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An instrumental variable estimate of the effect of fertility on the labour force participation of married women

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This study estimates the effect of fertility on the labour force participation of married women in Korea. Since Korean households prefer sons to daughters, there is exogenous variation in the number of children among households, depending on their first child's sex. Using this exogenous variation as an instrumental variable for fertility, it is found that having children reduces the labour force participation of married Korean women by 27.5%.

I. INTRODUCTION

The labour force participation (LFP) of married women in Korea has increased sharply since the 1980s. From a rate of 35.6% in 1980, married women's participation in the labour market grew to 47.0% by 1992. Corresponding to an increase in women's LFP, the total fertility rate in Korea declined to below replacement levels. In spite of this drastic time series evidence, there have been few household-level studies on the relationship between fertility and married women's LFP in Korea.

In exploring the relationship between fertility and married women's LFP, an endogeneity problem must be accounted for between these two decisions made by married women (Nakamura and Nakamura, 1992). Many researchers suggest the instrumental variable (IV) method as a solution to this problem.[1] However, it is difficult to find a good IV that is correlated with fertility and simultaneously exogenous to the labour supply decision. This study applies the IV method of sibling sex-composition suggested by Angrist and Evans (1998).

Angrist and Evans (1998) tried to solve the endogeneity problem of child status using the sex composition of children as an IV. Since parents of same-sex siblings are more likely to have an additional child, a dummy variable for whether the sex of the second child matches the sex of the first child becomes a good IV for further childbearing among women with at least two children. However, their method is based only on the preference of American parents for balancing the sex composition of their offspring.

While US households prefer balancing the sex composition of their children, Korean households have a different preference that is known as son preference.[2] Korean households prefer sons to daughters, especially until they have at least one son. If the first child of a Korean couple is a daughter, they will try to have one more child. Therefore, we expect that the first child's sex would be a good IV for fertility in Korea.

Son preference in Korea originates from the differences in labour market performance between males and females. Although young boys impose relatively higher rearing costs, they are still preferred to girls because of greater expected support in old age (Ahn, 1995). In Korean households, old-age support from mature sons is the most influential factor in parental decisions to have sons.

[1] For example, Rosenzweig and Wolpin (1980) suggest using the exogenous variation in the number of children born that is afforded by multiple births (twins). Some families receive an unanticipated child, and therefore, the treatment and control groups are randomly selected with respect to characteristics that may be related to market participation. However, the obvious weak point of this method is the rarity of multiple births. In their sample of 12 605 observations, only 87 were women whose first parity resulted in twins.

[2] See Park and Cho (1995) for Korea, Arnold and Zhaoxiang (1986) for China, and Das (1987) for India.

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Table 1. *Sample means and test of mean differences (married women aged 20–39)*

Variables	Whole sample mean (μ)	Mean difference ($\mu_m - \mu$)
Age	31.42	0.201[c]
		(0.114)
Years of education	12.00	−0.055
		(0.059)
Husband's earnings	19.31	0.124
		(0.191)
Lives in Seoul	0.286	−0.002
		(0.012)
Lives in big city	0.517	−0.002
		(0.013)
Lives in urban area	0.864	−0.004
		(0.009)
Lives with parents	0.095	−0.001
		(0.008)
Consumption	12.17	0.191
		(0.223)
Education cost for children	1.097	0.021
		(0.041)
Number of children	1.676	−0.062[a]
		(0.015)
Sample size	3997	2117

Notes: Mean differences are defined as the sample means of households having a son as the first child (μ_m) minus the sample means of all households (μ). Numbers in parentheses are standard errors.
[a]: Significant at 1% level. [b]: Significant at 5% level. [c]: Significant at 10% level.

II. DATA

The data used in this study are from the 1996 wave of the Korean National Survey of Family Income and Expenditure (NSFIE). The National Statistical Office in Korea conducts this survey every five years. The NSFIE was originally designed to analyse the pattern of household income and expenditures. It also has rich demographic variables, such as information on age and years of education for both the head of the household and their spouse, as well as the age and sex of each of their children.

To construct an IV, the sex of the first child needs to be identified. Therefore, the sample is restricted to households with at least one child. Since this survey does not identify the source of income for a self-employed household head, households whose heads are self-employed are excluded. After imposing these restrictions and omitting households with missing relevant information, 3997 sample households were obtained.

Table 1 examines whether the sex of the first child is randomly assigned. The mean for the sub-sample of households having a son as their first child (μ_m) is not significantly different from that of the total sample of households (μ). For all characteristics except the number of children, the hypothesis of the same mean cannot be rejected at the 5% significance level. For example, although the mean differences ($\mu_m - \mu$) for years of education and husband's earnings are −0.055 and 0.124, respectively, they are not significantly different at the 5% level.

Table 1, however, shows that the number of children in a Korean family is strongly related to the first child's sex. The mean difference in the number of children is −0.062 and is significant at the 1% level. This result indicates that if Koreans have a son as their first child, they are less likely to have additional children. Finally, Table 1 reports that consumption and education costs for children do not differ based on the first child's sex. Based on this result, it is argued that the so-called 'hand-me-down effect' does not exist in the sample.[3]

III. RESULTS

Following Angrist (1990) and Angrist and Evans (1998), the Wald type IV estimate is calculated using the grouping method. This IV estimate shows that the LFP rate difference between the two groups of households, differentiated by the sex of their first child, can be explained by the fertility difference between the two groups. Therefore, the Wald type IV estimate is defined as:

$$\beta_{\text{Wald}} = \frac{\overline{y}_m - \overline{y}_f}{\overline{x}_m - \overline{x}_f} \tag{1}$$

where $\overline{y}_m(\overline{y}_f)$ is the mean of the LFP rate of married women having a son (daughter) as the first child, and $\overline{x}_m(\overline{x}_f)$ is similarly defined for the number of children. The Wald-type IV estimate is −0.391 for households having at least one child.

A two-stage probit regression is used to control for the endogeneity of the number of children as well as other economic and demographic characteristics in a married woman's LFP decision. The first-stage fertility regression uses ordinary least squares to predict the number of children as a function of the sex of the first child and explanatory variables from the second-stage LFP equation. The fertility equation is,

$$x_i = Z_i\gamma + m_i\delta + u_i \tag{2}$$

where Z_i is a vector of demographic and economic variables, and m_i is an indicator variable, which equals 1 if the first child is a son and is zero otherwise. The LFP equation is expressed as,

[3] Rosenzweig and Wolpin (1998) raise a possible endogeneity problem in the children's sex composition IV approach suggested by Angrist and Evans (1998). They argue that the cost of children depends on sex composition, and show that there is strong evidence for a hand-me-down effect. If households with children of the same sex spend less money than do households with children of different sexes, this difference in consumption may affect the labour supply of married women. If this difference is large enough to change the labour supply of married women, the children's sex composition IV is no longer exogenous.

Table 2. *Estimation results*

	Households with at least one child			Households with two or more children		
	(1) Probit	(2) Two-stage probit		(3) Probit	(4) Two-stage probit	
Independent variables	LFP	Fertility	LFP	LFP	Fertility	LFP
Constant	−2.551[a]	0.710[a]	−2.086[a]	−2.677[a]	2.098[a]	−0.766
	(0.219)	(0.088)	(0.281)	(0.339)	(0.073)	(0.806)
Age	0.087[a]	0.046[a]	0.120[a]	0.097[a]	0.010[a]	0.106[a]
	(0.006)	(0.002)	(0.014)	(0.008)	(0.002)	(0.009)
Years of education	0.013	−0.041[a]	−0.016	−0.006	−0.019[a]	−0.023[c]
	(0.010)	(0.004)	(0.015)	(0.013)	(0.003)	(0.014)
Husband's earnings	−0.025[a]	0.009[a]	−0.019[a]	−0.024[a]	0.001	−0.022[a]
	(0.003)	(0.001)	(0.004)	(0.004)	(0.001)	(0.004)
Lives in Seoul	0.022	−0.039	−0.005	−0.129	−0.001	−0.130
	(0.069)	(0.028)	(0.070)	(0.093)	(0.023)	(0.093)
Lives in big city	−0.049	−0.067[a]	−0.096[c]	−0.054	−0.041[a]	−0.092[c]
	(0.049)	(0.020)	(0.053)	(0.062)	(0.015)	(0.063)
Lives in urban area	−0.034	−0.058[b]	−0.075	−0.029	0.048[b]	−0.075
	(0.067)	(0.028)	(0.070)	(0.084)	(0.021)	(0.086)
Lives with parents	0.412[a]	0.070[b]	0.462[a]	0.437	0.046[b]	0.485[a]
	(0.067)	(0.029)	(0.070)	(0.083)	(0.021)	(0.085)
Number of Children	−0.166[a]		−0.884[a]	−0.168[b]		−1.110[a]
	(0.038)		(0.275)	(0.076)		(0.368)
	[−0.057]		[−0.275]	[−0.057]		[−0.377]
First child's sex		−0.154[a]			−0.145[a]	
(1 = male; 0 = female)		(0.017)			(0.013)	
R^2/Log-likelihood	−2392.3	0.183	−2396.8	−1491.1	0.082	−1489.0
Sample size	3997	3997	3997	2495	2495	2495

Notes: The dependent variable in the labour force participation (LFP) equation is the dummy variable for the employment status of married women. The dependent variable in the fertility equation is the number of children. Numbers in parentheses are standard errors. Numbers in brackets are the marginal effects of having an additional child on the probability of a married woman's LFP.
[a]: Significant at 1% level. [b]: Significant at 5% level. [c]: Significant at 10% level.

$$y_i = Z_i\alpha + \hat{x}_i\beta + \varepsilon_i \tag{3}$$

where y_i is a dummy variable for the LFP of married women, which equals 1 if a woman is in the labour market and is zero otherwise, and $\hat{x}_i$ is the predicted number of children from the first-stage regression. Since the fertility equation includes an additional exogenous variable, m_i, this two-equation system is exactly identified.

In column (1) of Table 2, the probit estimate of the fertility effect on the LFP of married women is only −0.166. This estimate implies that an additional child can reduce the probability of LFP of married women by 5.7%. Our estimate is close to that of Yoon (1997), which is −0.099, based on the 1992 sample of Korean households. The LFP of married women also increases with their age and decreases with their husband's earnings.

The fertility equation estimation result, seen in column (2) of Table 2, shows that women with a son as the first child are less likely to have additional children. The estimate of the effect of the sex of the first child on future fertility is −0.154 and is significant at the 1% level. Since the focus is on relatively young households, the independent effect of age on fertility is significantly positive. Households living in an urban area with a highly educated wife are less likely to have children. Finally, if a husband has a large income, his wife is more likely to have children.

Column (2) of Table 2 also presents the two-stage probit estimates of the LFP equation for married women. Using the first child's sex IV, the two-stage probit estimate shows that fertility has a large negative effect on the LFP of married women, with a value of −0.884. This estimate implies that an additional child can reduce the probability of a married woman's LFP by 27.5%.[4] Table 2 shows that the IV estimate of the negative effect of fertility on the LFP of married women is much larger than that of the simple probit estimate. Correcting for the endogeneity problem between fertility and LFP, it is found that having children strongly discourages LFP by married Korean women.

In columns (3) and (4) of Table 2, households having two or more children are examined. Since most Korean households have at least two children, the effect of an additional child on the LFP decision of married women who already have at least two children is important. Without controlling for the endogeneity of fertility, the probit estimate in

[4] The two-stage probit estimate using the children's sex composition IV is smaller than the Wald-type IV estimate (−0.391). Compared to the Wald-type estimate, the probit regression controls for demographic and economic characteristics on the LFP of married women.

column (3) for the fertility effect on LFP is small and is very close to the estimates in column (1). The two-stage probit estimate shows that for women with at least two children, having an additional child reduces their LFP by almost 40%. In addition, living with parents has a positive effect on the LFP of married Korean women. Since the family network replaces the function of the child-care market in Korea, the LFP of married women living in an extended family would be higher than that of women living in a nuclear family.

IV. CONCLUSION

This study is the first attempt to estimate the effect of fertility on the LFP of married Korean women. It has been shown that the sex of the first child is a good IV for fertility in Korea. Using the IV method, it was also found that an additional child reduces the probability of LFP of married women by 27.5%. While the focus of this study is on Korean households, the approach may be applicable to other developing countries where son preference exists

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