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The impact of institutional reform from 1979 through 1987 on fertility in rural China

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Abstract

This empirical study brings together data on the local timing of the rural household responsibility system (HRS) reforms in China from 1979 through 1987 and assesses the association of the local reforms with individual parity-specific fertility changes as measured in the in-depth fertility survey. Fertility appears to have increased slightly in 1982 through 1984, but declined in 1985 through 1987, in the wake of these significant economic reforms. It is hypothesized that the reforms increased the private monetary and opportunity cost of childbearing and intensified market competition for the adoption of new production technologies that encouraged parents to educate their children better, while increasing the mobility of the rural labor force and thereby discouraging and delaying childbearing among rural Chinese.

JEL classification: J13; P21; R2

Keywords: Rural reforms; Fertility change; China; Household responsibility system

1. Introduction

In this article the term *institutional reform* refers to the dramatic changes in rural China since 1979 that have replaced the collective production team system (PTS) by the household responsibility system (HRS). This institutional change has resulted in remarkable growth in agricultural output, doubling from 1978 to 1990 (Lin, 1997). It is estimated that the net effect of shifting from the production team system to the household responsibility system increased productivity by 20% (see Lin, 1987, 1988). The rural institutional reform also started the engine of economic and political reform in China as a whole. It may be expected that such an institutional change could affect many forms of behavior, including childbearing.

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Several hypotheses could be advanced for why the HRS might have affected fertility. First, the reforms might have weakened the capacity of the local administration to control or depress fertility. Second, couples may have believed that with their own assigned plots after HRS, they would capture more of the productive benefits from having more children and realize future increases in family output and income through higher fertility (e.g., Parish, 1985, p. 15; Huaiyang, 1994). A third factor could work in the opposite direction, reducing fertility after the HRS. The collective PTS provided households with an implicit subsidy to have more children despite other government policies designed to discourage and delay childbearing. Families with many small children were not penalized for running a food deficit in their account with the production team. No interest on the household's deficit account was charged, nor did the production team fix a schedule for the family to repay its food deficit. By overdrawing the household account, the old system, in a sense, subsidized having more children, whereas the HRS did not (Nee, 1985, pp. 174–177). Rules denying additional food rations and private plot allocations for children born out of the birth planning quotas had, of course, a countervailing effect under the strict birth control policy implemented in most parts of rural China.

We know of little empirical evidence to verify these different hypotheses or to assess their relative importance. The motivation of this paper is to evaluate empirically the direction and magnitude of the net effect of the reforms on current levels of fertility by parity. The next section describes the data used in this paper. The third section reviews the Chinese rural institutional reform and presents the analysis on timing of the reform and its association with some socioeconomic variables. The model specifications of our life-table and multivariate logistic regression analysis are outlined in the fourth section. The fifth and sixth sections present the findings. The seventh section discusses explanations for the empirical findings, and concluding remarks are presented in the last section.

2. Data

This study uses the detailed retrospective fertility histories and individual characteristics collected by the second phase of the In-Depth Fertility Household Surveys, supplemented by the dates when the HRS reforms were introduced in the local community. The second phase of the In-Depth Fertility Surveys was conducted in April 1987 in Beijing Municipality and Liaoning, Shangdong, Guangdong, Guizhou, and Gansu provinces, representing a total population of 236 million (State Statistical Bureau, 1988). Based on the standard World Fertility Survey, the questionnaire covers six topics for ever-married women age 15 through 49: background, marriage history, detailed birth and pregnancy history, contraceptive knowledge and history of contraceptive use, fertility preferences, and background of current or last husband. Previous studies have concluded that the data from these Chinese fertility surveys are of high quality (International Institute of Statistics, 1991).

After the second phase of the In-Depth Fertility Surveys was completed, the State Statistical Bureau (SSB) helped us to go back to each sampling unit to collect the dates (month and year) of the local introduction of the HRS. These data were then merged with the individual event history data from the In-Depth Fertility-Surveys, based on the exact codes of sample cluster locations. As a result, for each rural woman interviewed in the surveys we know the

Table 1
Number of rural women aged 15–49 in 1987 surveys and percentage in communities by date of economic reform

Province of municipality	No. of women	Percentage by date of start of reforms			
		Early reform (1979–1980)	Middle reform (1981–1982)	Late reform (1983–April 1987)	Not started by May 1987
Beijing	3547	0	18	72	10
Liaoning	3111	0	41	38	22
Shandong	2859	44	43	7	5
Ganzu	4953	48	46	3	2
Gueizou	5492	64	34	0	2
Gungdon	5238	38	44	14	5
Total	25,200	36	38	19	7

month and year when the HRS reform was begun in her village.[1] Note that only the rural part of the In-Depth Fertility Surveys data set is used in this study and the urban part is excluded because the urban women were not directly affected by the household responsibility reform. The total working sample includes 25,200 rural women of reproductive age (see Table 1).

3. The institutional reform of household responsibility system

After the collectivization of agriculture in the 1950s, daily activities of agricultural production in China were organized under the PTS. The production team was a basic unit of production and income distribution for approximately 20 years. A production team usually consisted of approximately 35 households. Under this system, farmers received work points, based on their time devoted to the team's work, and sometimes the quality of the work was also considered. At the end of a year the net income of the team, including cash, food, and other income in kind, after deductions for state taxes and public welfare funds, was distributed among team members in proportion to the work points that each worker accumulated during the year. Because of the difficulties in measuring the quantity and quality of each farmer's daily work due to the complexity of agricultural production and the costs of supervision, the PTS tended to provide inadequate incentives for workers to apply themselves to maximize the team's output. The incentive to work hard was low, because the marginal private return to hard work was only a small share of the resulting increased output that was shared equally among the many other team workers. Therefore, agricultural production and the Chinese farmer's living standard in the 1960s and 1970s was low and grew slowly. This inefficiency of the PTS provides a plausible explanation for the rapid speed of diffusion of the rural institutional reform, once it had started in 1979.

Toward the end of 1978 with encouragement from the local authorities, a small number of production teams in Anhui province began to try out a new system of contracting land and other resources to individual households, who were then obligated to provide the government

[1]The question was addressed to the village leaders only. The whole process of collecting this additional data, including the identification of location codes, was handled by professional statistical officers at the county level in the six surveyed provinces. It is, therefore, expected that the dates of the HRS reforms are reasonably reliable.

with an output quota, with any additional output providing these households with their income.[2] One year later, these teams using the HRS produced more output than other teams in the same area. For example, the increase in grain output in 1979 as compared with 1978 by the teams that adopted the HRS in Chuxian, Quanjiao, Laian, and Jiashan counties were 35.7%, 35.7%, 37.1%, and 31.0%, respectively, compared with 12.5%, 12.4%, 0.7%, and 0.3% by other teams that remained in the collective system in the same four counties (Chen, 1981, p. 100). The central government was impressed by the achievements of the new HRS and welcomed the reform, but restricted it to the poor agricultural regions where people had lost most confidence in the collective system. Lin (1988) and Chen (1981) concluded that this restriction was not effective and wealthy regions welcomed the household responsibility system as enthusiastically as poor regions. However, as discussed later in this paper, our study found that the poorer areas did launch the HRS reform earlier than the wealthier areas. It is clear that the HRS reform spread rapidly to all parts of China, replacing the collective PTS in approximately 4 or 5 years. The HRS was accepted in late 1981 officially throughout China. Only 1.0% of all production teams in China had changed to the HRS as of January 1980. By December 1980, 14.4% had changed, by July 1981, 28.2% had changed, and by October 1981, 45.1% had changed (*Economic Weekly*, A Chinese periodical published in Beijing, January 11, 1982). By the end of 1983, approximately 94.2% of rural households in China had adopted the HRS (State Statistical Bureau, 1984, p. 131). Lin (1997) summarily reported that the percentage of production teams adopting the HRS increased from 1% in 1979 to 98% by 1993.

Figures 1 and 2 present the cumulative percent distribution of the rural sample villages that launched the HRS reform in the six provinces surveyed in this study. Guizhou, Gansu, Guangdong, and Shangdong started the reform in 1979. After the middle of 1980, the reform accelerated: 98% of the villages had launched reform by the end of 1981 in Guizhou; 97% had done so by March 1983 in Gansu; 95% had done so by the end of 1983 in Guandong; and 95% had done so by February 1985 in Shangdong. The Liaoning and Beijing villages started the reform later in March 1981 and in October 1981, respectively. By the time the surveys were conducted in April 1987, 78% and 90% of the sampled villages in Liaoning province and in the surrounding rural counties of Beijing had launched the reform. The main reasons why Liaoning province started the reform later and ended up with much lower cumulative percent reformed as compared with the other four provinces is that Liaoning had a larger concentration of heavy industry, and the degree of urbanization was much higher than that in the other four provinces.[3]

[2]The government also raised quota procurement prices and later set protective floors to the prices, while allowing farmers to receive even higher prices determined increasingly in local markets for the output above contracted quotas. Crop allocations were also relaxed to permit farmers to exploit regional comparative advantages and specialize in cash crops (Johnson, 1990; Lin, 1992a, 1997).

[3]For example, according to the 1982 census, urban population accounted for 42.0% in Liaoning, whereas the corresponding figures were 19.2%, 17.9%, 18.9%, and 16.0% in Shandong, Guangdong, Guizhou, and Gansu provinces, respectively. It was estimated that approximately one tenth of the state-owned enterprises of middle and large size in China are located in Liaoning province (*People's Daily*, overseas edition, July 23, 1997).

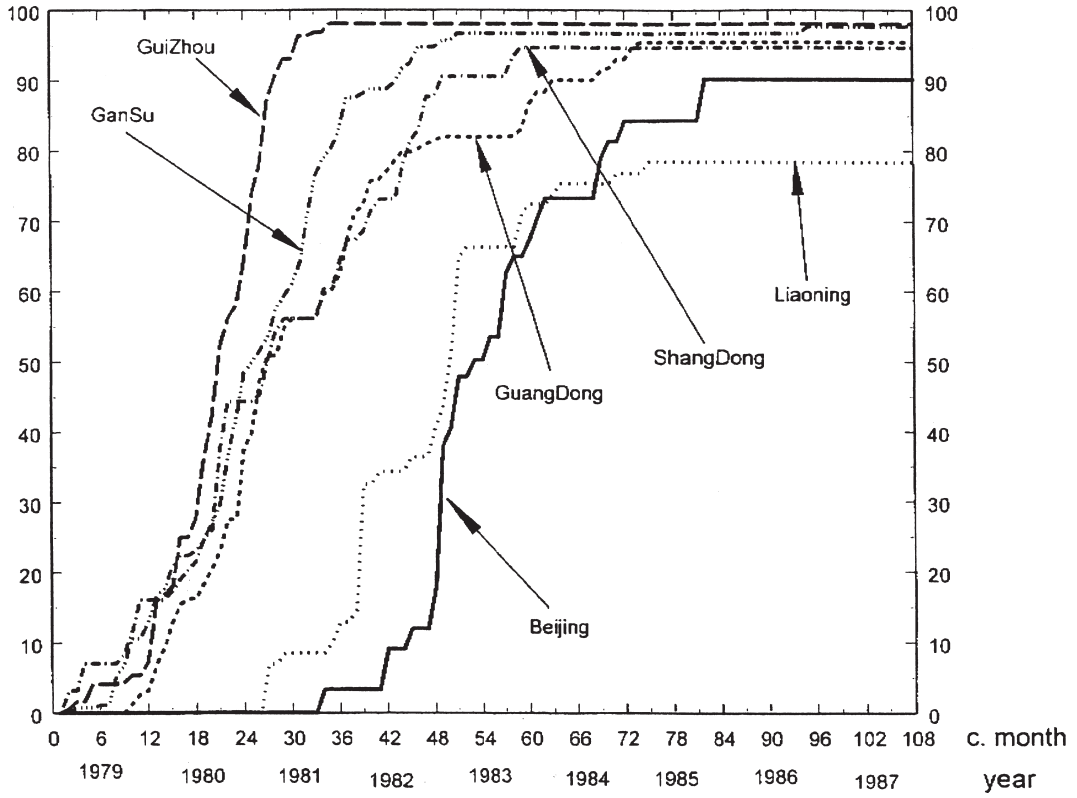

Fig. 1. Cumulative percent distribution of villages which launched HRS reform.

Table 2 presents sample statistics for two parts of our sample, those living in Beijing, Liaoning, Shangdong (cluster A), which tended to be more advanced economically and later in reforms, and Guangdong, Guizhou, and Gansu (cluster B), which tended to be poorer regions initially and earlier in reforms, and for the six surveyed provinces combined. Table 1 cross tabulates the proportions of each province's rural clusters that fall in four reform timing categories. The earlier the reform was launched, the higher the proportion of women and their husbands with no education, the lower proportion engaging in nonagricultural work, the higher proportion in extended family household, and the larger the average household size. Whether the household has a TV, refrigerator, washing machine, bicycle, or a higher average annual income are all negatively related to the timing of the reforms. Evidently, wealthier areas started the reform later or did not introduce it at all. This finding, based on our individual data, is consistent with the conclusion drawn by some previous studies based on regional patterns or qualitative field observations.

Using the aggregated data at the provincial level, Lin (1987) found that the average size of the team and the average number of draft animals per team were positively related to the spread of the HRS reform, whereas the average total horsepower of machinery per team had a negative relationship to the spread of the HRS reform. Based on field research from Janu-

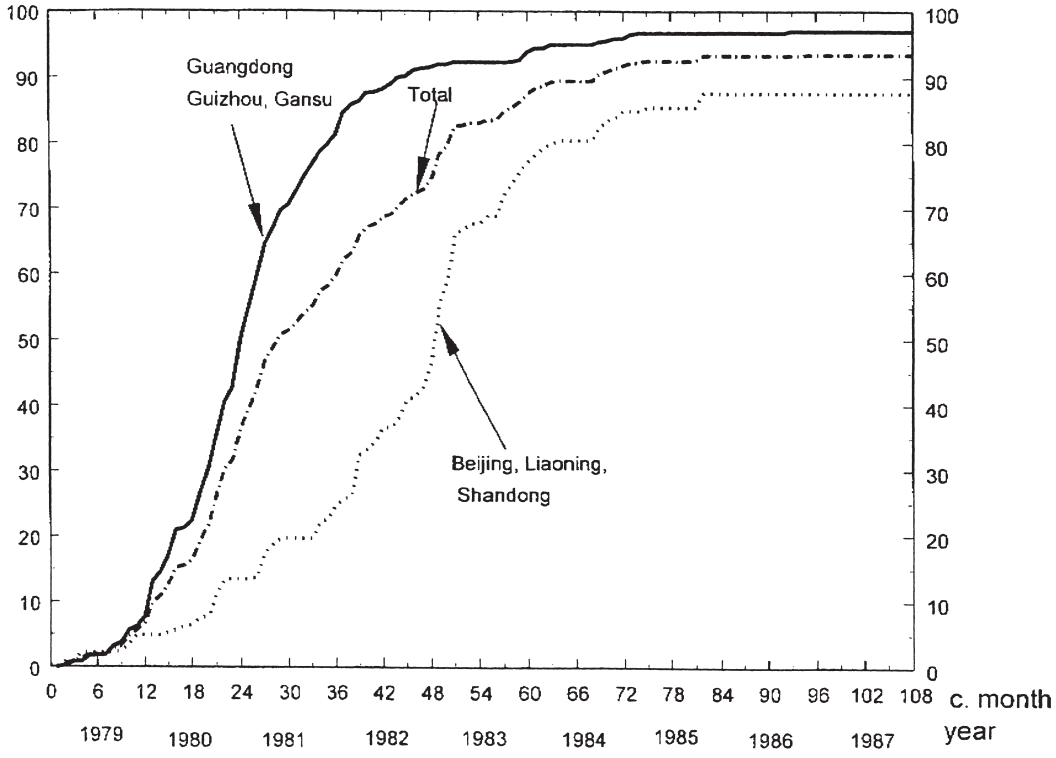

Fig. 2. Cumulative percent distribution: cluster A, cluster B, and six provinces combined.

ary through July 1981 in different areas in Jiangsu province, Zweig (1985) found that production teams in the vicinity of cities or suburban teams, which were mainly engaged in vegetable production, did not initiate the HRS reform as quickly as other areas, because vegetable production, with its numerous varieties, creates complicated accounting and organizational problems when individual household quotas are used. Zweig also found the HRS reform appeared first in areas more dependent on dry-field crops, because wet rice cultivation, particularly in hilly areas, requires complicated irrigation schedules and careful coordination when the land is divided among households (Zweig, 1985, p. 143–144).

We do not have the socioeconomic data from the early 1980s for the different reform timing groups; the socioeconomic data presented in Table 2 were collected in 1987 when the fertility survey was conducted. The poorer areas had earlier reforms perhaps because the peasants in these regions knew that they had more to gain by reforming the inefficient PTS. The richer areas, which implemented the reform later than average, were often in suburban areas. Socioeconomic development in these richer areas had also been more successful after 1979, according to the general policy of relaxing the centrally planned economy. The timing of the reform in each area of China may thus reflect the gains expected by the local farmers. The socioeconomic changes since 1979, in all areas of the six provinces under study, progressed in the same direction but at different speeds. The general patterns shown in Tables 1 and 2 may also roughly reflect the general situation in China during the early 1980s when the rural institutional reform started.

4. Methodology and empirical model specification

The basic methodology adopted in this study used life-table analysis and multivariate logistic regression to estimate fertility differences by the timing of the rural reform.[4] The basic question to be answered is: How did the HRS reform affect fertility in rural areas of China? The dependent variable is duration-specific probabilities of bearing the second, third, or fourth birth. Duration here refers to the number of years (measured in months) since the last birth. We emphasize parity in our analysis because contemporary Chinese fertility varies substantially by parity. For example, the probability for a woman who has two children to bear a third child is much smaller than the probability for a woman who has one child to have a second. These differences are partly the result of the strict birth control policy implemented by the government. We do not include the first birth in our analysis because virtually all women have had at least one birth, and most rural couples have their first birth as soon as possible after marriage. Births of fifth and higher order are also excluded in this study because such high-order births are not common in China after 1979, and the subsample sizes for such rare events are too small to analyze here meaningfully.

The novel explanatory variable in this study is how long ago the HRS reform occurred. In considering timing of the reform, we divide the sample (villages) into four categories as follows:

1. Early reform (1979–1980): launched before December 31, 1980
2. Middle reform (1981–1982): launched between January 1981 and December 1982
3. Late reform (1983–1987): launched between December 1982 and the date of the survey, which occurred in March or April 1987
4. No reform: no reform had been implemented until the time of the survey in 1987.

The early, middle, late, and no reform groups consist of 36.4%, 38.1%, 19.0%, and 6.5% of the total sample, respectively (Table 1). We constructed different fertility life tables for each of these four reform timing groups. Subsequently, the reform timing groups are introduced as dummy variables in our logistic regression models.

[4]For those women who are still of reproductive age at the time of the survey, we do not know whether they will give birth(s) later and when, if they do. This problem of "right-censoring" is handled by the life-table approach, at least to a large extent (Elandt-Johnson & Johnson, 1980). The life-table approach provides informative summary measures of the overall level and timing of fertility. However, the life-table measures have two major limitations. The life-table probabilities do not control for the influence of other covariates. Therefore, a multivariate regression model is used to study the effects of each specified covariate on fertility, while controlling for the effects of other covariates. The second limitation of the life-table approach is that when more variables are of interest, the life-table approach quickly encounters problems because of small sample sizes, requiring too many partitions of data to estimate relatively rare events (Menken, Trussell, Stempel, & Babakol, 1981). The combination of life-table and multivariate hazards or logistic regression model has been called a marriage between the life table and the multivariate regression (Menken et al., 1981). Numerous studies in demography and sociology show that the multivariate hazard and logistic models have two advantages in analyzing event history data in comparison to the traditional multiple regression techniques. In particular, the multivariate hazard or logistic models can adequately handle the censored data (exploits the event history information) and the time-varying covariates (Allison, 1984; Foster, Menken, Chowdhury, & Trussell, 1987).

Table 2
Socioeconomic characteristics among different reform timing groups

Provinces or municipalities	Early reform	Middle reform	Late reform	No reform
A. Beijing, Liaoning, Shandong (cluster sample size = 9517)				
Percent women with no education	60.99	24.04	12.44	15.32
Percent husband with no education	20.02	6.88	3.74	4.68
Percent women in nonagriculture	3.39	17.35	25.03	32.51
Percent husband in nonagriculture	23.33	40.02	55.39	53.02
Percent extended family	32.31	24.96	24.57	22.13
Percent with television	11.19	44.73	67.78	66.72
Percent with refrigerator	.16	1.50	5.26	8.43
Percent with washing machine	.71	15.06	36.55	39.32
Percent with bicycle	95.04	92.58	94.53	94.81
Average household size	5.28	4.65	4.52	4.48
Average income per year	1782	1915	2287	2599
B. Guangdong, Guizhou, Gansu (cluster sample size = 15683)				
Percent women with no education	57.26	52.07	21.55	25.27
Percent husband with no education	19.71	16.37	7.07	10.49
Percent women in nonagriculture	4.11	5.05	22.36	35.33
Percent husband in nonagriculture	18.33	17.77	46.81	63.38
Percent extended family	35.19	35.49	35.11	31.91
Percent with television	8.31	13.28	40.09	52.68
Percent with refrigerator	.20	.19	2.09	4.50
Percent with washing machine	.72	1.72	12.63	17.77
Percent with bicycle	38.00	58.44	88.99	8373
Average household size	5.90	5.95	5.62	5.20
Average income per year	1158	1328	3337	2548
Six provinces combined (total sample size = 25,200)				
Percent women with no education	57.77	42.89	14.08	18.15
Percent husband with no education	19.76	13.27	4.34	6.33
Percent women in nonagriculture	4.01	9.08	24.55	33.31
Percent husband in nonagriculture	19.02	25.05	53.85	55.91
Percent extended family	34.79	32.04	26.47	24.91
Percent with television	8.71	23.57	62.79	62.73
Percent with refrigerator	.20	.61	4.69	7.31
Percent with washing machine	.72	6.09	32.24	33.19
Percent with bicycle	45.89	69.61	93.53	91.66
Average household size	5.81	15.53	4.72	4.68
Average income per year	1244	1520	2476	2585

Early reform completed in 1979–1980,
Middle reform completed in 1981–1982,
Late reform completed in 1983–April 1987,
No reform occurred up to April 1987.

China announced and started to implement its famous and controversial one-child policy in 1979. After approximately 2 years, the one-child policy reached its most severe stage in 1982–1984, when fertility fell to its lowest level in the 1980s. However, resistance among the farmers mounted. Fearing a deterioration in the relationship between the government and

rural people, the Chinese Central Government issued Document No. 7 in 1984, relaxing the one-child policy to a large extent. Around the beginning of 1985, rural couples whose first child was a girl were allowed to have a second birth in almost all rural areas. In six provinces of Guangdong, Hainan, Yunnan, Ningxia, and Xingjian, all rural couples were officially allowed to have two children. The moderation of policy, the changing age structure (e.g., the large cohorts born in the early 1960s reached marriageable ages and began childbearing), as well as other factors led to a considerable increase in period-specific birth rates in 1985–1987. We decided, therefore, to focus our analysis on fertility differentials under three policy regimes: 1979 through 1981, 1982 through 1984, and 1985 through 1987. Because Chinese fertility may be strongly affected by these changes in policy, we constructed different life tables in different policy periods for different reform timing groups, respectively. The policy periods are later included as dummy variables in our logistic regression models.

In the logistic regression model, dummy variables are also included to capture provincial differences in socioeconomic and policy conditions. However, the subsample size would be too small if we had to construct the fertility life tables in each province. Therefore, we grouped the provinces according to their levels of socioeconomic development. The socioeconomic development in the provinces of Liaoning and Shangdong and the municipality of Beijing are among the highest in China. Consequently, they are grouped as cluster A in our analysis. The official fertility policies in Beijing, Liaoning, and Shangdong are, on average, to allow 1.33, 1.50, and 1.55 children per couple, respectively,[5] and the actual total fertility rates were 1.44, 1.70, and 2.11, respectively, in the late 1980s. Guizhou and Gansu are among the poorest provinces in the country, and their actual total fertility rates were 3.03 and 2.30, respectively, in the late 1980s. Economic development has progressed very rapidly in Guangdong, and it has become one of the riches areas in China. However, fertility policy was much more relaxed in Guandong as compared with any other province where the Han Chinese are a majority. All rural couples in Guangdong were allowed to have two children, regardless of the sex of the first child. The official fertility policy in all other Han-dominated provinces in China was below 1.7 children per couple, but Guangdong was an outlier by allowing 1.85 children per couple. This official policy of Guangdong was only slightly less than what was officially allowed in most minority-dominated (non-Han) provinces. The actual total fertility rate in Guangdong in the late 1980s was 2.48.[6] Therefore, we grouped Guangdong, Guizhou, and Gansu as cluster B in our analysis. Although they are a more heterogeneous group in terms of socioeconomic development, they all pursued more relaxed population policies, perhaps for different reasons.

[5]The official fertility policy mentioned in this paper is drawn from the estimates by the department of statistics and planning of the State Family Planning Commission, based on the weighted average according to the provincial regulations. The official fertility policy refers to the rural and urban sectors combined, because the data for the rural and urban sectors separately are not available. Because the policy in urban areas is much stricter (basically one child per couple, except for some special cases), the average number of children per couple consistent with the official fertility policies in the rural areas was higher than the published province-wide figures reported in this paper.

[6] The main reason why the fertility policy in Guangdong was more relaxed is because this region is the home of many overseas Chinese. Local government officials did not want a strict birth quota policy to discourage the inflow of capital investments from these overseas Chinese.

Three variables—reform timing, policy periods, and regional clusters—were used in both our aggregate life-table and individual multivariate logistic regression analyses. To control for the effects of other demographic and socioeconomic factors, we introduced the following additional household covariates in our logistic regression models: education of women and their husbands, occupation of women and their husbands, whether the household was extended (i.e., includes parents or other adult relative of the respondent couple), income per year, and the wealth of the household as proxied by ownership of a television set, refrigerator, washing machine, or bike.

5. Variations of parity progression ratios and their relative changes based on the life-table analysis

We first estimated the duration-specific probabilities of bearing a second, third, and fourth child for the different reform timing groups in different policy periods. Life tables are based on those estimated probabilities, assuming that the maximum duration to next birth is 15 years.[7] The proportions of women who had second, third, and fourth births at the maximum duration of 15 years since the last birth are the parity progression ratios on the basis of which we estimated the implied total fertility rate.[8] The estimated parity progression ratios and implied total fertility rates are presented in Table 3. With a few exceptions, the parity progression ratios for the second, third, and fourth births and implied total fertility rates in all policy periods in both clusters A and B, suggest that the early reform group had the highest ratio, the middle reform group had the second highest, the late reform group had the second lowest, and the no reform group had the lowest ratio. For example, in Beijing, Liaoning, and Shangdong, the parity progression ratios from second birth to the third birth were 0.712, 0.470, 0.338, and 0.310 in the early, middle, late, and no reform groups in the first policy period of 1979 through 1981, respectively, whereas these ratios were 0.470, 0.380, 0.273, and 0.226 in the third period of 1985 through 1987, respectively. The parity progression ratios from the third birth to the fourth birth in Guangdong, Guizhou, and Gansu were 0.933, 0.828, 0.424, and 0.244 in the early, middle, late, and no reform groups in the period of 1979 through 1981, respectively, whereas these ratios were 0.492, 0.441, 0.513, and 0.350 in the third policy period of 1985 through 1987, respectively. The implied total fertility rates in Beijing, Liaoning, and Shangdong were 2.48, 2.34, 2.34, and 1.87 in the early, middle, late, and no re-

[7] Almost no women had an additional birth after an interval of 15 years.

[8] Denote $b(I, j, r, t)$ as the estimated probability of giving i^{th} birth at duration j among women who have given $(I\text{-}1)^{th}$ birth in the reform timing group r in the policy period t. Denote $l(I, j, r, t)$ as the life-table proportion of women who have exactly given I births at duration j in the reform timing group r in the policy period t. Where $I = 0, 1, 2, 3, 4+$, referring to parity; $j = 0, 1, 2, 3, \ldots, 15$, referring to duration (years) since last birth; $r = 1, 2, 3, 4$, referring to early, middle, late, and no reform groups, respectively; $t = 1, 2, 3$, referring to policy periods 1979 through 1981, 1982 through 1984, and 1985 through 1987, respectively. Let $l(I, 0, r, t) = 1.0$ and define $l(I, j + 1, r, t) = l(I, j, r, t) - l(I, j, r, t)b(I + 1, j, r, t)$. Let $p(I, r, t)$ be the parity progressive ratio from i^{th} birth to $(I + 1)^{th}$ birth in the reform group r in the policy period t, which is calculated as: $p(I, r, t) = 1.0 - l(I, 15, r, t)$. Let $F(r, t)$ be the implied total fertility rate in reform group r in policy period t, and it is calculated as: $F(r, t) = p(1, r, t) + p(1, r, t)p(2, r, t) + p(1, r, t)p(2, r, t)p(3, r, t) + p(1, r, t)p(2, r, t)p(3, r, t)p(4+, r, t)$.

Table 3
Parity progression ratios and implied total fertility rates for the different reform timing groups in different fertility policy periods, by cluster

	A. Beijing, Liaoning, Shandong			B. Guangdong, Guizhou, Gansu		
	1979–81 (1)	1982–84 (2)	1985–87 (3)	1979–81 (1)	1982–84 (2)	1985–87 (3)
First birth to second birth						
Early reform	.872	.786	.885	.994	.987	.991
Middle reform	.904	.634	.790	.997	.977	.988
	(3.7)[a]	(−19.3)	(−10.7)	(0.2)	(−1.0)	(−0.3)
Late reform	.981	.729	.659	.950	.792	.896
	(12.5)	(−7.3)	(−25.5)	(−4.4)	(−19.8)	(−9.6)
No reform	.682	.437	.620	.880	.715	.908
	(−21.8)	(−44.4)	(−29.8)	(−11.5)	(−27.6)	(−8.4)
Second birth to third birth						
Early reform	.712	.410	.470	.916	.838	.769
Middle reform	.470	.216	.380	.889	.830	.717
	(−34.0)	(−47.3)	(−19.1)	(−2.9)	(−1.0)	(−6.8)
Late reform	.338	.187	.273	.592	.578	.608
	(−52.5)	(−54.4)	(−41.9)	(−35.4)	(−31.0)	(−20.9)
No reform	.310	.150	.226	.474	.239	.395
	(−56.5)	(−63.4)	(−51.9)	(−48.3)	(−71.5)	(−48.6)
Third birth to fourth birth						
Early reform	.258	.149	.124	.933	.795	.492
Middle reform	.217	.133	.125	.828	.798	.441
	(−15.9)	(−10.7)	(0.8)	(−11.3)	(0.4)	(−10.4)
Late reform	.218	.103	.135	.424	.452	.513
	(−15.5)	(−30.9)	(8.9)	(−54.6)	(−43.1)	(4.3)
No reform	.240	.125	.244	.244	.181	.350
	(−7.0)	(−16.1)	(96.8)	(−73.8)	(−77.2)	(−28.9)
Total fertility rates						
Early reform	2.48	2.06	2.24	3.73	3.44	3.10
Middle reform	2.34	1.76	2.06	3.59	3.41	2.93
	(−5.6%)	(−14.6%)	(−8.0%)	(−3.8%)	(−0.9%)	(−3.9%)
Late reform	2.34	1.85	1.84	2.68	2.36	2.62
	(−5.6%)	(−10.2)	(−17.9%)	(−28.2%)	(−31.4%)	(15.5%)
No reform	1.87	1.44	1.70	2.33	1.84	2.30
	(−24.6%)	(−30.1%)	(−24.1%)	(−37.5%)	(−46.5%)	(−25.8%)

[a]The figures in parentheses are the percentage difference between the group and the early reform group. The negative sign means smaller than the figure for the early reform group, and a positive sign means larger than the figure for the early reform group.

form groups in the period of 1979 through 1981, respectively, whereas these figures were 2.24, 2.06, 1.84, and 1.70 in the period 1985 through 1987, respectively. The implied total fertility rates in Guangdong, Guizhou, and Gansu were 3.73, 3.59, 2.68, and 2.33 in the early, middle, late, and no reform groups in the period 1979 through 1981, respectively, whereas these figures were 3.10, 2.98, 2.62, and 2.30 in the period 1985 through 1987, respectively. The earlier reform groups tended to continue to exhibit higher fertility levels several years af-

ter the reforms had diffused throughout China, as they did at the outset of the reforms, but they declined in terms of total fertility rates everywhere.

Consider next the variations in the parity progression ratios among different reform timing groups in the same policy period. The figures in the parentheses in Table 3 are the percentage differences between a later reform group's fertility and the early reform group's fertility. The fertility differences among the different reform timing groups tended to increase in the second period, 1982 through 84, and then to decrease in the third period, 1985 through 1987, and in a few cases it was even reversed. For example, the parity progressive ratios in cluster A from second birth to the third birth for the middle, late, and no reform groups were 34.0%, 52.5%, and 56.5% lower than the fertility for the early reform group in 1979 through 1981, respectively. These figures were 47.3%, 54.4%, and 63.4% lower, respectively, in 1982 through 1984, but 19.1%, 41.9%, and 51.9% lower, respectively, in 1985 through 1987. The parity progression ratios from third birth to fourth birth in cluster B for the middle, late, and no reform groups were 11.3%, 54.6%, 73.8% lower than the ratio for the early reform group in 1979 through 1981, respectively. The ratios for the middle and no reform groups became 10.4% and 28.9% lower than the early reform group, respectively, in the final period of 1985 through 1987. However, the ratio for the late reform group was 4.3% higher than the early reform group in 1985 through 1987, in contrast to it being 54.6% lower in 1979 through 1981.

Table 4 presents the percentage changes in parity progression ratios over time. Note that between the periods 1979 through 1981 and 1982 through 1984, the parity progression ratios for having second, third, and fourth births in all reform timing groups decreased in 23 of 24 cases. The reduction tended to be larger in the late, or no reform groups, compared with the early and middle reform groups. This trend is largely reversed when the periods 1985 through 1987 and 1982 through 1984 are compared—the parity progression ratio tended to increase in 1985 through 1987 as compared with 1982 through 1984 (17 of 24 cases), and the amount of increase in the late and no reform group was generally larger than that in the early and middle reform groups. For example, in Guangdong, Guizhou, and Gansu provinces, the parity progression ratios from first birth to the second birth in the early, middle, late, and no reform groups in 1982 through 1984 decreased by 0.7%, 2.0%, 16.7%, and 18.8%, respectively, as compared with 1979 through 1981. However, these ratios increased by 0.4%, 1.1%, 13.1%, and 27.1%, respectively, in 1985 through 1987 as compared with 1982 through 1984.

The implied total fertility rate in the four reform groups in Guangdong, Guizhou, and Gansu in the period 1982 through 1984 all decreased as compared with 1979 through 1981, and the magnitude of the decrease in the late and no reform group was higher than the early reform group by a margin of 51.2% and 171.1%, respectively. However, the implied total fertility rates in the early and middle reform groups in Guangdong, Guizhou, and Gansu in 1985 through 1987 continued to decline by 9.8% and 12.5%, respectively, whereas the corresponding figures increased by 10.7% and 24.8%, respectively, in the late and no reform groups.

How are these fertility patterns to be understood? One hypothesis is that the rural institutional reform in China weakened the state's birth control efforts in 1982 through 1984, but these birth control efforts were tightened in the later period 1985 through 1987, thereby reversing the trend in 1985 through 1987 as compared with 1982 through 1984. However, correlation between other uncontrolled socioeconomic determinants of fertility could modify these conclusions if they were related to the timing of the HRS reforms. If there had been no

HRS reform at all, would the same fertility trend have been observed as a result of the variations of other socioeconomic factors among the different reform groups? Table 3 shows that the initial fertility levels in 1978 through 1981 were noticeably higher in early reforms regions, and Table 2 confirms that their socioeconomic status was lower. To assume that the rural reform occurred randomly across China is not plausible. To control for the effects of the other socioeconomic factors, we present a multivariate logistic regression analysis at the household level in the next section.

6. Variations of odds ratios of childbearing and their relative changes based on a logistic regression

In addition to the reform timing groups and the policy periods, we now included socioeconomic covariates for the woman's and her husband's education and occupation, whether they reside in an extended household, annual income, provincial controls, and a quadratic effect of duration since last birth as control variables in our logistic model. The estimates of the effects of these socioeconomic covariates on fertility are similar to previous studies (e.g., Schultz & Zeng, 1995), in that women with higher socioeconomic status tended to have

Table 4
Percentage changes in parity progression ratios and implied total fertility rates over time for the different reform timing groups, by cluster

	A. Beijing, Liaoning, Shandong		B. Guangdong, Guizhou, Gansu	
	1982–84/1979–81 (1)	1985–87/1982–84 (2)	1982–84/1979–81 (1)	1985–87/1982–84 (2)
First birth to second birth				
Early reform	−9.85	12.61	−.70	.44
Middle reform	−29.91	24.74	−1.97	1.12
Late reform	−25.72	−9.59	−16.65	13.12
No reform	−35.88	42.02	−18.75	27.10
Second birth to third birth				
Early reform	−42.33	14.45	−8.56	−8.28
Middle reform	−54.02	75.83	−6.66	−13.60
Late reform	−44.86	46.14	−2.36	5.13
No reform	−51.77	51.20	−49.54	65.01
Third birth to fourth birth				
Early reform	−42.28	−16.40	−14.71	−38.14
Middle reform	−38.71	−6.24	−3.54	−44.82
Late reform	−52.51	30.69	6.70	13.40
No reform	−47.98	95.67	−25.88	93.80
Total fertility rate				
Early reform	−17.10	9.11	−7.74	−9.83
Middle reform	−24.56	16.82	−5.00	−12.50
Late reform	−21.07	−0.32	−11.70	10.70
No reform	−23.04	17.83	−20.98	24.83

Table 5
Odds ratios of probabilities of childbearing and their percentage change in different reform timing groups, between different fertility policy periods, based on the logistic regression, controlling for province

	Odds ratios			Percentage change in odds ratios	
	1979–81 (1)	1982–84 (2)	1985–87 (3)	1982–84/ 1979–81 (4)	1985–87/ 1982–84 (5)
First birth to second birth					
Early reform	1.219	1.158	1.076	−5.0	−7.1
Middle reform	1.239	.848	.839	−31.6	−1.1
	(1.6)[a]	(−26.8)	(−22.0)		
Late reform	1.118	.600	.491	−46.3	−18.2
	(−8.5)	(−48.2)	(−54.4)		
No reform	1.000	.405	.411	−59.5	1.5
	(−18.0)	(−65.0)	(−61.8)		
Second birth to third birth					
Early reform	2.005	1.448	1.092	−27.8	−24.6
Middle reform	1.722	1.277	.898	−25.8	−29.7
	(−14.1)	(−11.8)	(−17.8)		
Late reform	1.154	.725	.761	−37.2	5.0
	(−42.4)	(−49.9)	(−30.3)		
No reform	1.000	.388	.568	−61.2	46.4
	(−50.1)	(−73.2)	(−48.0)		
Third birth to fourth birth					
Early reform	1.722	1.267	1.035	−26.4	−18.3
Middle reform	1.407	1.059	.822	−24.7	−22.4
	(−18.3)	(−16.4)	(−20.6)		
Late reform	1.230	.877	1.345	−28.7	53.4
	(−28.6)	(−30.8)	(30.0)		
No reform	1.000	.550	.909	−45.0	65.3
	(−41.9)	(−56.6)	(−12.2)		
Average of second, third, and fourth births					
Early reform	1.649	1.291	1.068	−19.3	−16.7
Middle reform	1.456	1.061	.853	−27.4	−17.7
	(−11.7%)	(−17.8%)	(−20.1%)		
Late reform	1.167	.734	.866	−37.4	13.4
	(−29.2%)	(−43.1%)	(−18.9%)		
No reform	1.00	.448	.629	−55.2	37.7
	(−39.3%)	(−65.3%)	(−41.1%)		

[a]The figures in the parentheses are the percentage differences between the group and the early reform group.

The negative sign means smaller than the figure for the early reform group, and a positive sign means larger than the figure for the early reform group.

lower fertility rates, other things being equal. We do not present and discuss these full estimates in this paper because our focus here is on the impact of the rural institutional reform on fertility.

Estimates are first reported that combine all six provinces, in which regional variation is simply allowed for by the inclusion of dummy variables. Table 5 presents the odds ratios of the probability of childbearing to the probability of having a next birth in the reference group. The percentage changes in these odds ratios between different reform timing groups in different policy periods are reported in parentheses relative to the early reform regions. For each parity, we have chosen the no reform group in 1979 through 1981 as the reference group, whose odds ratio is therefore 1.0. If the odds ratio is larger or smaller than 1, the parity-specific birth probability in this group in this period is higher or lower than the reference group. When we controlled for other socioeconomic variables in Table 5, the earlier reform group tended to have higher odds ratios of fertility in all policy periods (in 25 of 27 cases). The differences of the odds ratios among different reform timing groups in the period 1982 through 1984 tended to increase in most cases, but the differences tended to decrease (or even reverse sign in one case) in the later period 1985 through 1987. For example, the odds ratios of the no reform group in 1979 through 1982, 1982 through 1984, and 1985 through 1987 were 41.9%, 56.6%, and 12.2% lower than those of the early reform group, respectively.

The percentage changes in the odds ratios between periods are presented in columns 4 and 5 of Table 5. Comparing the periods 1982 through 1984 and 1979 through 1981, the odds ratios of parity-specific birth probabilities in all reform timing groups decreased, with the reductions being larger in the late or no reform groups compared with the early and middle reform groups. This trend is reversed between the periods 1985 through 1987 to 1982 through 1984—the odds ratios in the late and no reform groups increased considerably for the progressions to third and fourth births, whereas they continue to decrease in the early and middle reform groups, where they were initially higher.

The logistic models are estimated separately for cluster A (Beijing, Liaoning, Shangdong) and cluster B (Guangdong, Guizhou, Gansu), and the results are summarized in Table 6. The relative changes in odds ratios for clusters A and B replicate the patterns described above, namely, either in regions where fertility policy is more strict (A versus B) or in periods when fertility policy is more relaxed (1979 through 1981 versus 1982 through 1984), the rural reform tended to weaken birth control, but this pattern is reversed in the final policy period, 1985 through 1987.

7. Explanations

Our empirical findings based on both the life table analysis comparisons and the multivariate logistic regression analysis controlling the other socioeconomic factors have shown that the rural institutional reform tended to weaken birth control in the second period 1982 through 1984, but it tended to strengthen birth control in the third period 1985 through 1987. Other socioeconomic factors that may influence fertility cannot be included in our analysis because of lack of data, and the omission of these controls could bias our estimate if the controls were correlated with the reform groupings. The existing evidence from the logit analysis suggests that such additional controls for heterogeneity available from our survey did not greatly affect the estimated impact of the reform timing categories, and therefore including

Table 6
Percentage change in odds ratios of probability of childbearing in different reform groups, between different fertility policy periods, based on the logistic regression by cluster, controlling for province

	Cluster A: Beijing, Liaoning, and Shandong		Cluster B: Guangdong, Guizhou, and Gansu	
	1982–84/1979–81 (1)	1985–87/1982–84 (2)	1982–84/1979–81 (1)	1985–87/1982–84 (2)
First birth to second birth				
Early reform	−1.30	−2.02	−.08	−.15
Middle reform	−11.09	−.38	−1.05	−.05
Late reform	−27.65	−10.23	−3.87	−2.72
No reform	−35.21	1.03	−9.31	.37
Second birth to third birth				
Early reform	−18.81	−18.39	−6.34	−8.30
Middle reform	−18.35	−23.36	−7.13	−12.09
Late reform	−30.67	4.17	−17.93	2.51
No reform	−55.08	39.90	−40.83	27.78
Third birth to fourth birth				
Early reform	−22.17	−15.86	−13.03	−10.39
Middle reform	−21.32	−19.97	−13.76	−14.28
Late reform	−25.41	44.46	−17.65	27.04
No reform	−41.71	57.83	−33.11	41.18
Average of second, third, and fourth births				
Early reform	−14.1	−12.1	−6.5	−6.3
Middle reform	−16.9	−14.6	−7.3	−8.8
Late reform	−27.9	12.8	−13.2	8.9
No reform	−44.0	32.9	−27.8	23.1

better controls for those opting for earlier reforms in rural institutional arrangements would probably not change our findings substantially .

First, we consider why the rural institutional reform movement might have tended to weaken fertility control initially in the period 1982 through 1984. The rural reform removed some of the government's administrative capacity to monitor and influence family planning behavior, at least in the early stages of the reform. Under the PTS, the penalty fees for people who had "unplanned" births could be deducted directly from their food ration, cash, and other income-in-kind that the team distributed residually to the household. This was easy for the authorities to enforce and difficult for the farmers to avoid. But this income distribution mechanism did not exist under the new HRS. The penalty had to be collected directly from the household, which was much more difficult for the government to implement. People could refuse payment of the penalty because they had no money. In addition, under the PTS, village leaders could devote much of their working time to family planning activities, because they were fully paid. With the HRS, the village leaders had to work on their assigned plots or other businesses to sustain their income, and they were not directly and fully paid to engage in family planning activities. The Chinese government tried to tighten up the implementation of the family planning program in the period 1982 through 1984, and consequently those regions that began to introduce the reforms later,

or not at all, were less affected by the relaxation of controls on births than those who were the first to initiate the HRS. Second, after farmers adapted for many years to the PTS which did not encourage them to work particularly diligently, farmers suddenly saw opportunities to work and earn extra income. Their short-run reaction to the HRS might have been to have more children, especially sons, to increase household labor supply. This behavioral response was more difficult if the regions began the reforms later, because administrative procedures had by this time been tightened substantially. Third, the household responsibility system weakened the power of the officially appointed party and village leaders to coordinate production activities and control community affairs. The relative importance of family kinship relations may have correspondingly increased, which may have further encouraged farmers to have more sons to enhance their traditional status in their extended family and in the local community.

What are the mechanisms that led the early and middle reform groups to continue to reduce their fertility, whereas the late and no reform groups increased their fertility in the later period 1985 through 1987? The following explanation may shed light on understanding this pattern. First, as observed by Nee (1985) and described earlier in this paper, families with many small children were not penalized for running a deficit account with the production team. By overdrawing the household account, the team subsidized having more children, and thereby reduced the parental cost of additional children. Second, the HRS reform changed the previous mode of "eating-from-a-big-pan" under the PTS, into a market competition system, in which each household provided for its own needs. Farmers became increasingly aware of their need to adopt selectively new technology if they were to increase their family income. Based on theoretical and empirical study of the diffusion of high yielding varieties of rice in China, Lin (1992b) concluded that even under the centrally planned economy, farmers, as rational decision makers, would tend to adopt the new agricultural technologies rather than use more labor-intensive traditional production practices to increase their output.[9] Education is extremely important for learning and mastering the new technologies that became the key to increasing incomes in modern agriculture. Under such a system, farmers may pay more attention to the "quality" of their children, instead of merely wanting to have more children. Third, in the PTS, women were credited with making only a small contribution to family income, and the opportunity cost of devoting their time to childbearing versus team production was very low. However, under the new system in which all households are encouraged to increase their income with their assigned land and other means, everyone is likely to work more diligently either in agricultural or nonagricultural activities. Women's time has consequently become more valuable, and the opportunity cost of women bearing and raising additional children has increased for the farm family. Fourth, in the PTS everyone is supposed to stay in the village, and migration was not officially allowed. Opportunities for making money in nonagricultural activities were thus severely limited. This situation changed after the reforms. Many farmers began to move around the country in search of better employment opportunities. The resulting increased mobility encouraged young people to delay their marriage and childbearing and even reduce their fertility goals. The fifth explanation is that the weakened capacity of the government to control fertility at the early stages of the reform may have recovered after a few

[9]Specialization refers to households who concentrate on certain special production processes, such as raising pigs, chicken, fish, mushrooms, or something else, which typically requires a nontraditional technology to be successful.

years, as the authorities adjusted to the new system. For example, some areas introduced compensation for village leaders to perform their part-time work on family planning, and some areas found new ways to collect penalties from farmers who had births above the quota, such as reducing the payment they received from selling their output quota to government agencies.[10]

It is likely that the level of commitment to implementing the one-child policy varied substantially across villages in China, even within a province, and may be correlated across our sample with the timing of the HRS reforms. Both of these policy developments occurred roughly simultaneously in China, but they diffused at different rates in different regions, with the population policy spreading out from the more developed regions, whereas the HRS evolved from less developed regions. The observed patterns in fertility decline by reform group could be partly associated with the underlying heterogeneity of village population policy implementation. For example, if the one-child policy was enforced with greater commitment in more prosperous villages that tended to be relatively late in implementing the HRS reforms, this could explain why in late reform areas fertility declined more during the strict policy period and why during the most relaxed policy period, 1985 through 1987, fertility tended to exhibit a larger rebound in these regions. Conversely, the poorer villages may have experienced less strict implementation of the one-child policy after it was initially announced and hence still had a higher fertility level in the strict period, although they were likely to initiate HRS reforms relatively early and subsequently report continuing declines in fertility even in the relaxed policy environment of 1985 through 1987. This explanation for our empirical findings is plausible, although we do not have the data to test this interpretation.[11] However, this auxiliary explanation does not seem inconsistent with several of our hypotheses for the observed patterns between the timing of the HRS and the declining fertility in the different policy periods.

8. Conclusions

Our empirical study brings together local data on the timing of the household responsibility reforms from 1979 through 1987 and household survey reproductive histories and some socioeconomic information. It has shown that the HRS reform weakened the birth control efforts in the earlier period 1982 through 1984, but that the reforms tended to strengthen birth control efforts in the later period 1985 through 1987. The rural institutional reform has not only accelerated economic development, it may also have contributed to the long-term decline in fertility. The hypothesized mechanisms are that the reforms led to increases in the private monetary and opportunity costs of childbearing, it intensified market competition for the adoption of new production technologies that encourage parents to educate their children, and it allowed workers to become more mobile to locate more favorable employment opportunities, which discouraged and delayed childbearing. As a consequence, the agricultural

[10]The staple foods, and other main products, such as cotton, are still largely traded by government controlled agencies, especially for the contracted quotas, although the farmer may sell any surplus in the free market.

[11]This interpretation of our findings was offered by William Lavely at the University of Washington.

population demands for higher "quality" children have partly replaced demand for having more children. The returns to technical change and mobility generated by the evolving reform have led more young people to delay their marriages and childbearing and adopt a smaller family size goal. The current Chinese one-child policy may be relaxed to allow parents to have two children with ample birth spacing (Greenhalgh & Bongaarts, 1992; Zeng & Vaupel, 1989; Vaupel & Zeng, 1991; Zeng, 1997). In the discussion of this sensitive issue, many policy makers and scholars express the concern that farmers in poorer areas who bear two or three children if they are allowed to have only one child may bear three or four children if permitted to have two. The findings from this study indicate that such a fear may be unwarranted. As described in Table 2 and in the text, the earlier reform groups were located in the poorer areas, and the later reform areas are in the wealthier areas. In the period 1985 through 1987, when the fertility policy was relaxed, the earlier reform and poorer areas continued to reduce their fertility or had a small increase in fertility, whereas the wealthier areas which began their reforms later experienced a considerable increase in fertility during the period of policy relaxation in 1985 through 1987. Farmers in poorer and wealthier areas approach fertility decision making with an eye to their own lifetime goals. The rural institutional reform resulted in an increase in the economic and opportunity costs of childbearing, and the market competition for new production technologies places a premium on management skills that are enhanced by schooling. Labor mobility also increased the private returns to educating children instead of having only more children. This new economic environment encouraged farmers in the poorer and earlier reform areas to reduce their fertility even when the national policy on family size was being relaxed in 1985 through 1987. We infer from this evidence that further socioeconomic development that continues to move in the direction of a competitive market economy, with increased labor mobility, will work to reduce fertility further in rural China. A transition from the one-child policy to a two-child plus spacing policy early in the next century would improve the welfare of the rural Chinese population without encouraging a disproportionate number of farmers in poorer areas to bear three, four, or more children. In such a setting, overall population growth in China can be expected to remain close to zero in the long run.

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