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ABSTRACT

Data on 2,288 married women from the 2006 China Health and Nutrition Survey are deployed to study how off-farm female employment affects fertility. Such employment reduces a married woman's actual number of children by 0.64, her preferred number by 0.48, and her probability of having more than one child by 54.8 percent. Causality flows in both directions; hence, we use well validated instrumental variables to estimate employment status. China has deep concerns with both female employment and population size. Moreover, female employment is growing quickly. Hence, its implications for fertility must be understood. Ramifications for China's one-child policy are discussed.

JEL Classification Codes: J13, J18, O15

Keywords: Fertility; female labor supply; employment in China; employment and fertility; one-child policy

1. INTRODUCTION

Seminal contributions to the economic theory of the household suggest that fertility and job market behavior are interrelated choices, since both strongly affect household time allocation (Becker 1960, 1965; Mincer 1962; Willis 1973). Recently, Soares and Falcao (2008) developed a theory tracing the global fall in fertility and increase in female labor-force participation over the past century to a single causal process of demographic transition, beginning with reductions in mortality and changes in household production.[1] Both sets of theories support a strong link between female labor force participation and fertility decisions, with causality flowing in both directions. These predictions are confirmed by several empirical studies (see for example, Killingsworth and Heckman, 1986; Angrist and Evans, 1998; Ebenstein, 2007; Kalwij, 2000; Lehr, 2009).

China is a particularly important place to study the relationship between employment and fertility, given its rapid pace of economic development, controversial family planning policies, and enormous population.[2] With 1.34 billion people in 2008, China is the most populous nation

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[1] In the Soares and Falcao (2008) model, increasing adult longevity heightens incentives to invest in human capital, leading to a shift toward women working outside the home and reductions in the gender wage gap. Although this process increases the opportunity cost of time, if female labor force participation is initially low, increasing longevity leads to both greater investments in children (child quality) and increased female labor force participation. Others have suggested several phases of demographic transition, with fertility first increasing and then decreasing as economy-wide productivity grows (see for example Lehr 2009).

[2] Li and Zhang (2007) provide evidence suggesting that low fertility contributed to China’s rapid economic growth since the 1980s.

in the world (National Bureau of Statistics of China, 2009). For more than 30 years, China has sought to control population growth. Initiated in 1979, the "one-child" policy limits most couples to precisely that. Although fertility rates had already begun to decline steeply prior to the initiation of this policy, the one-child policy appears to have substantially reduced fertility rates and population growth (Rosenzweig and Zhang, 2009).

Our study focuses on how female employment affects fertility in rural China, where both female labor force participation and adherence to the strict "one-child" policy are lower than in urban areas. There are several reasons why enforcement of the one-child policy has been particularly difficult in rural China. Children – especially sons – are valued for contributing to farm labor (Schultz and Zeng, 1995) and for providing parents with old-age security (Hussain, 1994), since social security and pension systems in rural China are both recent and limited. The one-child policy is also often linked to the increase in China's unbalanced sex ratio, enabled by ultrasound technology that permits sex-selective abortion[3] If employment reduces fertility, encouraging female off-farm employment could be an alternative tool for limiting population growth in rural China.

Our analysis uses 2006 data from the China Health and Nutrition Survey to assess how female employment affects fertility in rural China. A major challenge in inferring the effect of employment on fertility is the reverse causal flow, noted above. To overcome this endogeneity problem, we employ instrumental variables methods to estimate employment status. To the best of our knowledge, this is the first study to analyze the causal effects of employment on fertility behavior using data from China. For example, Schultz and Zeng (1995) find that female

[3] The sex ratio at birth (boy/girls) increased from 1.056 in 1982 to 1.153 in 2000 (Ebenstein, 2008a).

schooling and availability of health and family planning services significantly and negatively affect fertility in rural China, but they do not analyze female off-farm employment behavior.

We study fertility preferences as well as actual fertility, and find that employment significantly reduces both. Controlling for endogeneity increases the estimated effect of female employment status on fertility in rural China. Our preferred specification indicates that female off-farm employment reduces the actual number of children by 0.64, the preferred number of children by 0.48, and the probability of having more than one child by 54.7 percent. Having a first child who is a son is associated with lower fertility, both actual and preferred.

The rest of the paper is organized as follows. Section 2 provides background information about female employment status and policies affecting fertility in rural China. Data and variables are described in Section 3. Section 4 presents our estimation strategy. Section 5 shows the results. Section 6 summarizes our findings and discusses their policy implications.

2. FEMALE EMPLOYMENT AND FERTILITY IN RURAL CHINA

2.1 The Household Registration System

The Chinese government employs a household registration system policy (*hukou*) to strictly control internal population migration. This system was started in urban China in 1951, and extended to rural areas in 1955 (Liu, 2005). Under the *hukou*, adults are required to register where they are living (much as US residents report their residential addresses for elections or other purposes). This policy prevents citizens from changing their place of residence without legal permission. Movement from a rural to an urban *hukou* is particularly discouraged (Li and Zhang, 2006). However, many rural individuals still prefer an urban *hukou*, since opportunity there is much greater.

Temporary rural migrants[4] to urban areas are subject to substantial discrimination. They receive fewer educational and employment opportunities and health care services, because they lack urban *hukou* status. Indeed, most of these migrants to urban areas retain their rural *hukou* (Wang and Zuo, 1999). The *hukou* system leads to labor force surpluses in rural areas because people can only migrate legally to urban areas with permission from the government. Thus the *hukou* system contributes to segregated labor markets (Wang and Zuo, 1999).

2.2 Female Labor Force Participation in Rural China

The labor market in rural China is underdeveloped (Ashenfelter and Zhang, 2004). Incomes from cultivating land are relatively low, spurring demand for off-farm jobs either in local rural communities or in urban areas. Rural off-farm jobs are limited, however, because the economy of rural areas is underdeveloped (Li et al, 2004). Ho (1994) finds that approximately 25 percent of the work force in rural China is redundant.

Good off-farm jobs for females are often difficult to find, and generally pay less, than those for males (Jacka, 1997; Yao, 1999). In addition, married women frequently assume farm work when their husbands and/or sons are employed off the farm (Huang, 1990; Judd, 1994), since the cramped temporary housing provided to migrant workers in urban areas, and lack of access to public services, make it extremely difficult for migrating rural families to live together, especially when they have children (Wang and Zuo, 1999).

These factors imply that rural Chinese women have difficulty securing off-farm employment. The central question for this paper is if they do get employed, what effect does that have on their actual and preferred fertility? There are three conceivable answers that have

[4] Rural residents cannot register their permanent residency (*hukou*) in the urban areas, but they can have temporary permits to live in the urban areas if they find jobs.

plausible explanations. First, there could be no effect. Child bearing has very significant and pervasive benefits and costs, many of which are non-monetary. Thus, the impact of employment on fertility decisions may be small. Second, working reduces a woman's available time, and children are time intensive. Thus, employed women might choose to have fewer children. Third, a woman's off-farm employment can substantially boost family income. Since children are expensive, employed women may choose to have more children. We now turn to the data to disentangle these three possibilities.

3. DATA AND VARIABLES

3.1 Data

We utilize 2006 data from the China Health and Nutrition Survey (CHNS), which is maintained at the Carolina Population Center of the University of North Carolina at Chapel Hill. The 2006 CHNS includes 11,739 adult and child respondents from a stratified random sample from 9 provinces, which account for 44 percent of the Chinese population. Although not strictly representative of all of China, the data are rich and capture a wide range of China's geographic and socioeconomic diversity. (See the appendix for further discussion.)

Because our study focuses on actual fertility and fertility preferences of married women in rural China, only respondents in rural China who are married, widowed, or divorced, and under age 52 in 2006 are included, resulting in a sample of 2,288 adult female respondents. The CHNS fertility preference questionnaire is not asked of women who were never married, or who are 52 years old (maximum reproductive age) or older. Since the official retirement age for women in China is 55, having to confine our sample to women under 52 years of age nevertheless allows us to analyze virtually all women with the potential to be in the formal off-farm labor force.

3.2 Variables

Two fertility variables are employed. The first measures actual fertility as the number of surviving children of an ever-married female.[5] The second variable measures fertility preference as the number of children that a woman says she would prefer to have. Both fertility variables are count measures. To obtain information on fertility preferences, the CHNS questionnaire asked "if you could choose the number of children to have, how many more children would you want to have?" Thus, the preferred number equals the actual number of children plus the number of additional children that a female would like to have. While it is conceivable that some women may prefer fewer children than they currently have, we believe that the effect of this on fertility is extremely low in rural China for several reasons: challenges in implementing the one-child policy reveal that it suppresses fertility below the preferred level; children remain highly valued for old-age support; and couples without children are often discriminated against in China, because people believe that they have a physical disability (infertility). Hesketh et al (2005) find that 87 percent of married women in China use contraception, and 25 percent of reproductive-age women have at least one abortion. Given the valuable economic role of children (especially

[5] This number equals the total number of children that a woman gives birth to, minus the number of children who have died, if any. If the woman is currently pregnant, this future birth is also counted as part of the cumulative fertility measure, because the current infant mortality rate in China is very low (The Lancet, 2008). Most women in rural China become pregnant soon after their marriage.

sons, but increasingly daughters as well[6]), and the fertility constraints imposed by the state, most women would prefer at least as many children as they have.[7]

We also construct two binary fertility measures. The first is whether the married woman has more than one child, and the second is whether she says she would prefer to have more than one child. These measures allow us to examine whether female employment status affects the probability that people have violated or would like to violate the one-child policy.

This study uses a binary variable of whether the respondent has an off-farm job to measure female employment status. Each respondent is asked “are you presently working?” If the answer is yes, the respondent is further asked “what is your primary occupation?” The off-farm employment variable equals 1 if a woman is presently working and her primary occupation is not farmer, fisherman, or hunter; and equals 0 otherwise. This measure includes both full-time and part-time employment.

Instrumental variables

A central challenge to assessing how off-farm employment affects fertility in rural China is that employment is likely to be endogenous for two reasons: unobservable factors and simultaneity (reverse causality) (Wooldridge, 2002). Factors not observable to researchers or omitted in the estimation, such as employment opportunities, the cost of raising a child, and the income effects of employment, are correlated with female employment status and may also affect

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[6] For example, using longitudinal surveys in Anhui and Guangdong provinces, Li et al (2010) find that daughters’ ability to support their parents has increased, particularly through off-farm labor including temporary migration to urban areas.

[7] In formulating the fertility preference question as it did, it seems clear that the CHNS surveyors felt that the chances of women preferring to have fewer children were remote.

fertility. The number of children a woman has, and intends to have, also affects her employment status. Such reverse causality produces a simultaneity problem. Indeed, the number of children has long been recognized to be an important factor affecting female labor supply in the labor economics literature (Killingworth and Heckman, 1986; Angrist and Evans, 1998; Ebenstein, 2007).

We use two instrumental variables (IV) to help control for these endogeneity concerns. To be effective, the instruments must be correlated with the endogenous variable – off-farm employment – but should not directly affect fertility after controlling for a woman's employment status.

Our first instrumental variable is whether there is a bus stop in the village where the women resides. A bus stop will enable women to work in other villages or towns, thereby boosting off-farm job opportunities for them. Bus stops are particularly important in rural China, since transportation options are limited and people often rely upon public transportation. Since good transportation can enhance economic development, China has been investing substantial amounts in improving transportation infrastructure down to the village level. The setup of bus stops in villages appears to depend on a variety of administrative policies and infrastructural factors (See discussion in the appendix.) Evidence supports our identifying assumption that bus stops in rural China do not affect fertility directly after controlling for female employment status.

The second instrument is the proportion of the work force in the village that is employed in enterprises having at least 20 employees (hereafter called larger enterprises). A larger enterprise is more likely to hire clerks or staff to fulfill administrative responsibilities, and women are often employed for these positions based on their education, preferences, and work experience (Szafran, 1982). The second instrument thus reflects the opportunities for women to be hired within their local communities. To check the robustness of our IV results, we compare estimates using both instruments to those using one instrument at a time.

Data for these two instrumental variables are taken from the CHNS 2006 Community Survey (supplement to the CHNS 2006) and are reported by the community (village) heads or cadres for the entire village.

The estimated average treatment effect will be biased if the subjects who are influenced by the instruments do not represent the overall population (Ebenstein, 2008b). This would occur, for example, if the instruments applied to only a small subset of the sample. But the two instrumental variables used in this study – availability of a bus stop and percent of the work force in large enterprises – likely affect a wide range of the observations in our study sample, not simply a small subset.[8] This will ensure that our estimates are close to the true average treatment effect.

We recognize that if there were a combination of shocks to fertility across villages unrelated to employment, if fertility significantly affected female employment, and if female employment significantly influenced whether a bus stop would be installed or large employers opened, our instruments would be measuring fertility directly not merely employment opportunities. This parlay of required conditions strikes us as unlikely. Moreover, if female employment did boost bus stops or larger enterprises, the posited instrumental variable

[8] In fact, 60.2 percent of unemployed women and 75.9 percent of employed women in our sample have access to a bus stop in their villages, and employees of enterprises with at least 20 employees represented from one-fifth to one-third of the village labor force; see Table 1.

relationship would be overstated. This in turn would reduce the absolute impact of using instrumental variables compared to single-stage estimation.[9]

Other explanatory variables

Our multivariate estimates also control for other explanatory variables that may affect fertility. Household income has been found to positively affect fertility, so we include a measure of total household income.[10] Ethnic minorities in China are often allowed to have more than one child, so we include a binary variable indicating minority status (of the wife and/or husband). Because a strong preference for sons is still apparent in rural China (e.g., Coale and Banister, 1996; Li et al, 2010), we also include a binary variable indicating whether the first child is a son. We expect that women who have already had a son will have or prefer to have fewer children than those who have not.

The socio-demographic factors we adjust for include: age, educational attainment (less than primary school, primary school, lower middle school, upper middle school, technical school, and college), current marital status (married and widowed/divorced), and residence province (Liaoning serves as the reference province). Including the province where the respondent resides further helps to control for unobserved environmental or cultural characteristics that may correlate with female employment and fertility. We also control for

[9] We find below that the IV estimates magnify the negative effect of employment on fertility. Thus, if anything, this negative effect is underestimated in OLS, implying the hypothetical scenario outlined in this paragraph does not apply.

[10] As an additional robustness check, we replaced total household income with household income excluding any female income in the multivariate regressions; the results were very similar to those reported in the text.

smoking and alcohol consumption status. Smoking may lead to infertility (Howe et al, 1985; Bolumar et al, 1996). Alcohol consumption can be seen as an indicator of an individual's addictive traits and responsibility level, which may influence fertility. Alcohol consumption is also often a complement of smoking.

4. ESTIMATION STRATEGY

Our fertility measures are either

F_a = actual number of children, or

F_p = preferred number of children.

Both measures are estimated with the same empirical model, which assumes that fertility is a function of employment and other explanatory variables:

(1) $F_i = \beta_0 + X\beta_1 + E\beta_2 + \varepsilon,$

where

F_i = fertility measure, i = a or p;

X = a vector of other explanatory variables;

E = a binary indicator of whether the woman is employed in an off-farm job;

β_0 - β_2 = coefficients to be estimated; and

ε = the disturbance term.

The key coefficient of interest is β_2, the effect of employment on fertility. The previous literature has employed ordinary least squares (OLS) (Zhang, 1990) and count variable estimation (Poisson) (Schultz, 1988) to estimate equation (1). Given that fertility measures are count variables, Poisson estimation seems more appropriate. However, that correction alone would not address the problem of endogeneity in female employment, which would cause inconsistent estimation of β_2.

Therefore, as discussed above, we employ the IV method to overcome endogeneity bias. A two-stage least squares estimation is implemented, with the following first-stage regression model:

(2) $E = \alpha_0 + X\alpha_1 + IV\alpha_2 + u$,

where

IV	=	Instrumental variables;
$\alpha_0 - \alpha_2$	=	coefficients to be estimated; and
u	=	the disturbance term.

Equation (2) will be estimated by OLS estimation at the first stage in the two-stage least squares model. Traditional two-stage least squares estimation assumes that both the fertility measures and the employment measure are continuous, but in this context obviously they are not. The fertility measure is a count variable while our employment measure is binary, employed or not employed. Therefore, OLS and two-stage least squares may not estimate the effect of female employment status on fertility efficiently. Thus, after presenting traditional results for ordinary and two-stage least squares, we turn to a Poisson estimation procedure without correcting for endogeneity. Finally, we present a two-stage Poisson estimation to correct for endogeneity.

Unfortunately, it is not feasible to replace the employment status measure with its predicted value from the first stage in the two-stage Poisson model (Terza et al., 2008). Therefore, for our Poisson results we use two-stage residual inclusion estimation (Terza et al, 2008), which is equivalent to control function estimation (Wooldridge, 2002; Rivers and Vuong, 1988; Smith and Blundell, 1986). The first stage of this two stage-residual inclusion estimation is similar to that in equation (2). That gives us the estimated residual instead of the predicted dependent variable. Considering the binary nature of female employment status, our model in the first stage will be a Probit estimation, and we will obtain the generalized residual (Gourieroux et al, 1987). We then insert this generalized residual from the first stage, namely $\hat{u}$, into equation (1) as follows:

(3) $F = \beta_0 + X\beta_1 + E\beta_2 + \hat{u}\beta_3 + \varepsilon.$

If the coefficient on $\hat{u}$ is statistically significant, this indicates that female employment status is endogenous (Wooldridge, 2002; Rivers and Vuong, 1988; Smith and Blundell, 1986; Terza, et al, 2008). The endogeneity-corrected coefficient β_2 in equation (3) provides an unbiased estimate of the effect of female employment status on fertility (Terza et al., 2008). Due to the two-stage feature of this approach, the estimated standard errors in equation (3) are underestimated (Terza et al., 2008). Thus, we employ bootstrapping techniques with 1,000 replications to obtain the corrected standard errors.

For the binary variable measuring whether the actual number of children exceeds 1 (in violation of the one-child policy), we employ Probit estimation:

(4) $Y_a = \beta_0 + X\beta_1 + E\beta_2 + \varepsilon,$

where

Y_a = a binary measure indicating that the actual number of children is greater than 1.

In order to control for endogeneity, an IV Probit model will be implemented to estimate equations (2) and (4) simultaneously. The IV Probit provides a maximum likelihood estimate that corrects for endogenous explanatory variables. The dependent variables in these two equations are binary outcome measures (indicating whether the number of actual children exceeds 1, and whether a female has an off-farm job). We use the same instrumental variables as described above. We then report the marginal effects of female employment status on the probability of have more than one child. We replace the binary measure “having more than 1 child” with the binary measure “preferring more than 1 child” to estimate equation (5):

(5) $Y_p = \beta_0 + X\beta_1 + E\beta_2 + \varepsilon$,

Y_p = a binary measure indicating that the preferred number of children is greater than 1.

Then we repeat the above IV Probit estimation and report the marginal effects of female employment status on the probability of preferring more than one child.

5. RESULTS

5.1 Descriptive statistics

Our study sample of rural China in 2006 includes 2,288 ever-married women between 20 and 52 years old.[11] Table 1 shows descriptive statistics by female employment status. In our sample, 36.58 percent (837 women) are employed in full-time or part-time off-farm jobs. This employment rate is consistent with previous studies.[12] On average, an unemployed woman has 1.641 children and an employed woman has 1.205 children, a difference of 0.436 children. On average, an unemployed woman would prefer to have 1.765 children, while an employed woman would prefer 1.378 children, a difference of 0.387 children. Thus, when comparing employed

[11] The marriage law in China sets a minimum legal age for women of 20 years.

[12] For example, Yao (1999) reports the female employment rate in a rural county of Zhejiang province to be about 33 percent.

and unemployed women, differences in the preferred number of children are close to but smaller than those in the actual number of children.[13]

(Insert Table 1)

Among women not employed in off-farm jobs, 60.2 percent have access to a bus stop in their own villages; this percent rises to 75.9 for the employed sample. Employees of enterprises with at least 20 employees represented 20.3 percent of the village labor force is in the unemployed sample. By contrast, this percentage is substantially higher – 33.5 percent – in the employed female sample. Thus, having a bus stop in the village, and the proportion of the work force in the village that works in enterprises with at least 20 employees, are strongly and positively correlated with female employment status, suggesting that our instrumental variables have strong potential.

Appendix Table 1 shows the results from the first-stage regressions predicting employment status (both OLS and Probit). Both instrumental variables prove to be positively and significantly related to employment at the 1 percent level. Appendix Table 1 also reports various tests for these two instrumental variables obtained from the two-stage least squares estimation using the actual number of children as the dependent variable, including tests for endogeneity, tests of excluded instruments, under-identification tests, and weak instrument-robust inference tests. Each of these tests is statistically significant at the 1 percent level. For example, the F statistic of the weak identification test is 38.32 and significant at the 1 percent level, indicating that these two instrumental variables are not weak in the first stage estimation and strongly affect employment status. Our preferred model includes more than one instrument.

[13] Although fertility is higher in rural than urban areas, China's average total fertility per woman has remained under 2 since 1992 (McElroy and Dennis, 2000).

Fortunately, the Hansen J statistic shows that including both instruments does not confront us with an over-identification issue. In sum, all of these tests indicate that the off-farm employment measure is endogenous as we expected, and that our instruments for correcting endogeneity are valid.

Table 1 also provides descriptive statistics for the other explanatory variables by employment status. Compared to unemployed women, employed women have higher household income, are less likely to be minority, are more likely to have a son as the first child, are less likely to smoke but more likely to drink alcohol, are more likely to have health insurance, have more education and enjoy better health status. The approximate average ages of unemployed women are 40.5, and of employed women are 39. This slight gap in ages cannot explain the substantial differences in fertility between these two groups.

Table 2 shows the frequency and percent of fertility measures by employment status. Among unemployed women, 4.618 percent have no children and 40.179 percent have only one child. Thus, more than 50 percent of unemployed women have more than one child. Among employed women, just 22.5 percent have more than one child. We also find that approximately 63 percent of unemployed women prefer to have more than one child, while only 34 percent of employed women prefer to have more than one child. Overall, women who do not work off the farm in rural China have more children, prefer to have more children, and are more likely to have or prefer to have more than one child, compared to their employed counterparts.

(Insert Table 2)

5.2 OLS and two-stage least squares estimation

Table 3 presents the results using OLS estimation without controlling for endogeneity. On average, employment reduces the actual number of children by 0.201 and the preferred number of children by 0.152. The coefficients on female employment status in all the regressions are statistically significant at the 1 percent level. These marginal effects of employment on fertility are somewhat smaller than those found in Table 1, possibly reflecting the endogeneity problems that the OLS approach encounters. Our results are consistent with the finding of Scotese and Wang (1995) that female employment significantly reduces fertility, although they do not control for the endogeneity of employment. The adjusted R squared in OLS is about 0.27 for the actual fertility estimation and 0.19 for the preferred fertility estimation.

(Insert Table 3)

Table 4 reports the second-stage estimation results by two-stage least squares after controlling for endogeneity; the first stage estimation results are in Appendix Table A1. We find that the coefficients on female employment status remain negative, and are highly significant. In addition, the absolute values of coefficients increase, suggesting that OLS estimation underestimates the negative effects of female employment on fertility.

(Insert Table 4)

5.3 Poisson estimation

Table 5 shows the estimated marginal effects of selected variables from the Poisson estimation; the full results (coefficients) are reported in Appendix Tables 2 and 3. The marginal effects of female employment remain negative and statistically significant at the 1 percent level, indicating that off-farm employment reduces fertility. Without controlling for endogeneity, employment reduces the actual number of children by 0.19 and reduces the preferred number of children by 0.15 – marginal effects that are very close to those estimated by OLS (Table 3). After controlling for endogeneity with the two-stage residual inclusion Poisson estimation, the negative effects of employment on the actual number of children and the preferred number of children increase (in absolute value) to 0.64 and 0.48, respectively. The marginal effects of Poisson estimation, after correcting for endogeneity, are smaller than those estimated by two-stage least squares in Table 4, probably reflecting the advantages of count variables estimation (since linear regressions may over-estimate the true effects).

(Insert Table 5)

Results using Poisson estimations are similar to those using OLS and two-stage least squares, and suggest that endogeneity leads one to underestimate the negative effects of employment status on fertility. In addition, the included residual obtained from the first stage is positive and highly significant, confirming that the employment measure is endogenous (Hausman, 1978; Hausman, 1983; Wooldridge, 2002), and the disturbance terms of the fertility equation (1) and the employment equation (2) are positively correlated. This positive correlation makes OLS and simple Poisson underestimate the employment effects on fertility. This is consistent with the test for endogeneity in the two-stage least square estimates reported in Appendix Table A1.

5.4 Probit and IV Probit estimation

Table 6 shows selected results from the Probit and IV Probit estimations, reporting marginal effects of female employment status on fertility. The full results are available from the authors upon request. The dependent variables are binary measures indicating whether the subject has more than one child or prefers to have more than one child. Without controlling for endogeneity, employment reduces the probability of having more than one child by 17.4 percent and reduces the probability of preferring to have more than one child by 14.5 percent. After controlling for endogeneity by IV Probit estimation, the marginal effects of employment become significantly larger. In particular, the endogeneity-corrected estimates indicate that employment reduces the probability of having more than one child by 54.8 percent and the probability of preferring more than one child by 49.6 percent. The Chi-square tests by IV Probit estimations also indicate that female employment status is endogenous.

(Insert Table 6)

Table 7 shows selected results using only one instrument at a time as a robustness test. Appendix Table A1 reports the Hansen J statistic, which indicates that using both instruments does not cause an over-identification problem. Indeed, the results in Table 7 using each instrument separately are very similar to those using both instruments in terms of estimated coefficients, marginal effects, and significance levels. This suggests that our estimation results are robust.

(Insert Table 7)

Employing our preferred Poisson estimations with two-stage residual inclusion, as reported in Appendix Table 3, we also find that household annual income positively affects both actual fertility and preferred fertility. Age and age squared are good predictors for actual fertility, but not for preferred fertility. Having a first child who is a son significantly reduces both actual and preferred fertility, as expected given the Chinese emphasis on sons. We also find that married women with health insurance are more likely to have or prefer more children. This may reflect that their birth expenses or health-care costs for their children are covered by insurance, or possibly reflect other correlates of having health insurance (such as husband’s occupation). We also find that education reduces fertility, perhaps reflecting the differential opportunity costs of having more children for women with greater education. Education is also positively correlated with the probability of being employed in an off-farm job as reported in Appendix Table A1. We do not find that a woman's off-farm occupation significantly affects fertility after controlling for off-farm employment status. Poor health status, not surprisingly, correlates with having and preferring fewer children. We also find that there is substantial variation in fertility among the 9 provinces, holding other factors fixed. Women living in less economically-developed provinces (Guangxi and Guizhou) or in agriculture-intensive provinces (Henan, Hubei, and Hunan) have and prefer to have more children.

6. CONCLUSION

The prime finding of our paper is that employment reduces fertility for rural Chinese women. Based on our Poisson estimation with two-stage residual inclusion controlling for endogeneity of female employment status, and holding other factors at the mean for our sample, employment reduces the actual number of children by 0.64 and the preferred number of children by 0.48. The endogeneity-corrected estimates also indicate that off-farm employment reduces the probability of having more than one child by 54.8 percent and the probability of preferring more than one child by 49.6 percent.

Why does controlling for endogeneity yield a more powerful negative effect of employment on fertility? We conjecture that controlling for the endogeneity of employment removes the income effect that positively impacts fertility in rural China.[14] while female employment *per se* has negative substitution effects. High incomes also allow parents to pay the

[14] Note that our estimate of a positive effect of income on fertility contrasts with that of Schultz and Zeng (1995) that income negatively affects fertility in rural China.

penalty fines in China if they violate the one-child policy.[15] Because collinearity precludes us from including both employment and income (for females) in the same regression, the coefficient of non-instrumented employment includes both effects, which push in opposite directions. Once we instrument for employment, the mitigating impact of female income disappears, revealing the strong negative effect of off-farm employment on fertility. In addition, the effects of fertility on employment may be small. Angrist and Evans (1998) find that Ordinary Least Squares (OLS) without controlling for endogeneity overestimates the effect of fertility on labor supply and conclude that fertility *per se* may have a smaller impact on female labor supply than one might expect. The reverse causality issue in our study may not be very serious, and omitted variable biases (such as regarding female income) may dominate the endogeneity of the employment measure.

These findings do not merely provide empirical evidence regarding the economic theory of fertility and female labor force participation; they also have potentially important implications for employment and fertility policies in China. Given that the government continues to want to curb population growth, the finding of a causal impact of employment on fertility has important implications as China considers the combination of policies that will sustain its economic development while meeting other goals. Despite the significant rise in markets for China's rural economy, government interventions still have great influence (Yao, 1999). Using government policies to raise female employment rates could substantially reduce fertility without imposing

[15] As most jobs in rural China are not in state-owned enterprises or government agencies, administrative tools such as firing a violator of the one-child policy or losing promotion opportunities are not options. Penalty fines are the most powerful tools (McElroy and Yang, 2000).

any of the punishments and penalties for childbearing that have earned China so much criticism.[16] Further improvements in women's education would complement pro-employment policies by increasing the productivity of employment and multiplying its fertility-reducing effects.

In sum, our study confirms that off-farm employment for rural Chinese women curbs both actual and preferred fertility. Given that economic performance and population size are two critical concerns for China, it is vital that this strong negative link be recognized.

[16] The requirements imposed by the one-child policy, and the punishments inflicted on violators, have been widely criticized (Hardee-Cleaveland and Banister, 1988). The benefits for a couple with only one child have included health care, housing, cash, and food subsidies (McElory and Dennis, 2000). Punishments for the employees of state-owned enterprises and governments may involve loss of promotion opportunities or even jobs; others are subject to cash penalties (Li and Zhang, 2006). Unpermitted babies are often not able to register their residency, nor to obtain their identification card until these punishments are enforced. More draconian measures are also employed. In selected rural areas, some pregnant females with one child or more are forced to have abortions, and females in their prime reproductive ages with 2 or more children are also forced to undergo sterilization by the local family planning authorities (Hardee-Cleaveland and Banister, 1988).

Appendix: Discussion of dataset and instrumental variables

The China Health and Nutrition Survey (CHNS) is an ongoing international collaborative project by the Carolina Population Center, the National Institute of Nutrition and Food Safety, and the Chinese Center for Disease Control and Prevention. The CHNS was developed to promote the study of social and economic changes in Chinese society on health and nutrition. It was fielded by an international team of researchers whose backgrounds include nutrition, public health, economics, sociology, Chinese studies, and demography. Our study uses the latest wave of data for 2006.

Mainland China consists of 32 province-level administrative units. The CHNS data were collected from 9 provinces which account for 44 percent of the Chinese population: Liaoning, Heilongjiang, Jiansu, Shandong, Henan, Hubei, Hunan, Guangxi, and Guizhou. These 9 provinces vary substantially in geography, economic development, public resources, and health indicators, with greater wealth and development in the east. Liaoning and Heilongjiang are two heavily-industrialized provinces in northeastern China. Jiansu and Shandong are two lightly-industrialized provinces in eastern China. Henan, Hubei, and Hunan are three agricultural provinces in central China, and Guangxi and Guizhou are relatively underdeveloped southwestern provinces.

The CHNS employed sophisticated sampling techniques. A multistage, random cluster process was used to draw the sample surveyed in each of the provinces. Counties in the 9 provinces were stratified by income (low, middle, and high) and a weighted sampling scheme was used to randomly select 4 counties within each province. In addition, the provincial capital and a lower income city were selected when feasible. Villages within the counties, and urban and suburban neighborhoods within the cities, were selected at random.

The CHNS has a community survey that accompanies each wave. This survey collects information from community officials/cadres and business venders. Communities are defined by villages in rural China. Our instrumental variables to help control for endogeneity are two variables commonly reported by village officials in the 2006 CHNS community survey: bus stops and the percentage of the village off-farm workforce that is employed in firms with more than 20 employees. We discuss potential concerns about each instrument in turn.

A review of policy documents suggests that the set-up of bus stops in villages is largely determined by government administrative needs, population size, and road infrastructure. The administration system in rural China includes county, township, and administrative villages. One county (*xian*) includes several townships (*xiang*), and one township includes several administrative villages (*xingzheng cun*). The administrative village is the lowest administration or government level in rural China, which may cover several natural villages (*ziran cun*). An administration village is often the largest natural village among several neighboring natural villages. Policies have subsidized standard roads (*gong lu*) to various villages. Bus stops are usually set up first in counties and townships, and later are extended to each administrative village and large natural villages. Although we cannot completely rule out the possibility that bus stops are set up partly in response to demand for female off-farm employment, we think that this is highly unlikely, and that bus stops do not affect fertility directly after controlling for female employment status.

Our second instrument is the percentage of the village off-farm workforce that is employed in firms with more than 20 employees. This variable captures off-farm employment opportunities for women because of several factors. There is evidence that women are more likely to be employed in a large enterprise than a small one (Mitra, 2003), and the gender wage gap in large enterprises is believed to be smaller (Jolliffe and Campos, 2005). As noted in the main text, we recognize that there could be shocks to fertility across villages unrelated to employment, and if fertility strongly affected female employment, and if female employment significantly influenced whether a bus stop would be installed or large employers opened, our instruments would be measuring fertility not merely employment opportunities. But we do not believe that such a constellation of required conditions is very likely.

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Table 1: Descriptive statistics

Variables	Mean[1]			
Employment status[2]	Unemployed		Employed	
Sample size	N = 1451		N = 837	
Fertility variables				
Actual number of children	1.641	(0.808)	1.205	(0.633)
Preferred number of children	1.765	(0.822)	1.378	(0.697)
Instrumental variables[3]				
A bus stop in the village	0.602		0.759	
Proportion of the work force in the village works in enterprises with at least 20 employees	0.203	(0.225)	0.338	(0.286)
Other explanatory variables				
Household annual income (RMB)	18245.980	(26595.150)	31794.530	(33174.480)
Ethnic minority (wife and/or husband)	0.155		0.102	
Age	40.493		39.007	
Married	0.983		0.967	
The first child is a son	0.460		0.493	
Wife has siblings	0.967		0.957	
Husband has siblings	0.932		0.886	
Smoking	0.024		0.004	
Drinking alcohol	0.068		0.124	
Health insurance	0.440		0.581	
Education				
Less than primary school	0.207		0.050	
Primary school	0.236		0.096	
Lower middle school	0.404		0.378	
Upper middle school	0.123		0.172	
Technologic school	0.025		0.161	
College	0.003		0.143	
Occupation (off-farm)				
Worker	N/A		0.588	
Professional	N/A		0.166	
Manager	N/A		0.038	
Staff	N/A		0.130	
Other off-farm occupations	N/A		0.078	
Health status				
Excellent	0.114		0.178	
Good	0.554		0.527	
Fair	0.277		0.278	
Poor	0.055		0.017	
Province				
Liaoning	0.120		0.130	
Heilongjiang	0.129		0.109	
Jiangsu	0.079		0.165	
Shandong	0.091		0.121	
Henan	0.130		0.065	
Hubei	0.109		0.103	
Hunan	0.122		0.068	
Guangxi	0.110		0.133	
Guizhou	0.110		0.108	

Data source: China Health and Nutrition Survey 2006.
N/A: not applicable.
[1] Standard deviations are reported in parentheses for continuous variables.
[2] Employment status is defined by whether one individual is working in an enterprise as an employee (employed) or in the field as a peasant (unemployed).
[3] Instrumental variables are from China Health and Nutrition Survey Community Questionnaire 2006.

Table 2: Frequency and percent of fertility in rural China

Actual number of children	Unemployed		Employed	
	Frequency	Percent	Frequency	Percent
0	67	4.618	52	6.213
1	583	40.179	597	71.326
2	639	44.039	160	19.116
3	137	9.442	22	2.628
4	16	1.103	5	0.597
5	9	0.620	0	0.000
6	0	0.000	1	0.119
Total	1451	100.000	837	100.000

Preferred number of children	Unemployed		Employed	
	Frequency	Percent	Frequency	Percent
0	52	3.584	29	3.465
1	481	33.150	527	62.963
2	721	49.690	226	27.001
3	165	11.371	48	5.735
4	19	1.309	6	0.717
5	11	0.758	0	0.000
6	2	0.138	1	0.119
Total	1451	100.000	837	100.000

Table 3: Ordinary least squares estimation of actual and preferred fertility

Variables	Ordinary Least Squares Estimation: Actual Number of Children		Ordinary Least Squares Estimation: Preferred Number of Children	
Female employment status				
Unemployed (reference)				
Employed	-0.201	(0.037)***	-0.152	(0.042)***
Other explanatory variables				
Household annual income in natural log	0.003	(0.008)	0.008	(0.009)
Ethnic minority (wife and/or husband)	-0.008	(0.051)	-0.037	(0.056)
Age	0.072	(0.017)***	-0.018	(0.020)
Age squared	-0.001	(0.0002)**	0.0004	(0.0003)
Married	0.205	(0.132)	0.131	(0.151)
The first child is a son	-0.077	(0.027)***	-0.094	(0.030)***
Wife has siblings	0.051	(0.079)	0.076	(0.081)
Husband has siblings	-0.007	(0.066)	0.028	(0.072)
Smoking	-0.057	(0.132)	-0.081	(0.138)
Drinking alcohol	0.014	(0.050)	0.067	(0.053)
Health insurance	0.084	(0.032)***	0.080	(0.034)**
Education				
Less than primary school (reference)				
Primary school	-0.160	(0.059)***	-0.155	(0.062)***
Lower middle school	-0.266	(0.052)***	-0.274	(0.056)***
Upper middle school	-0.431	(0.060)***	-0.458	(0.064)***
Technologic school	-0.525	(0.067)***	-0.610	(0.076)***
College	-0.554	(0.075)***	-0.563	(0.090)***
Occupation (off-farm)				
Worker (reference)				
Professional	-0.047	(0.055)	-0.055	(0.067)
Manager	-0.101	(0.089)	-0.113	(0.105)
Staff	-0.081	(0.060)	-0.087	(0.075)
Other off-farm occupations	0.009	(0.087)	-0.037	(0.096)
Health status				
Excellent (reference)				
Good	-0.039	(0.038)	0.009	(0.041)
Fair	-0.056	(0.045)	0.006	(0.050)
Poor	-0.091	(0.082)	-0.082	(0.084)
Province				
Liaoning (reference)				
Heilongjiang	-0.037	(0.044)	-0.062	(0.049)
Jiangsu	-0.117	(0.048)***	-0.080	(0.053)
Shandong	0.015	(0.053)	0.097	(0.059)
Henan	0.471	(0.055)***	0.490	(0.060)***
Hubei	0.313	(0.055)***	0.353	(0.059)***
Hunan	0.225	(0.055)***	0.368	(0.066)***
Guangxi	0.266	(0.068)***	0.336	(0.071)***
Guizhou	0.417	(0.061)***	0.449	(0.066)***
Constant	-0.551	(0.353)	1.509	(0.437)***

Note: standard deviations are reported in parentheses.

* significant at the 10% level; ** significant at the 5% level; *** significant at the 1% level.

Table 4: Two-stage least squares estimation of actual and preferred fertility

Variables	Two Stage Least Squares Estimation			
	Actual Number of Children		Preferred Number of Children	
Female employment status				
Unemployed (reference)				
Employed	-0.802	(0.223)***	-0.556	(0.240)**
Other explanatory variables				
Household annual income in natural log	0.020	(0.011)*	0.019	(0.012)
Ethnic minority (wife and/or husband)	-0.053	(0.054)	-0.067	(0.058)
Age	0.094	(0.020)***	-0.003	(0.023)
Age squared	-0.001	(0.0003)***	0.0002	(0.0003)
Married	0.162	(0.138)	0.102	(0.152)
The first child is a son	-0.067	(0.029)**	-0.087	(0.030)***
Wife has siblings	0.041	(0.082)	0.069	(0.084)
Husband has siblings	-0.016	(0.067)	0.022	(0.071)
Smoking	-0.093	(0.131)	-0.105	(0.137)
Drinking alcohol	0.033	(0.053)	0.079	(0.054)
Health insurance	0.078	(0.034)**	0.075	(0.035)**
Education				
Less than primary school (reference)				
Primary school	-0.132	(0.060)**	-0.136	(0.063)**
Lower middle school	-0.157	(0.063)***	-0.200	(0.069)***
Upper middle school	-0.295	(0.076)***	-0.367	(0.082)***
Technologic school	-0.347	(0.093)***	-0.490	(0.102)***
College	-0.378	(0.096)***	-0.444	(0.109)***
Occupation (off-farm)				
Worker (reference)				
Professional	0.297	(0.139)**	0.177	(0.152)
Manager	0.256	(0.157)*	0.127	(0.173)
Staff	0.250	(0.134)*	0.137	(0.151)
Other off-farm occupations	0.413	(0.170)**	0.235	(0.181)
Health status				
Excellent (reference)				
Good	-0.085	(0.044)**	-0.022	(0.045)
Fair	-0.093	(0.050)*	-0.018	(0.054)
Poor	-0.194	(0.095)**	-0.151	(0.095)
Province				
Liaoning (reference)				
Heilongjiang	-0.115	(0.055)**	-0.115	(0.057)**
Jiangsu	-0.026	(0.062)	-0.019	(0.065)
Shandong	0.028	(0.058)	0.106	(0.061)*
Henan	0.400	(0.063)***	0.442	(0.067)***
Hubei	0.314	(0.057)***	0.354	(0.059)***
Hunan	0.154	(0.064)**	0.320	(0.075)***
Guangxi	0.297	(0.073)***	0.357	(0.075)***
Guizhou	0.439	(0.065)***	0.463	(0.067)***
Constant	-0.912	(0.391)**	1.266	(0.469)***

Note: standard deviations are reported in parentheses.

* significant at the 10% level; ** significant at the 5% level; *** significant at the 1% level.

Table 5: Selected results (marginal effects) of Poisson estimation of actual and preferred fertility

Variables	Marginal Effect			
	Actual Number of Children		Preferred Number of Children	
Estimation model	Poisson Estimation			
Female employment status				
Unemployed (reference)				
Employed	-0.193	(0.036)***	-0.147	(0.041)***
Estimation model	Poisson Estimation with Two Stage Residual Inclusion			
Female employment status				
Unemployed (reference)				
Employed	-0.644	(0.127)***	0.482	(0.146)***
Residual from the first stage	0.299	(0.083)***	0.218	(0.093)**

Note: standard deviations are reported in parentheses.

* significant at the 10% level; ** significant at the 5% level; *** significant at the 1% level.

Table 6: Probit and IV Probit estimations of actual and preferred fertility

Variables	The Dependent Variable is Binary			
	Having More Than One Child		Preferring More Than One Child	
Estimation model	**Probit estimation: marginal effect**			
Female employment status				
Unemployed (reference)				
Employed	-0.174	(0.028)***	-0.145	(0.029)***
Estimation model	**IV Probit estimation: marginal effect**			
Female employment status				
Unemployed (reference)				
Employed	-0.548	(0.075)***	0.496	(0.103)***
Lnsigma	-1.007	(0.015)***	-1.007	(0.015)***
Athrho	0.541	(0.159)***	0.403	(0.154)***
Sigma	0.365	(0.005)	0.365	(0.005)
Rho	0.494	(0.120)	0.383	(0.131)
Test of exogeneity (athrho=0)				
Chi-square test	11.660	***	6.900	***

Note: standard deviations are reported in parentheses.

* significant at the 10% level; ** significant at the 5% level; *** significant at the 1% level.

Table 7: Estimation results using only one instrumental variable of actual and preferred fertility

	Actual Number of Children				Preferred Number of Children			
	Instrument 1[1]		Instrument 2[2]		Instrument 1[1]		Instrument 2[2]	
Estimation model	**Two Stage Least Squares: Coefficient**							
Female employment status								
Unemployed (reference)								
Employed	-0.885	(0.283)***	-0.656	(0.297)**	-0.789	(0.308)***	-0.224	(0.323)
Estimation model	**Poisson Estimation with Two Stage Residual Inclusion: Marginal Effect**							
Female employment status								
Unemployed (reference)								
Employed	-0.683	(0.143)***	-0.623	(0.146)***	-0.551	(0.168)***	-0.422	(0.170)***
Residual from the first stage	0.325	(0.093)***	0.280	(0.097)***	0.266	(0.107)***	0.175	(0.109)
Estimation model[3]	**IV Probit Estimation: Marginal Effect**							
Female employment status								
Unemployed (reference)								
Employed	-0.520	(0.106)***	-0.579	(0.098)***	-0.534	(0.118)***	-0.403	(0.189)**

Note: standard deviations are reported in parentheses.

[1] A bus stop in the village.

[2] Proportion of the work force in the village works in enterprises with at least 20 employees.

[3] The dependent variables are binary measures of having more than one child and preferring more than one child.

* significant at the 10% level; ** significant at the 5% level; *** significant at the 1% level.

Appendix Table A1: The first-stage estimation of "Employed"

Estimation model	Estimation with "Employed" as the dependent variable: Ordinary Least Squares Coefficient		Probit Marginal Effect	
Instrumental variables				
A bus stop in the village	0.112	(0.017)***	0.142	(0.024)***
Proportion of the work force in the village works in enterprises with at least 20 employees	0.178	(0.035)***	0.266	(0.046)***
Other explanatory variables				
Household annual income in natural log	0.025	(0.004)***	0.049	(0.010)***
Ethnic minority (wife and/or husband)	-0.048	(0.025)**	-0.064	(0.036)*
Age	0.038	(0.010)***	-0.065	(0.015)***
Age squared	-0.001	(0.0001)***	-0.001	(0.0002)***
Married	-0.067	(0.059)	-0.107	(0.094)
The first child is a son	0.018	(0.016)	0.034	(0.023)
Wife has siblings	-0.008	(0.043)	0.013	(0.064)
Husband has siblings	-0.024	(0.035)	-0.022	(0.052)
Smoking	-0.066	(0.039)*	-0.211	(0.061)***
Drinking alcohol	0.027	(0.028)	0.079	(0.044)*
Health insurance	-0.015	(0.018)	0.024	(0.025)
Education				
Less than primary school (reference)				
Primary school	0.043	(0.025)*	0.115	(0.048)***
Lower middle school	0.165	(0.023)***	0.293	(0.040)***
Upper middle school	0.197	(0.030)***	0.378	(0.045)***
Technologic school	0.260	(0.040)***	0.620	(0.029)***
College	0.240	(0.041)***	0.703	(0.014)***
Health status				
Excellent (reference)				
Good	-0.068	(0.025)***	-0.097	(0.034)***
Fair	-0.056	(0.028)**	-0.057	(0.037)
Poor	-0.171	(0.042)***	-0.220	(0.045)***
Province				
Liaoning (reference)				
Heilongjiang	-0.082	(0.030)***	-0.115	(0.041)***
Jiangsu	0.186	(0.038)***	0.218	(0.052)***
Shandong	0.038	(0.035)	0.060	(0.049)
Henan	-0.098	(0.032)***	-0.157	(0.040)***
Hubei	0.017	(0.036)	-0.006	(0.047)
Hunan	-0.065	(0.034)*	-0.098	(0.045)**
Guangxi	0.066	(0.036)*	0.106	(0.049)**
Guizhou	0.063	(0.034)*	0.102	(0.052)**
Constant	-0.719	(0.200)***	N/A	
Tests of the first stage[1]				
Tests of endogeneity				
Wu-Hausman F test	9.021	***	N/A	
Durbin-Wu-Hausman Chi-squared test	9.120	***	N/A	
Test of excluded instruments				
F statistic	38.320	***	N/A	

Underidentification tests			
Kleibergen-Paap rk LM statistic	75.150	***	N/A
Kleibergen-Paap rk Wald statistic	79.360	***	N/A
Weak identification test			
Kleibergen-Paap Wald rk F statistic	39.090	***	N/A
Weak-instrument-robust inference			
Anderson-Rubin Wald test, F statistic	6.840	***	N/A
Anderson-Rubin Wald test, Chi-squared statistic	13.890	***	N/A
Stock-Wright LM S statistic	13.740	***	N/A
Overidentifiation test of all instruments			
Hansen J statistic	0.486		N/A

N/A: not applicable.

* significant at the 10% level; ** significant at the 5% level; *** significant at the 1% level.

[1] Tests are obtained using actual number of children as the dependent variable in two stage least squares estimation.

Appendix Table 2: Poisson estimation of actual and preferred fertility

Variables	Poisson Estimation			
	Actual Number of Children		Preferred Number of Children	
Female employment status				
Unemployed (reference)				
Employed	-0.139	(0.026)***	-0.094	(0.026)***
Other explanatory variables				
Household annual income in natural log	0.001	(0.005)	0.004	(0.006)
Ethnic minority (wife and/or husband)	-0.007	(0.033)	-0.024	(0.033)
Age	0.072	(0.012)***	-0.009	(0.013)
Age squared	-0.001	(0.0002)***	0.0002	(0.0002)
Married	0.140	(0.100)	0.090	(0.104)
The first child is a son	-0.053	(0.018)***	-0.058	(0.018)***
Wife has siblings	0.065	(0.058)	0.062	(0.054)
Husband has siblings	0.000	(0.048)	0.019	(0.047)
Smoking	-0.019	(0.083)	-0.032	(0.086)
Drinking alcohol	0.010	(0.034)	0.040	(0.032)
Health insurance	0.062	(0.021)***	0.053	(0.021)***
Education				
Less than primary school (reference)				
Primary school	-0.074	(0.032)**	-0.074	(0.032)**
Lower middle school	-0.141	(0.029)***	-0.143	(0.030)***
Upper middle school	-0.256	(0.037)***	-0.260	(0.037)***
Technologic school	-0.365	(0.047)***	-0.392	(0.050)***
College	-0.409	(0.055)***	-0.362	(0.063)***
Occupation (off-farm)				
Worker (reference)				
Professional	-0.030	(0.046)	-0.042	(0.050)
Manager	-0.069	(0.069)	-0.078	(0.078)
Staff	-0.102	(0.052)**	-0.089	(0.058)
Other off-farm occupations	0.014	(0.063)	-0.022	(0.063)
Health status				
Excellent (reference)				
Good	-0.022	(0.027)	0.007	(0.027)
Fair	-0.035	(0.030)	0.006	(0.031)
Poor	-0.058	(0.052)	-0.047	(0.051)
Province				
Liaoning (reference)				
Heilongjiang	-0.023	(0.033)	-0.045	(0.035)
Jiangsu	-0.093	(0.036)***	-0.057	(0.037)
Shandong	0.019	(0.038)	0.070	(0.039)*
Henan	0.312	(0.035)***	0.300	(0.035)***
Hubei	0.209	(0.035)***	0.222	(0.035)***
Hunan	0.162	(0.038)***	0.234	(0.039)***
Guangxi	0.193	(0.045)***	0.218	(0.043)***
Guizhou	0.287	(0.038)***	0.281	(0.038)***
Constant	-1.553	(0.272)***	0.310	(0.278)

Note: standard deviations are reported in parentheses.

* significant at the 10% level; ** significant at the 5% level; *** significant at the 1% level.

Appendix Table 3: Poisson estimation with two stage residual inclusion of actual and preferred fertility

Variables	Poisson Estimation with Two Stage Residual Inclusion			
	Actual Number of Children		Preferred Number of Children	
Female employment status				
Unemployed (reference)				
Employed	-0.479	(0.102)***	-0.316	(0.103)***
Residual from the first stage	0.210	(0.060)***	0.138	(0.061)**
Other explanatory variables				
Household annual income in natural log	0.012	(0.006)**	0.012	(0.007)*
Ethnic minority (wife and/or husband)	-0.034	(0.035)	-0.042	(0.035)
Age	0.088	(0.014)***	0.001	(0.137)
Age squared	-0.001	(0.0002)***	0.0001	(0.0002)
Married	0.114	(0.104)	0.073	(0.104)
The first child is a son	-0.044	(0.019)**	-0.053	(0.019)***
Wife has siblings	0.062	(0.060)	0.060	(0.056)
Husband has siblings	-0.003	(0.047)	0.017	(0.048)
Smoking	-0.050	(0.087)	-0.053	(0.089)
Drinking alcohol	0.029	(0.037)	0.053	(0.033)
Health insurance	0.070	(0.022)***	0.058	(0.023)***
Education				
Less than primary school (reference)				
Primary school	-0.053	(0.034)	-0.060	(0.034)*
Lower middle school	-0.068	(0.038)*	-0.094	(0.036)**
Upper middle school	-0.155	(0.049)***	-0.193	(0.049)***
Technologic school	-0.152	(0.081)*	-0.252	(0.078)***
College	-0.148	(0.095)*	-0.191	(0.098)**
Occupation (off-farm)				
Worker (reference)				
Professional	-0.029	(0.047)	-0.041	(0.052)
Manager	-0.061	(0.072)	-0.073	(0.084)
Staff	-0.103	(0.055)*	-0.090	(0.060)*
Other off-farm occupations	-0.0001	(0.067)	-0.031	(0.063)
Health status				
Excellent (reference)				
Good	-0.051	(0.029)*	-0.012	(0.028)
Fair	-0.055	(0.034)	-0.007	(0.032)
Poor	-0.125	(0.058)**	-0.091	(0.055)*
Province				
Liaoning (reference)				
Heilongjiang	-0.068	(0.039)*	-0.075	(0.039)**
Jiangsu	-0.049	(0.043)	-0.028	(0.038)
Shandong	0.030	(0.042)	0.077	(0.040)*
Henan	0.269	(0.039)***	0.272	(0.041)***
Hubei	0.201	(0.037)***	0.216	(0.036)***
Hunan	0.117	(0.042)***	0.205	(0.042)***
Guangxi	0.216	(0.050)***	0.233	(0.046)***
Guizhou	0.300	(0.040)***	0.289	(0.040)***
Constant	-1.840	(0.293)***	0.123	(0.288)

Note: standard deviations are reported in parentheses.
* significant at the 10% level; ** significant at the 5% level; *** significant at the 1% level.