Carrots and Sticks: Fertility Effects of China's Population Policies

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For 20 years following 1949, average total fertility per woman in China hovered just above six children. The year 1970 marked the beginning of persistent fertility declines. By 1980, the rate had dropped to 2.75, and since 1992 it has remained under 2 (Peiyun Peng, 1996). While some of this transition can be accounted for by broad socioeconomic developments (e.g., T. Paul Schultz and Yi Zeng, 1995; Junshen Zhang, 1990), the extent to which it is attributable to China's unique population policies remains controversial. This paper analyzes household data from the 1992 Household Economy and Fertility Survey (HEFS) to provide the first direct microeconomic empirical evidence on the efficacy of these policies.

I. Overview

The HEFS contains unique data on monetary penalties that were imposed on "above-quota births" in rural China. We use these penalties as proxies for the overall intensity of population controls at the county level and thereby estimate the impact of these controls on fertility. Since most young couples residing in cities and towns have one child, HEFS does not contain a sufficient number of observed penalties for statistical analysis. Hence, our empirical work is confined to the effects of population controls on rural fertility.

Our empirical findings suggest that China's population policies have played a role in Chinese fertility that cannot be ignored. First, the number of children born to rural women is significantly lower in counties with higher penalties on above-quota births, but these penalties are onerous for the average family. Moreover, these effects appear to be the greatest for low-income families, decline as wealth increases, and disappear altogether for sufficiently wealthy families. Second, our inability to find evidence that a mother's education reduces fertility itself constitutes evidence that China's population controls do bind fertility behavior. Third, China's policy of restricting the flow of labor out of agriculture may have significant pro-natal effects that run counter to its population-control policies. Finally and most importantly, we find that a complete removal of the existing monetary penalties in rural China would only result in relatively small increases in fertility of 0.33 cumulative births per woman.

Therefore, the current paper suggests that there may be more efficient and less coercive ways to achieve the economic growth that China's various policies are designed to foster. Priority should be given to terminating a series of pro-natal institutions and policies inherited from the centrally planned system, such as restrictions on labor mobility. The responses of families to the resulting changes in economic incentives would help to foster economic growth and may go a long way toward affecting the desired demographic transition.

II. Population Control Policies and Data

The standard economic model and empirical determinants of fertility are well known (e.g., Robert Willis, 1973) and include income and wealth constraints, the costs and benefits of having children, marital and biological characteristics of the parents, and other socioeconomic factors. In China, fertility determination is complicated by institutions and policies that have (either purposefully or inadvertently) promoted or restrained fertility (D. Gale Johnson, 1994; Dandan Chen et al., 1999). Population controls by the central government began in earnest in 1971 with the "Later, Longer, and Fewer" (LLF) family-planning campaign (later marriage, longer intervals between births, and fewer children). Implementation relied primarily on propaganda, "persuasion," and social pressure.

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In about 1980, the government abandoned these indirect controls and moved to directly targeting the number of children per family, and China's so-called "one-child policy" was born. Under this policy, in cities and towns, a second child was permitted only under special circumstances (e.g., a severely handicapped first child). However, after 1983 in rural areas, policies were liberalized. Local officials were given the authority to approve a second child for families who faced "real difficulties." A number of provinces allowed a second birth, after a specified interval, when the first child was a daughter. As a rule, a third child remained strictly prohibited.

To implement these policies, local governments instituted coercive means, offering substantial financial rewards for single-child families and imposing heavy penalties on above-quota births. The central government suggested that lower-level jurisdictions reward single-child families with some menu of benefits, including subsidized health care and child care, welfare allowances, paid maternal and extra leaves, preferential access to schooling, employment, college admission, and housing. In rural areas, single-child families paid lower in-kind taxes (reduced quotas of grain owed to the government) and obtained larger allotments of "responsibility land" (land farmed to produce the grain quota as well as for commercial purposes). In cities and towns, typical monetary penalties for a second child ranged from 10 percent to 20 percent of both parents' wages for a period lasting from 3 to 14 years. In contrast, in rural villages the most common penalty on an above-quota birth was a large, one-time, lump-sum fine, which often accounted for a large percentage of a worker's annual earnings.

This study uses the rural sample from the 1992 HEFS, consisting of 5,532 households from 43 counties distributed across ten Chinese provinces (see Chen et al., 1999). To be included in the survey a household must have at least one child. In addition to the usual socioeconomic variables that help to explain fertility behavior, HEFS records the monetary penalty paid for each above-quota birth in 1991. Among the 299 births in that year, 91 were above quota. We use within-county average penalties to construct county-specific measures of the penalty on an above-quota birth and take these to be exogenous to individual family fertility decisions.

Our "average sample woman" had slightly more than an elementary education (5.4 years), at age 22.9 she married a husband two years older than herself who had about two more years of schooling than she (7.5 years), and was 14.3 years into her marriage as of the survey year. By then she was 36.7 years old with 2.3 children and (fixed plus mobile) family assets of 19,891 yuan. On average, a full-time worker earned 2,362 yuan per year, and 42.9 percent of this total came from nonagricultural activities. Expenditures on children were substantial. Per-student expenditures for medical and educational purposes (including tuition, books, stationery, and expenses on various training and apprenticeships) accounted, respectively, for 1.6 percent and 6.5 percent of a worker's annual income. The average financial penalty for an above-quota birth amounted to 41.3 percent of income per worker. Looking across the sample, the county-average penalties exhibited substantial variation, ranging from 30 to 4,000 yuan.

III. The Effects of Fertility Control on Rural Families

The four columns in Table 1 present two-stage least-squares (2SLS) estimates of four models for children born to women in rural China.[1] In all models, earnings per worker and the share of income from nonagricultural earnings are assumed to be endogenous; we use county-level variables of average income per worker and the share of nonagricultural incomes as instruments to identify the impact of exogenous variations in these two variables on women's fertility. As seen toward the bottom of the table, models (i) and (ii) employ a simple trifurcation of marriage cohorts: those married in the 1980's (one-child policy), those married in the 1970's (LLF policy regime), and those married prior to the beginning of serious efforts to control population growth. This last group constitutes the reference marriage cohort or policy

[1] The alternatives to this linear model are ordered Probit specifications and Poisson regressions, which yield similar results to what is reported here. While the strength of these nonlinear models is to allow flexibility in the error structures, the interpretation of the estimates is much less straightforward. Due to space constraints, we adopt a linear model.

TABLE 1—TWO-STAGE LEAST-SQUARES ESTIMATES OF CHILDREN PER FAMILY IN RURAL CHINA

Explanatory Variables	Model (i)	(ii)	(iii)	(iv)
Women's Education				
Dummy for elementary school	−0.011 (−0.193)	0.028 (0.494)	0.003 (0.055)	0.040 (0.712)
Dummy for middle school or more	−0.052 (−0.855)	0.011 (0.172)	−0.019 (−0.301)	0.043 (0.697)
Predicted earnings per worker	0.255** (4.812)	0.528** (7.355)	0.253** (4.878)	0.513** (7.275)
Family assets	—	1.66×10^{-4} (0.094)	—	5.28×10^{-4} (0.299)
Predicted percentage of nonagricultural income	−1.596** (−8.933)	−1.756** (−9.879)	−1.664** (−9.272)	−1.081** (−10.150)
Average penalty in county of residence	−0.468** (−3.632)	−0.329** (−2.481)	−0.460** (−3.666)	−0.338** (−2.602)
(Penalty)^2	0.028 (1.302)	0.036 (1.575)	0.021 (1.001)	0.033 (1.434)
Penalty × earnings	0.063 (0.896)	−0.042 (−0.587)	0.092 (1.409)	−0.003 (−0.042)
Penalty × assets	—	5.32×10^{-3}** (2.490)	—	4.78×10^{-3}* (2.237)
Educational expenses/student[a]	—	−0.003** (−3.745)	—	−0.003** (−3.635)
Medical expenses/student[a]	—	−0.021** (−8.592)	—	−0.021** (−8.640)
Married between 1980 and 1991	−0.514** (−5.600)	−0.495** (−5.456)	—	—
Married 1980–1991 × penalty	0.061 (0.842)	0.079 (1.126)	—	—
Married between 1971 and 1979	−0.320** (−3.412)	−0.263** (−2.858)	—	—
Married 1971–1979 × penalty	0.030 (0.435)	0.017 (0.250)	—	—
Woman's age at marriage	—	−0.057** (−6.823)	—	−0.053** (−6.326)
20 yearly marriage cohort dummies	no	no	yes	yes
Constant	3.303** (30.399)	5.153** (24.769)	3.287** (31.746)	5.069** (24.285)
R^2:	0.0577	0.1050	0.067	0.111

Notes: For education, the reference indicator is for women with less than elementary education. Asymptotic t ratios are in parentheses. Assets, earnings, and the penalty are in units of 1,000 yuan.

[a] County average.

* Statistically significant at the 5-percent level.

** Statistically significant at the 1-percent level.

regime. Models (iii) and (iv) replace these policy-regime cohorts with 20 annual marriage-cohort dummies, with all those married prior to 1971 again serving as the reference cohort. These marriage-cohort dummies help to control for the incomplete fertility of women in later cohorts and allow for separate effects of two population-control regimes.

To allay any remaining qualms concerning the endogeneity of right-hand side variables, models (i) and (iii) omit all arguably potentially endogenous variables for which our instruments are in doubt. These include family assets that may reflect past economic behavior and the age of mother, which may interact with fertility decisions for which we have no instruments. Also omitted are county-level, per-child expenditures on education and health care as these are less than wholly satisfactory measures of the cost of a child faced by families.

Our results are stable across all four specifications. For a given variable, the significance of its coefficient never varies across specifications; if it is significant, its sign never flips. With the exception of earnings per worker (which about doubles upon the deletion of potentially endogenous variables), the sizes of all significant variables are similar across specifications.

Contrary to most previous empirical work, these data yield no evidence that more-educated mothers had fewer children, a result that is robust across all four models. One interpretation is that, for rural women, China's population policies generally result in binding restrictions on fertility. Consequently, actual fertility lies below the desired number, and data cannot reveal the potential impact of women's education on fertility.

All four models also strongly indicate that families in counties with larger penalties on above-quota births have statistically significantly fewer children. As one would expect, the marginal impact of a given increase in the penalty declines as the level of the penalty rises (but these squared terms do not meet conventional levels of statistical significance). To assess the effects of penalties on fertility, we use estimates from model (iv), which represents the most complete and flexible specification. At the sample mean, a 10-percent increase in the penalty would reduce total births per woman by 0.03. Disregarding the insignificant quadratic terms, doubling the existing average penalty (i.e., raising the fine to 82.6 percent of a worker's annual income) would further reduce the average number of births per woman by only 0.33. Hence, while penalties "work," it takes a large increase

in the penalty for a fairly small reduction in fertility. To examine the effects of relaxing the current controls, a removal of the existing penalties would increase fertility by 0.33 births per woman. This fertility effect appears to be small in view of the government's presumptions.

With regard to assets, while the total-family-asset term proved statistically insignificant, we found significant and positive interactions between total family assets and penalties. This indicates that the wealthier the family, the less a given penalty impacts its fertility. Our sample average for total family assets was just under 20,000 yuan. Roughly speaking (and based on lack of significance, disregarding both the squared penalty and the interaction of the penalty with income) we find that a 10-percent increase in assets would offset the marginal fertility effects of the penalties by 2.9 percent. In fact, at the sample mean, an increase in assets of 50,000 yuan would fully offset the penalties. This implies that, in our rural sample, penalties do not reduce the fertility of the wealthiest 3.9 percent of families.

With regard to family income, we find that higher total income increases fertility, but the distribution of income between farm income and off-farm income matter. In China as elsewhere, with secularly increasing nonagricultural opportunities, parents have incentives to raise the schooling level of their children, to spread educational investments more equally, and to reduce total fertility (Yang and Xiaodong Zhu, 2000). We found that, for a given family income level, those families with a larger share coming from off-farm earnings have fewer children. At our sample mean, a 10-percent increase in total income per worker raises fertility by 0.12. However, controlling for total income, a 10-percentage-point increase in the share of this income from nonagricultural earnings reduces births per woman by 0.11.

This finding, in combination with our penalty results, has important policy implications. China has well-known restrictions on the exit of labor from agriculture. This finding shows that these mobility restrictions may have large and significant pro-natal effects, thereby unintentionally countermanding the effects of China's explicit population policies.

With regard to the cost of children, we find that fertility is significantly lower in counties where the cost of an extra child is higher (when costs are measured by the average per-student educational and medical expenses). We caution that these cost measures are less than ideal.

Finally, we turn to the marriage cohorts and age at marriage. On average, for a given marriage cohort, postponement of marriage for a year results in a small but significant decline in the number of children born to a woman, indicating that if 100 women postponed marriage for a year, they would in total have about five fewer children. Models (i) and (ii) show that, holding constant the county average penalty for an above-quota birth, age at marriage, and all other measured variables, women who married in the LFF regime (1971–1979) averaged between one-quarter and one-third fewer children than those who married before 1971. More strongly, women who married during the one-child policy regime (1980–1991) averaged half a child less than those married before 1971. Models (iii) and (iv) yield very similar results.

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