Age at first birth	25.44	25.38	24.50	25.41	25.43	23.84
	(3.04)	(3.14)	(3.08)	(3.04)	(3.16)	(3.16)
Schooling	7.41	7.14	5.90	11.08	10.69	9.49
	(3.17)	(3.19)	(3.35)	(2.69)	(2.76)	(2.93)
Husband schooling	7.47	7.03	6.47	10.76	10.38	9.28
	(4.18)	(4.32)	(4.31)	(4.22)	(4.59)	(4.24)
Ethnic minority	0.04	0.05	0.09	0.05	0.05	0.12
	(0.20)	(0.21)	(0.28)	(0.23)	(0.21)	(0.32)
First-born child aged 0–8	0.59	0.55	0.15	0.39	0.33	0.09
	(0.49)	(0.50)	(0.35)	(0.49)	(0.47)	(0.28)
Observations	234,508	1,652	58,840	30,325	240	3,283

Note: Standard deviations are reported in parenthesis.

A mother is considered as a labour force participant if she is either employed or is actively looking for a job. Those who are not employed and no longer actively searching for work are considered to be out of labour force. Table 1 displays the summary statistics. Female labour 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). The statistics also show that mothers giving birth to singletons and mothers giving birth to twins have similar individual characteristics in both 1990 and 2000.

3 Empirical strategies

We use two identification strategies to explore the causal link between fertility and female labour force participation in China.

when a couple are both the only child in their families, they are allowed to have a second child. Another case is that rural couples in some provinces can have a second child if the first child is a girl. Moreover, the One-Child Policy does not apply to ethnic minorities. For couples who are not legally allowed to have more than one child but are willing to pay fines, having a second child is still possible in some areas.

3.1 IV approach

The first strategy employed is an instrumental variable (IV) approach. Following existing studies such as Agüero and Marks (2008), we use the following linear specification

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

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

where the dependent variable LFP_i is equal to one if a woman is in the labour force, and zero otherwise. The endogenous explanatory variable $Children$ is the number of children in each household (either one or two). The parameter α indicates the effect of having one more child on women's labour force participation. X_i is a vector of control variables including mother's age, age squared, mother's years of schooling, ethnicity dummy, husband's years of schooling and their occupation dummies as well as province fixed effects. c_1 and c_2 are constants. u_i and v_i denote error terms.

Wife's education and her husband's education are used as exogenous controls in our estimation as most people in China usually complete their formal education before giving birth to children. The data do not have the information on husbands' income, which is highly likely to affect marred women's participation decisions. We use husbands's years of schooling and occupation information (seven occupation dummies) as the proxy variables for husband's income. The inclusion of these controls in the regressions can also increase the precision of our estimates.

The ordinary least squares (OLS) estimation of equation (1) will inconsistently estimate the coefficient of α because of the endogeneity of fertility decisions resulting from unobserved heterogeneity and reverse causality. We exploit a binary variable $Twins_i$, which is equal to one if a woman is a mother of twins and zero otherwise, as the instrumental variable for $Children_i$ in equation (2) (Angrist and Evans, 1998; Jacobsen *et al.*, 1999). The IV estimate of α can consistently measure the effect of an additional child on women's labour

[3]The Chinese Population Censuses 1990 and 2000 do not have information about hours worked, part-time or full-time employment.

force participation. This identification strategy relies on, first, the exogenous variation of family size that a twins shock generates; second, the exclusion restriction that having twins is not associated with female labour force participation decisions unless through the channel of family size; and last, the monotonicity assumption that the effect of twin births on the number of children in a family is always positive.

3.2 Sub-sample OLS estimation

Our second identification strategy employs ordinary least squares (OLS) estimation but using a sub-sample of our data. Same as Equation (1), the model is specified as

$$LFP_i = c_1 + \alpha Children_i + \gamma' X_i + u_i \tag{3}$$

We conduct the estimation using the sample composed of (i) women with one child only and (ii) women with twins. We exclude from the estimation women with two children who are not twins. The final sub-samples utilised consist of 236,160 women (234,508 mothers with one child and 1,652 mothers with twins) in 1990 and 30,565 women (30,325 mothers with one child and 240 mothers with twins) in 2000.

In this model, no instrument is needed as the variation in the number of children only comes from having twins, which can be considered as exogenous. This approach will estimate the effect of moving from one to two children, a very relevant estimate that can be applied to many Chinese women now that the One-Child Policy has been relaxed since December 2013.

3.3 Possible threat to identification

The identification strategies described in Sections 3.1 and 3.2 rely on the randomisation nature of twin births. Many existing studies have utilised multiple births as the source of exogenous variation in family size to examine the effect of fertility on mothers' labour market outcomes (Bronars and Grogger, 1994; Angrist and Evans, 1998; Jacobsen *et al.*,

[4]We thank one anonymous referee for this suggestion.

[5]This excluded group consists of women who are non-compliers with the One-Child Policy.

1999; Caceres-Delpiano, 2009). Other studies have investigated the quality-quantity trade-off among children (Li *et al.*, 2008; Liu, 2014) and the effects of child-bearing on women's marital status (Jacobsen *et al.*, 2001). This study has followed the aforementioned studies in exploiting multiple births as the source of variation in family size.

Although widely used in the existing literature, twin births may not be completely random. For example, multiple births are common among mothers undergoing fertility treatments. As twining is allowed under the One-Child Policy, some families may have used fertility treatments in a deliberate attempt to bear more babies, and at the same time, to get around the One-Child policy. Without sufficient information in the data, we cannot rule out this possibility. If some mothers of twins have chosen to use fertility treatments, they can be different in unobservables from mothers of singletons. For example, women who take fertility drugs usually have the preference to larger families and less attachment to labour force. In this case, we may overestimate the magnitude of the potential negative impact of fertility on women's labour force participation, using the identification strategies described in Sections 3.1 and 3.2.

4 Results

Table 2 shows the ordinary least squares (OLS) regression results. Without using any controls, women having two children are respectively 10.8 and 13.4 percentage points less likely to be in the labour force than those with one child in 1990 and 2000. The inclusion of control variables in the estimation reduces the magnitudes of the associations between fertility and female labour force participation to 5.9 and 9.3 percentage points in 1990 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

[6]Interested readers are referred to the following BBC news (13 February 2006): "Fertility drug use booms in China" (http://news.bbc.co.uk/2/hi/asia-pacific/4708432.stm).

[7]There are other concerns related to the use of multiple births as an instrument for fertility. First, the birth weights of twins are generally lower than their singleton counterparts, suggesting that twins have higher risks of infant mortality. This could have a direct effect on labor participation decisions. Second, due to lower birth weights, twins are more likely to suffer from long-term health conditions if they survive. Mothers might react to the poorer health of twins by being less attached to the labor market and spending more time with the children.

(Angrist and Evans, 1998; Jacobsen *et al.*, 1999) and developing economies (Cruces and Galiani, 2007; Agüero and Marks, 2008). However, one should interpret this correlation with caution as ignoring the endogeneity of fertility in women's work decisions is likely to result in inconsistent estimates.

Table 2: OLS estimation results

	1990		2000	
	No control	With controls	No control	With controls
Second child	–0.108***	–0.059***	–0.134***	–0.093***
	(0.004)	(0.007)	(0.014)	(0.010)
Age		0.069***		0.070***
		(0.005)		(0.005)
Age squared/100		–0.101***		–0.098***
		(0.008)		(0.007)
Schooling		0.019***		0.034***
		(0.002)		(0.002)
Husband Schooling		0.005***		0.001
		(0.001)		(0.001)
Ethnic minority		–0.024*		0.001
		(0.013)		(0.009)
Husband occupation dummies	No	Yes	No	Yes
Province fixed effects	No	Yes	No	Yes
R-squared	0.02	0.17	0.01	0.12
Observations	295,000	295,000	33,848	33,848

Note: *** $p<0.01$, ** $p<0.05$, * $p<0.1$. Standard errors clustered at province level are reported in parentheses.

We report the first-stage results of instrumental variable (IV) regressions in Table 3. The presence of twin births is used as the instrumental variable for the number of children (either 1 or 2) in a family. The first-stage results all show that the instrument $Twins$ is significantly correlated with the number of children a woman has in both 1990 and 2000. The F-statistics on the excluded instrument in the first stage regressions 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.

The second-stage results of IV regressions reported in Table 4 show that having two children has a very small but statistically significant effect on female labour force participation in 1990. More specifically, having two children will lead to a decrease of female participation rate by around two percentage points. We do not find evidence that female

Table 3: First-stage results of IV estimation

	1990		2000	
	No control	With controls	No control	With controls
Twins	0.720***	0.717***	0.874***	0.859***
	(0.019)	(0.018)	(0.018)	(0.019)
Age		0.100***		0.066***
		(0.011)		(0.008)
Age squared/100		–0.120***		–0.085***
		(0.015)		(0.012)
Schooling		–0.016***		–0.015***
		(0.001)		(0.002)
Husband Schooling		–0.004***		–0.005***
		(0.001)		(0.001)
Ethnic minority		–0.140***		0.097***
		(0.027)		(0.030)
Husband occupation	No	Yes	No	Yes
Province fixed effects	No	Yes	No	Yes
F-statistic on the excluded instrument	1,400.13	1,565.11	2,249.92	1,963.79
Observations	295,000	295,000	33,848	33,848

Note: *** $p<0.01$, ** $p<0.05$, * $p<0.1$. Standard errors clustered at province level are reported in parentheses.

participation rate is causally affected by having a second child in 2000. One possible reason for the insignificant effect in 2000 is that the much smaller sample size in 2000 produces estimates with less precision, although the IV estimates share similar magnitude in 1990 and 2000. To sum up, we find that having two children in China is unlikely to substantially reduce the female labour force participation rate in urban China. Clearly, the OLS estimates overstate the impact of fertility on labour force participation of women in urban China.

Table 4 also reports the sub-sample OLS estimates when this alternative identification strategy is used. We include women with one child and women with two children who are twins in the estimation. Women with two children who are not twins are excluded. In the context of the One-Child policy, this identification comes from the fact that among this sub-sample of women who comply with the policy, one can have more than one child only if she has twins at first birth, which is largely random with respect to labour force

[8]Existing studies find much larger effects. For example, Angrist and Evans (1998) find that an additional child reduces the probability of female labour force participation by 8.7 percentage points in the US, while Chun and Oh (2002) find the effect to be –27.5 percentage points in South Korea.

Table 4: IV and sub-sample OLS estimation results

Panel A: IV (second-stage)	1990		2000	
	No control	With controls	No control	With controls
Second child	–0.053***	–0.022**	–0.041	–0.025
	(0.015)	(0.011)	(0.025)	(0.025)
Age		0.065***		0.066***
		(0.005)		(0.005)
Age squared/100		–0.097***		–0.092***
		(0.007)		(0.007)
Schooling		0.020***		0.035***
		(0.002)		(0.002)
Husband Schooling		0.005***		0.002*
		(0.001)		(0.001)
Ethnic minority		–0.029**		–0.006
		(0.013)		(0.010)
Husband occupation	No	Yes	No	Yes
Province fixed effects	No	Yes	No	Yes
R-squared	0.02	0.17	0.01	0.15
Observations	295,000	295,000	33,848	33,848
Panel B: Sub-sample OLS	1990		2000	
	No control	With controls	No control	With controls
Second child	–0.038***	–0.021**	–0.040	–0.027
	(0.011)	(0.009)	(0.025)	(0.024)
Age		0.067***		0.073***
		(0.005)		(0.005)
Age squared/100		–0.101***		–0.010***
		(0.008)		(0.007)
Schooling		0.017***		0.034***
		(0.002)		(0.003)
Husband Schooling		0.004***		0.001
		(0.002)		(0.001)
Ethnic minority		–0.027**		–0.004
		(0.011)		(0.011)
Husband occupation	No	Yes	No	Yes
Province fixed effects	No	Yes	No	Yes
R-squared	0.0001	0.16	0.0001	0.11
Observations	236,160	236,160	30,565	30,565

Note: *** $p<0.01$, ** $p<0.05$, * $p<0.1$. Standard errors clustered at province level are reported in parentheses.

participation. Applying OLS estimation to this sub-sample, the effect estimated can be interpreted as the causal effect of moving from one to two children if twin births are random. Results reported in Table 4 are very similar to those obtained using IV estimation, in terms of both magnitude and precision.

One particular pattern of results reported in Table 4 deserves special attention. If twin births are completely random, controlling for and not controlling for covariates should produce point estimates of virtually identical magnitude. However, the estimated coefficients of second child reported in Table 4 are larger when not controlling for covariates than when controlling for covariates, indicating twin births are not a completely random event. Some twin births may be from mothers undergoing fertility treatments and the selection into fertility treatments is not random. As women who take fertility drugs usually prefer larger families and less attachment to labour force, results reported in Table 4 may have overstated the magnitude of the negative estimates, which further strengthens our conclusion that having a second child can hardly constitutes a great barrier to women's labour force participation in urban China.

The above analyses consider the effect of a second children aged 0–17 on mothers' labour force participation. A natural question to ask is whether children belonging to different age groups have differential effects on mothers' participation in the workforce. For example, mothers of younger children may need to provide more childcare and other non-market services; consequently, they can be more likely to drop out of the labour force entirely. In contrast, school-aged children may not affect their mother's current labour force participation as much since they need less care than younger children do.

Table 5 shows the estimation results for two groups of mothers defined by the age of their first born children (0–8 and 9–17). We pay particular attention to the IV and subsample OLS estimates, after controlling for observed characteristics. We find that in the 1990 sample, having an additional child aged 8 or below will lead to a decrease of women's labour force participation rate by about 2.5–2.7 percentage points. However, school aged children are not found to significantly affect mothers' labour force participation. The IV and subs-ample OLS estimates in 2000 are all statistically insignificant. Thus we find no

Table 5: Estimation results by the age group of first-born child

	1990		2000	
	0≤child age≤8	9≤child age≤17	0≤child age≤8	9≤child age≤17
OLS	–0.135***	–0.052***	–0.075***	–0.101***
	(0.012)	(0.007)	(0.027)	(0.01)
Observations	147,200	147,800	12,120	21,728
IV	–0.025*	–0.019	–0.079	0.006
	(0.014)	(0.025)	(0.055)	(0.039)
Observations	147,200	147,800	12,120	21,728
Sub-sample	–0.027*	–0.011	–0.079	–0.004
OLS	(0.014)	(0.014)	(0.054)	(0.034)
Observations	138,570	97,590	11,830	18,735

Note: *** $p<0.01$, ** $p<0.05$, * $p<0.1$. Control variables include mother's age, age squared, mother's years of schooling, ethnicity dummy, husband's years of schooling, husband's occupation and province dummies. Standard errors clustered at province level are reported in parenthesis.

evidence that a second child will not affect women's work decisions in 2000, regardless of child age.

Linking our findings to China's fertility control policies, we argue that the potential negative influence of bearing a second child on female labour force participation would be either insignificant or very small after the recent relaxation of the One-Child Policy. Given the small or insignificant effects reported in Tables 3, 4 and 5 and the extremity of having 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 labour market as more time is needed for childcare, a women giving a non-twin birth may smooth the second-child shock by rationally lengthening the birth spacing. Thus, our estimates actually constitute the upper bound of the effect of fertility on female labour force participation, which strengthens the main conclusion of this study.

5 Conclusion

This paper investigates the relationship between fertility and female labour force participation in urban China. By exploiting twin births as the source of exogenous variation in the number of children, our analyses show that having a second child can hardly constitutes a great barrier to women's job participation, implying that the relaxation of the

One-Child Policy is unlikely to affect substantially the female labour force participation in urban China.

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