Pacific Economic Review, 9: 3 (2004) pp. 269–290

TRANSFORMATIONS IN CHINA'S POPULATION POLICIES AND DEMOGRAPHIC STRUCTURE

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Abstract. We use data from a 1992 national fertility survey to analyze China's changing demographic patterns between 1970 and 1989, covering marriage, childbearing, fertility and the gender composition of children. The analysis focuses on the relationship between population control policies and the behavior of successive marriage cohorts. Adopting a regression approach, we characterize a set of stylized demographic features in China over the two decades, including new results on women's average age at first marriage and first births, number of children per couple, and sex ratios among children. China's changing demographic patterns differed significantly among urban, township and rural populations.

1. INTRODUCTION

It has been widely believed that China's population control policies have had a profound impact on fertility and other demographic behavior, thereby influencing the size and quality of the labor force in the future. This presumption, however, has been subject to few empirical investigations. One major difficulty of assessing policy impacts is that, concurrently with the implementations of family planning programs since the early 1970s, fundamental socioeconomic changes have occurred in China. Indeed, institutional reforms have occurred whereby pension arrangements, health care systems and other social welfare provisions have evolved with the transition from a planning to a market economy. Other elements, such as a higher level of women's education, urbanization and increase in per capita income, occurred during the same period, and most likely have affected demographic behavior. Thus, isolating the effects of those policies from various socioeconomic influences presents a major research problem to social scientists as well as policy-makers.[1]

This paper has two main purposes. First, we briefly describe Chinese population policies during the 'Later, Longer, Fewer' campaign of the 1970s and the

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[1] Among other studies, Tien (1984) and Zhang (1990) investigated the influence of socioeconomic factors on fertility, while Poston and Gu (1987), Zhang (1994), Johnson (1994), Schultz and Zeng (1995), McElroy and Yang (2000) and Schultz (this issue) analyzed the role of policies and institutions in affecting family choices. A comprehensive assessment of the impact of population policies and socioeconomic changes on demographic behavior over a long period of time remains a challenging research topic.

'One Child' policy regime that started in 1979. This review identifies various government guidelines and regulations, focusing on the timing of policy announcements, the implementation mechanisms and regional variations. We then discuss the *ceteris paribus*, *a priori* expected effects of these polices on key demographic variables. Second, with the policy environment as background, we document China's changing demographic patterns for the period 1970–89. More specifically, we construct eight demographic variables measuring age of marriage, age of childbearing, conception, birth intervals and fertility, as well as the gender composition of children. For most variables we organize the sample by marriage cohorts – the groups targeted by successive policies – to mark time. Using a regression approach, we can describe how these demographic variables have changed over time and vary among populations in cities, townships and rural regions. In light of the policy changes, we are able to infer whether or not the observed demographic behavior is consistent with the anticipated effects of various government interventions. While our analysis cannot separate the effects of Chinese population policies on demographic behavior from the effects of other socioeconomic influences, the attempt to juxtapose the two represents a constructive step toward doing so.[2]

The data used in this paper are from the 1992 Household Economy and Fertility Survey, a representative sample from 14,000 households from 10 Chinese provinces. These data contain rich information on marriage, contraception and other demographic variables that are unavailable in the standard population census and fertility surveys. In addition to examining the standard total fertility rate (TFR), we are able to examine closely, and in parallel, a variety of demographic variables. Our findings suggest that the observed patterns of demographic behavior are broadly consistent with the expected impact of population control policies implemented in China in the two decades.

2. CHINA'S POPULATION POLICIES

In view of China's population policies in the two decades between 1970 and 1990, we need to closely examine the timing of policy announcements and the primary means of implementation. One finds that Chinese population controls are usefully divided into two policy regimes, the 1970s and 1980s.

2.1. *The 1970s: 'Later, longer, and fewer' via 'persuasion'*

Effective implementation of China's population policies started in July 1971.[3] In a State Council Directive, premier Zhou Enlai initiated a nationwide

[2] A comprehensive assessment requires time-series information on major socioeconomic variables, such as income, women's education, pension arrangements and other social welfare provisions at the family level, and costs of education, health care and the availability of family planning services at the community level. At present, data limitations prevent us from making further investigations in this direction.

[3] See Banister (1987) and Peng (1991) for information on two family planning campaigns prior to 1971, and other general descriptions of China's population policies.

campaign by calling on cadres at all administrative levels to promote population controls (Peng, 1996).[4] Shortly afterwards, the central government made population targets an integral part of national economic planning and established a hierarchical, nationwide family planning network. While local family planning authorities propagandized national guidelines, disseminated birth control knowledge and supplied contraceptive devices, they did so with variations in the means of implementation and vigor of enforcement.

China's population policies in the 1970s are best summarized by the widely repeated slogan, '*Wan* (Later), *Xi* (Longer), *and Shao* (Fewer)', which meant *later* marriage, *longer* intervals between births, and *fewer* children. Henceforth, this slogan is abbreviated as LLF.

Education, propaganda and persuasion were the officially stated means of policy implementation. However, both implementation practices and effectiveness varied widely across and within work units, urban districts and rural communes. Typically, local family planning personnel held regular meetings for all workers of marriageable or fecund ages. Attendees studied family planning instructions and interpreted the latest policies. Resistance to recommended policies typically first triggered frank conversations with recalcitrant persons, who were urged to postpone marriages, prolong birth intervals and limit childbearing. Published sources seldom reported coercion. However, local officials who had direct incentives to make the policies work in order to advance their careers depended heavily on local progress in achieving family planning goals. The population was under tight administrative and economic controls, and government officials could exert both psychological and social pressures on local residents, forcing them to comply with official policies.

As part of the campaign in the 1970s, provincial governments set separate guidelines for minimum age at marriage for women and men – the so-called 'late marriage age'. (The minimum ages for men were almost always two or three years above those for women, and later in this paper we focus exclusively on secular changes in the specified minimum married age for women.) At the beginning of the 1970s, the Marriage Law of 1950, which still in effect, set the legal minimum age of marriage for women at 18. At that time, the average age of first marriage for women in our sample was over 21 in rural areas and over 3 in urban areas, a statistics consistent with national figures. In 1973, however, the central family planning authority raised the 'late marriage age' to 23 years for rural women and to 25 for urban women, with some variations across provinces and over time. These new minimum ages were about two years above the prevailing average age of marriage found in our sample.

The main mechanism for controlling age at marriage was the marriage registration system. Urban district offices or rural communes had to certify their approval of a marriage. To complete their marriage registration, the bride and groom typically had to obtain letters of introduction from their respective work

[4] Peng (1996) is a major Chinese publication on China's population and family planning which collects, among other documents, an exhaustive set of regulations and guidelines made by the government since the early 1950s.

units. In effect, these letters constituted permissions to marry. If a couple did not satisfy the age requirements, the leaders of the work units could withhold the letter of introduction.

Just as they were given authority to implement later marriages, local officials also carried responsibility for implementing longer spacing between births. In 1971 national policy was recommending a three to five-year interval between the first and the second birth; in practice, longer intervals were encouraged.

For fewer births, the family planning authorities tried to popularize the two-child-per-family model with the well known slogan 'One is not too few, two is just right, and three is too many.' In addition to the education-and-persuasion approach, government at all levels acted vigorously to disseminate information on birth control and to provide contraceptive devices. Public funding for family planning activities increased throughout the decade.

From the 1970s to the present, China's family planning programs have demonstrated several noticeable and consistent features. First, the central authority almost always sets general goals and guidelines for family planning campaigns, leaving some freedom for provincial leaders to interpret central documents and to formulate practical policies within the context of local conditions. As a result, there are significant variations in both policies and means of implementation across provinces.

Second, implementation and compliance usually fall behind the momentum of policy initiation. In part, this lagging process reflects the time required to establish new institutions for policy execution. Regions with strong administrative networks tend to carry out policies faster than remote regions with weak administrative networks. Hence aggregate behavior measures often show gradual policy compliance over time.

Third, there have been marked rural–urban disparities, in both policies and their means of implementation, which reflect marked differences in various socioeconomic contexts. For our empirical work, the practical import of these observations is that we allow for differences in demographic behavior across provinces, over time, and across degrees of urbanization (urban, town and village).

By the late 1970s China had begun moving toward more restrictive policies. A State Council Directive in 1978 recommended that each couple should have one child with a maximum of two. Importantly, the State Council also recommended specific compliance incentives and non-compliance punishments (e.g. regarding employment benefits, housing and grain allocation in rural areas – Peng, 1996). However, it should be noted that these recommendations were espoused for only a brief transition period, after which population policies were further tightened.

2.2. *The 1980s: 'One Child' via economic incentives*

Officially, the 'One Child' policy began in September 1980 with an open letter from the Communist Party Central Committee to communist and youth league

members encouraging them to take the lead in responding to the Party's call.[5] One child per couple became the national policy.[6] With special consent from local officials, families were permitted a second child if one child would cause a household 'real difficulties.' This exception suggested that there was some flexibility for local interpretation, although a third child was strictly prohibited. In addition, the central government endorsed the use of economic incentives to reward single-child families and to penalize extra births.

In a 1982 directive, the Party Central Committee listed rewards for One Child families and penalties for violators. For single-child families, rewards included health and child care, welfare allowances, paid maternal and extra leave, as well as preferential access to schooling, employment and housing. In rural areas, single-child families would have their quota procurement reduced and their allocation of 'responsibility land' increased. Penalties for a second child included a percentage reduction in salaries for both parents, removal of child care, health care and welfare benefits, and withdrawal of a chance of promotion. In rural areas penalties included systematic disadvantages in agricultural procurement and land allocations (Peng, 1996).

Each provincial government was required to draft its own regulations governing rewards and penalties. Within each province, cities and rural counties also were required to give their interpretations of the regulations. At each level, consideration was given to specific local conditions and customs. Hence, as in the earlier LLF campaign, the extent of incentives and disincentives varied significantly across provinces and finer geographic areas.[7]

China's stated official policy has always been that regulation compliance is voluntary and is to be achieved via persuasion and education. In practice, however, when persuasion and economic incentives failed, coercive measures were reported to have been taken at local level. Compulsion seems to have peaked during the period 1980–83, when the One Child policy was carried out stringently throughout the nation. Resistance to the One Child rule was especially strong in rural areas, where couples often had strong desires for a son to provide old age security and insure the continuity of the family line – universal compliance with the One Child policy would have broken about half of the lines of descent. In addition, the general need for more labor motivated a desire for larger families. However, these fertility desires were suppressed by local cadres, who had the incentive to accomplish their own fertility control tasks. In anticipation that the One Child policy would continue to be enforced,

[5] The motivation for this policy lies in the perceptions of Chinese leaders of the relationship between population growth and economic progress. In order to achieve the per capita income target for the year 2000, planning authorities believed that China's population had to be kept below 1.2 billion at the turn of the century.

[6] It should be noted that, before this official announcement, the proposal for such a policy was announced in 1978, and its implementation actually began in many places as early as January 1, 1979.

[7] Economic sanctions on out-of-plan births can be substantial. For instance, wage reductions may range between 10% and 20% of parents' wages for a period of 3–14 years. In rural areas a single child was commonly accounted as 1.5–2 persons with regard to the allocation of private plots and housing land. See Peng (1991) for descriptions of provincial variations.

some families resorted to neglecting, abandoning or failing to report a baby girl, thereby creating a second chance of having a son. For those families who defied the orders and had a second child, heavy financial and administrative penalties were imposed. To implement the One Child policy forcefully, China carried out a nationwide campaign of mandatory sterilization, abortion and IUD insertion in the early 1980s, (see Greenhalgh, 1986'; Hardee-Cleaveland and Banister, 1988).

Strong sentiments against the policy existed during its first years of practice. In 1984 the Chinese government responded to the public resistance to the strict One Child policy. Central Document No. 7, while continuing the strict One Child policy for urban couples, relaxed the conditions under which a second child would be permitted to rural couples. This directive gave more autonomy to local family planning authorities to devise regulations in accordance with local conditions. With respect to implementation, it re-emphasized public cooperation rather than coercion, a practice known as 'blocking up the big breach, while opening a small hole.'

Specifically, there were many complex factors that could create a situation in which a couple would be permitted to have a second child. For example, if a couple's child suffered from disablement, or if the spouses were returned overseas Chinese or minority nationalities, then a second child was permitted. Another special condition applied to rural couples: they could have two children if having just one child would present them with 'real difficulties.' This proved to be the most flexible factor in the One Child policy. Some provinces interpreted couples living in poor or remote areas as 'facing real difficulties;' other provinces, such as Guangdong, allowed families to have a second child if the first child was a girl. In fact, by the end of the 1980s, despite strict enforcement of the One Child policy in urban areas, official policies for rural areas demonstrated differences and variety. They fell into three categories: (1) in 18 provinces, families whose first child was a daughter were allowed to have a second child after a required number of years; (2) in six other provinces or autonomous regions, each couple could have two children with proper spacing, regardless of the gender of the first child. (3) In the three municipalities and the two remaining provinces with high population densities, the One Child policy was still applied to all rural families (Zeng, 1989).

So far we have focused on restrictions on the number of children per couple. It is also important to document changes in regulations on marriage age and the spacing of births since 1980. Because an overwhelming percentage of urban families and many rural couples have only one child, the spacing of births no longer has practical significance for them. For families who are permitted to have a second child under special conditions, the three to five-year interval is still advised but is less stringently implemented. In contrast to the 1970s, the spacing of births has partly lost its significance as a key mechanism for reducing fertility.

Family planning authorities still encourage late marriage and childbearing. However, the Marriage Law of 1980, which took effect on 1 January 1981, set the minimum age of marriage at 20 for females and 22 for males, several years

below the 'late marriage ages' practiced in the 1970s. As a result, 'late age' requirements faded into the background as direct restrictions on births took center-stage.[8]

The above discussion indicates that government interventions in the 1970s and 1980s represent two distinctive regimes differing in policy targets and methods of implementation. The LLF policies in the 1970s targeted indirect methods for reducing births; with regard to these policies, 'persuasion' was the primary means of implementation. In contrast, the One Child policy directly targeted the number of births per couple; this policy's implementation relied on attractive rewards and harsh penalties as well as coercive means. Less direct goals of reducing births, such as delayed marriages, were relaxed. We expect that these differences in policies and methods of implementation may have had differential impacts on demographic behavior.

3. EXPECTED IMPACT OF POPULATION POLICIES

Standard demographic analysis often focuses on certain key descriptors of demographic conditions, including age at first marriage, age at first birth, spacing between births, rates of contraception, fertility rates, numbers of children per couple and the gender composition of children. In this section we analyze the likely effects of population control policies on these demographic variables, thus relating specific interventions observed in the LLF and the One Child policy regimes to demographic changes over those two decades. In what follows, we discuss the changes in China's demographic landscape in six patterns of aggregate behavior.

The '*later*' marriage policy in the LLF campaign of the 1970s resulted in a dramatic increase in the approved age at first marriage – the 'late marriage age.' As noted above, for women this age was as much as two years above the average age of first marriage in most areas in 1970. This late marriage policy continued until 1980 and the initiation of the One Child policy. However, the 1980 Marriage Law specified the legal age of first marriage as 20 for all women, which was well below the then-prevailing average age of first marriage. While still encouraged, late marriage was neither rewarded nor emphasized in the 1980s. As a consequence, the higher 'late marriage ages' prescribed in the LLF policy were no longer a binding constraint.

We now come to the six patterns of Chinese demography.

1. The actual effects of China's population policies may have raised the age at first marriage throughout the 1970s; then, since by 1980 it was high, the policies actually allowed for a *falling* age at first marriage in the 1980s – at least until this age reverted to the natural age determined by other socioeconomic factors.

[8] It should be noted that since 1987 the government has renewed an attempt to implement late marriage ages, although its effectiveness is questionable owing in part to the fact that during the course of reform an increasing percentage of the labor force has worked for non-state enterprises, with the accompanying high costs of policy implementation.

A woman's age at first marriage, natural fecundity and sexual activity and contraceptive practices together determine the interval between when she marries and her first birth, and consequently her age at first birth. In the 1970s and 1980s, Chinese women who married in their mid or late 20s were anxious to have a child immediately. Hence we see no particular reason why contraception rates between marriage and first birth, or intervals between marriage and first birth, should have responded to either the LLF policy or the One Child policy. If contraception rates stayed the same, serial changes in the mean age at first birth would closely mimic serial changes in the mean age of first marriage, rising in the 1970s and falling in the 1980s.

2. We would expect a gradual increase in the interval between the first and second births in the 1970s, and a constant or perhaps declining birth interval in the 1980s. The '*longer*' policy in the LLF campaign of the 1970s recommended a three to five-year interval between first and second births. However, the implementation of this guideline was unlikely to be immediate because it took time to establish enforcement mechanisms. After China shifted to the One Child policy regime in 1980, the spacing of birth was no longer applicable to the majority of families in cities and towns who had one child. For those who were permitted a second child because of special conditions, the spacing of births could be under less control. In rural areas, while spacing was required for couples permitted a second child, implementation was expected to be less effective relative to the 1970s, when communes controlled many aspects of family life.

3. Implementation of population policies may be expected to lead to a continuously declining number of children per couple in the 1970s in cities and towns and to a low fertility of slightly above one child per couple in the 1980s. The latter pattern reflects stringent implementation of the One Child policy throughout the decade. In rural areas, children per couple could have declined continuously throughout the two decades because the economic and non-economic rewards and penalties of the 1980s were more effective than the 'persuasion' of the 1970s. Since the number of children per rural couple was still at a high level at the beginning of 1980s, there was room for further fertility reduction throughout the decade. Of course, China's population policies and socioeconomic progress may both influence family fertility decisions. Although we do not investigate the separate effects of these two factors in this paper, it seems clear that the population policies of the 1970s and 1980s played a role in reducing fertility in China. Our focus is to investigate whether differences in policies and environments of implementation have resulted in differential fertility patterns across cities/towns and rural villages.

4. We would expect the total fertility rate (TFR) to decline in the 1970s, but to decline less sharply (or even increase) in the 1980s owing to reductions in women's age at childbearing. Previous studies have used TFR to depict China's fertility changes. By definition, TFR is computed from year-specific information on women's birth rates by age. For a given year, TFR is the average number of children that would be born to a hypothetical woman over her lifetime if, at each later age in her life, she exhibited the same fertility rates as

women who were already those ages in the given year. Many studies show that China's TFR declined rapidly in the 1970s, but leveled off in the 1980s.

We argue that TFR contains systematic biases in depicting China's fertility changes, because China experienced a rapid demographic transition in which women's age at childbirth increased in the 1970s but declined in the 1980s. (Details will be presented in later empirical analysis.) It is well known that increases in age at childbirth introduce downward biases in period-based TFR to forecast women's lifetime fertility, while declines in age at childbirth inflate the period TFR (see Ryder, 1964; Foster, 1990). Because of significant changes in women's age at childbirth, the standard findings based on TFR measures may have exaggerated China's fertility reductions in the 1970s and discounted the declines in the 1980s. This result will be examined in light of the number of children per couple over time, which is an alternative measure to TFR and is less sensitive to changes in women's age at childbirth.

5. We expect sex ratios (or the corresponding fraction of children born who are male) to be higher than the natural rate and steady for both decades, except for a possible peak in the late 1970s and early 1980s. Demographers and policy-makers have focused on the effect of population policies on gender discrimination in China. The sex ratio at birth measures the number of boys born per 100 girls born. Under normal circumstances, the ratio for living children is close to unity, which reflects the fact that the sex ratio at birth is normally about 1.06, and that boys usually have higher mortality than girls, so that the sex ratio declines as a cohort of children matures. In China researchers have found high male sex ratios, especially in rural areas (e.g. Johansson and Nygren, 1991; Coale and Banister, 1994; Chu, 2001), indicating evidence of systematic discrimination against girls. These high sex ratios could be the result of sex-selective abortion, concealment of female births, girl infanticide or abandonment, as well as biased treatments against girls in the provision of nutrition and health care that cause higher mortality.

Holding policy and socioeconomic environments the same, we would expect consistently high but stable sex ratios over time in societies with a high preference for sons. However, if coercive policies restrict the number of children per couple, this preference for sons could manifest itself in higher sex ratios. This is because, in order to guarantee at least one surviving son, some parents may practice discrimination against girls (e.g. girl infanticide). When population control announcements are sudden and forceful, one could see a significant rise in sex ratios.

A prime candidate for a rise in the sex ratio would therefore be the late 1970s and early 1980s, when China proposed and adopted the single-child policy. In anticipation of stringent implementation, some parents may practice gender discrimination, thus resulting in a hike in the sex ratio during that interval. The extent of discrimination may have lessened when the government relaxed the policy in 1984, allowing some rural families to have a second child.

6. We expect gender-based stopping behavior in childbearing; in other words, couples who had male children were more likely to stop further childbearing than those who had only daughters, as a result of son preference. This stopping

rule is a reason behind the fact that larger families tend to have a higher percentage of girls.[9] Admittedly, rural families typically have a strong desire for sons because of the traditional value for a male heir, as well as demand for labor and old age security. These desires may induce them to practice sex-selective childbearing. This type of family choice has been reinforced by Chinese population policies: in many provinces families whose first child is a girl are now allowed to have a second child.

For all of these variables in patterns (1)–(6), we expect rural women to marry earlier, to have lower rates of contraception, and to bear more children at an earlier age than their urban counterparts. Moreover, we expect rural families to have more children and to exhibit a stronger preference for boys. Finally, as noted earlier, we expect variations in all of these demographic variables across regions and provinces.

4. EMPIRICAL FRAMEWORK

4.1. *Data*

To examine China's demographic patterns, we use data from the 1992 Household Economy and Fertility Survey (HEFS), consisting of 14,000 households from 10 Chinese provinces. HEFS was designed and implemented jointly by researchers from the United Nations Population Programs and the Institute of Population Studies of the Chinese Academy of Social Sciences. Previous studies indicate that the sample statistics from this survey match the corresponding national and provincial statistics (see Tian *et al.*, 1994).

HEFS contains rich demographic information. It reports marriage history, contraceptive use and other information that is usually unavailable in population census or standard fertility surveys. To examine how demographic behavior responded to population policies, we utilize a subsample of 8646 couples who were married between 1970 and 1989. Considering the fact that the effects of policy changes are manifested in the decisions of couples, we concentrate on marriage cohorts in our analysis. This subsample represents a rather even distribution of families across marriage cohorts. By registration type, approximately 29% of the households are from cities, 21% from towns and the remaining 50% from rural villages; these figures are broadly consistent with the proportions of household types on the national scale. An Addendum to this paper, which is available upon request, reports additional information on HEFS and the characteristics of the subsample.

Table 1 presents the means and standard deviations of the eight demographic variables analyzed in this paper, stratified by residential location (city, town or rural village). As expected, there are systematic differences in the means across location types. For example, on average, women are first married at age 24.58, 23.68 and 22.54 respectively in urban, town and village locations. Women's age

[9] See Arnold and Liu (1986), which also reported that couples whose first child was a son had higher rates of contraception, and were more likely to receive One Child certificates.

Table 1. Means and standard deviations of key demographic variables

	(1) City		(2) Town		(3) Village	
	Mean	*S. D.*	*Mean*	*S. D.*	*Mean*	*S. D.*
Women's age at marriage	24.58	2.58	23.68	2.25	22.54	2.27
Women's age at first birth	25.49	2.76	24.64	2.45	23.52	2.51
Contraception use between marriage and birth (%)	9.54		6.50		3.36	
Interval between 1st and 2nd birth (years)	3.74	4.30	3.87	4.92	3.21	3.40
Total fertility rate	1.83	0.55	2.24	0.94	3.08	0.89
No. of children per couple	1.23	0.48	1.30	0.54	1.91	0.83
Household fraction of male children (F^b)	0.51		0.56		0.57	
Aggregate fraction of male children (F^B)	0.51		0.55		0.55	

at first marriage, their age at first birth and their contraception use are highest in the cities, next highest in towns and lowest in villages. In contrast, the total fertility rate, the number of children per couple and the two measures of the percentage of children who are male are lowest in cities, higher in towns and higher still in rural villages. Finally, the interval between first and second births is higher in cities and towns than in rural villages.

Three points are notable. First, contraceptive use between marriage and birth of a first child is low, revealing the desire for childbearing immediately after marriage. Second, reported TFRs exceed the number of children per couple as a measure of fertility. This finding may reflect the fact that TFRs are inherently less accurate than the children-per-couple measure since, as discussed earlier, they embody certain static assumptions that are inappropriate when the age of childbearing is changing rapidly. Of course, measuring fertility by the number of children per couple opens the possibility of neglecting incomplete fertility, which may introduce a downward bias. This problem becomes worse for recent marriage cohorts than for earlier cohorts, who are more likely to have completed fertility. For empirical analysis, we adjust for incomplete fertility to estimate children per couple, and we compare and contrast the Chinese fertility changes that are presented by using the two alternative measures.

Finally, we note that in towns and rural villages the percentages of male children surviving to 1989 considerably exceed the 'natural rate' at birth, which is generally taken to be around 0.515 (equivalent to 106 boys per 100 girls). These reported ratios would be even more abnormal if one took into account the fact that boys usually have a higher mortality rate than girls. In Table 1 we present two measures of sex ratios. The first variable is Household Fraction of Boys (F^b), for which we first compute the percentage of male children for each household and then take the average for all households. The second variable is Aggregate Fraction of Boys (F^B), for which we pool children of all households together and compute the percentage of male children. As will be analyzed in greater detail, F^B contains information on anti-girl discrimination associated with higher female mortality rates, and F^b contains additional information on gender-based stopping behavior in childbearing. The high sex ratios of F^B of 0.55 for towns and villages point to evidence of sex-selective abortion,

female infanticide or higher subsequent mortality rates for girls than for boys resulting from neglect or abandonment. The even higher ratios of F^b for towns and villages, i.e. 0.56 and 0.57 respectively, point to evidence of stopping behavior in childbearing in favor of boys. On the other hand, the two measures of surviving male children in urban areas stand at 0.51, which is consistent with more equal treatment of boys and girls.

4.2. *Empirical specification*

For each of the demographic variables of interest, we estimate

$$Y_{ijt} = \alpha + \sum_{i=1}^{10} \beta_i D_i + \sum_{j=1}^{3} \gamma_j D_j + \sum_{t=70}^{89} \theta_t D_t + \varepsilon_{ijt},$$

where Y is the average value of the demographic variable (e.g. age at first marriage) in province i at location j (city, town or rural village) for women (or couples) who married in year t; D are provincial, location and cohort dummies; and ε is a residual. Since the samples are from 10 provinces of three residential locations over a period of 20 years, there are 600 observations for each regression. Therefore, the parameters to be estimated (β_i, γ_j, θ_t) would indicate how the values of the demographic variables change across provinces, across residential locations and over the years between 1970 and 1989.

The above specification takes the marriage cohort as the analytical unit for tracking time. This specification attempts to capture the fact that married couples are the basic unit for understanding the effects of population policies. When the single-child policy started in 1979, for instance, it had one effect on those who married in 1979 and subsequent years, but a different effect on those who were already married and had already had children. The effects of the policy could be fully reflected only in the number of children of the 1979 and subsequent marriage cohorts. Only in the case of TFRs do we track time with calendar years.

The above equation allows systematic differences in demographic behavior across urban, town and rural regions/provinces, as well as marriage cohorts. In a more general formulation, we first included interactions between the location and time dummies for each of the dependent variables. However, the test statistics show that, for all variables except the number of children per couple, one cannot reject the null hypothesis of no interactions between the year and location dummies (see the Addendum for details). Based on this information, location–year interaction terms are included only for the average number of children per couple.

5. ESTIMATION RESULTS

Tables 2–4 report OLS estimates for the eight demographic variables for the period 1970–89. We use 1979 as the reference year and a rural village as the reference location. The tables first present the provincial average value of a demographic variable in rural regions in 1979; other estimates are deviations

Table 2. OLS estimates of age at first marriage, age at first birth, contraception, and birth interval

	(1) Age at first marriage		*(2) Age at first birth*		*(3) Contraception between marriage and 1st birth (%)*		*(4) Interval between 1st and 2nd birth (years)*	
Provincial average (rural, 1979)	23.09		24.05		2.1		4.24	
City dummy	2.02	(25.96)	1.99	(23.47)	6.0	(8.79)	0.71	(2.50)
Town dummy	1.19	(13.91)	1.20	(13.05)	2.8	(3.75)	0.69	(2.46)
Married in:								
1970	−1.61	(−7.41)	−1.42	(−6.01)	−1.5	(−0.78)	−1.31	(−2.63)
1971	−1.50	(−6.77)	−1.24	(−5.12)	−1.2	(−0.61)	−1.31	(−2.60)
1972	−1.62	(−6.94)	−1.39	(−5.48)	2.2	(1.09)	−1.52	(−2.85)
1973	−1.24	(−5.49)	−1.04	(−4.23)	0.5	(0.27)	−1.40	(−2.68)
1974	−0.63	(−2.85)	−0.52	(−2.15)	−1.1	(−0.61)	−1.21	(−2.35)
1975	−0.62	(−2.94)	−0.49	(−2.16)	0.6	(0.30)	−0.77	(−1.49)
1976	−0.53	(−2.62)	−0.44	(−1.99)	0.5	(0.29)	−0.81	(−1.56)
1977	−0.27	(−1.31)	−0.13	(−0.58)	0.6	(0.32)	−0.46	(−0.84)
1978	0.02	(0.10)	0.06	(0.29)	0.6	(0.34)	−0.51	(−0.94)
1979								
1980	−0.17	(−0.96)	−0.20	(−1.00)	2.2	(1.42)	−0.30	(−0.60)
1981	−0.03	(−0.14)	−0.03	(−0.15)	0.5	(0.31)	−0.85	(−1.58)
1982	−0.14	(−0.73)	−0.17	(−0.83)	1.8	(1.07)	−0.56	(−1.03)
1983	−0.48	(−2.47)	−0.55	(−2.57)	2.1	(1.26)	−1.04	(−1.82)
1984	−0.61	(−3.05)	−0.64	(−2.95)	1.9	(1.10)	−1.42	(−2.39)
1985	−0.64	(−3.35)	−0.73	(−3.51)	3.4	(2.03)	−1.54	(−2.58)
1986	−0.87	(−4.48)	−0.94	(−4.45)	5.0	(2.98)	−1.57	(−2.41)
1987	−0.56	(−2.84)	−0.68	(−3.16)	1.4	(0.83)	−1.72	(−2.26)
1988	−0.48	(−2.35)	−0.61	(−2.77)	3.5	(1.97)	−2.18	(−2.06)
1989	−0.28	(−1.36)	−0.49	(−2.20)	3.8	(2.13)	−1.61	(−1.07)
Mean of deviations in the 1970s (m_{70})	−0.80	[36.45]	−0.66	[20.98]	0.1	[0.01]	−0.93	[7.07]
Mean of deviations in the 1980s (m_{80})	−0.43	[8.85]	−0.50	[10.46]	2.6	[4.18]	−1.28	[8.88]
F-ratio for H_o: $m_{70}=m_{80}$	[29.54]		[4.37]		[16.83]		[1.85]	
No. of observations	598		598		598		464	
R^2	0.99		0.99		0.48		0.76	

Notes
Provincial dummies are included for all regressions in Tables 2–4.
T-ratios are in parentheses and *F*-ratios are in square brackets.

from this baseline value. To compare demographic behavior in the 1970s and 1980s that represent different policy regimes, we also report the average deviations of a variable for each decade from the reference year 1979. A *F*-test statistic on the null hypothesis that the mean values are equal over the two decades is also included. Because of space limitations, we omit the provincial dummy coefficients from the tables.

5.1. *Marriage age, contraception and birth intervals*

Table 2 presents OLS estimates of women's age at first marriage, age at first birth, contraceptive use and birth interval. Estimates in column (1) put the

average age at first marriage for rural village women who married in 1979 at 23.09, while it is 2.02 and 1.19 years higher for women in cities and towns, respectively. Age at first marriage exhibits an inverted-V process, in congruence with 'prediction' 1 above. During the 1970s there were continuous increases in the age at first marriage, climbing by a total of 1.61 years. This pattern accords well with effective implementation of the '*later*' marriage policy. In contrast, the marriage age started to decline in 1980, a fact that is consistent with the institution of new rules on ages in the 1980 Marriage Law and with decreasing emphasis on late marriage ages during the 1980s. Moreover, the averages of the cohort coefficients for the 1970s (–0.8) and the 1980s (–0.43) show that the increase in marriage age in the first decade is about twice as fast as the decrease in marriage age in the second decade. All of these estimates are statistically significant at conventional levels, and broadly consistent with earlier findings (e.g. Feeney and Wang, 1992).[10]

As expected, column (2) of Table 2 shows that the mean age at first birth closely tracks first marriage ages, exhibiting the same inverted-V pattern with an upturn in the last three years. The age at first birth for 1970 rural marriage cohort was 22.63; this increased to 24.05 in 1979, and declined to 23.11 by 1986. This is followed by an upturn to 23.55 in 1989. Women in cities and towns had their first child 1.99 and 1.20 years later, respectively, than rural women,. The average coefficients for the 1970s and the 1980s were –0.66 and –0.50, which indicate that the rise in women's birth ages in the first decade was slightly faster than the age decline in the 1980s.

Table 2 also shows patterns over time for contraceptive use between marriage and first birth and the spacing of births between the first and second children. The estimates in column (3) indicate low rates of contraception. In 1979, for the reference rural cohort only 2.1% of the couples practiced contraception, which was representative of their behavior in the 1970s, although the rate more than doubled (about 2.6% higher) in the 1980s. The rates in cities and towns were respectively about 6% and 2.8% higher than for rural couples. The implied behavior of having children immediately after marriage is consistent with previous findings (e.g. Banister, 1987).

Column (4) of Table 2 presents evidence that is consistent with the effective implementation of the '*longer*' policy in the 1970s. The average interval between the first and second birth for rural families increased from 2.93 in 1970 to 4.24 years in 1979 (see Luther *et al*., 1990 for related results). Differences exist across locations, where the averages of spacing in cities and towns are 0.71 and 0.69 year longer than in rural villages. Caution is needed to interpret the gradual declines in birth intervals in the 1980s, which could be caused by two factors. First, a majority of the couples in cities and towns only had one child, so that the analysis of birth spacing is not applicable to them. For families who were permitted a second child owing to special reasons, such as disablement

[10] It is worth noting that there was an increase in marriage age for the last three years of analysis: the mean ages increased consecutively by 0.31, 0.08, and 0.2. This result, which is consistent with national figures, may reflect the government's intention to impose late marriages again since 1987.

of the first child, implementation on spacing may be less effective, thus resulting in shorter birth intervals. Second, the downward trend could be a result of sample truncation, whereby families who had not yet had their second child at the time of the survey were excluded from computing the birth intervals. This problem of data censoring is likely to be more serious for the most recent marriage cohorts, because a higher fraction of families will not yet have had the second child, and these families will usually have longer birth spacing, thus introducing a downward bias.[11] We do not have sufficient information to evaluate the influence of these two factors and correct the corresponding biases.

5.2. *Fertility*

Table 3 presents patterns of fertility change measured by TFR and children per couple. The TFR estimates replicate the stylized results found in the literature that China's fertility rate declined rapidly in the 1970s and remained relatively flat in the 1980s, consistent with pattern 4 discussed earlier. The estimated TFR for 1979 predicts that the average woman in a rural village would have 2.81 children over her lifetime, down by nearly 1.29 children from the beginning of the decade. Except for a continued fertility decline in 1980, the estimated TFR remained flat throughout the 1980s in cities and towns, as well as in rural villages. Based on the estimates, the mean TFRs for women in the three locations are 2.26, 2.57 and 3.43 in the 1970s, respectively, and 1.32, 1.63, and 2.49 in the 1980s.

In earlier discussions we pointed out that the TFR may contain biases in predicting the number of births per woman over her lifetime. This is because during the period China experienced significant demographic changes that should by no means be neglected. We have shown that mean age at first birth exhibited an inverted-V pattern between 1970 and 1989. When childbearing age rises in the 1970s, period TFR exaggerates the reductions in fertility, and when childbearing age declines in the 1980s, the TFR systematically underestimates fertility declines.

As an alternative measure to the TFR, we also examined how the number of children per couple changes over time. The number of children per marriage cohort of couples is not as biased as the TFR, because this measures how many children the couple has a certain number of years after their marriage. Therefore, this measure is not sensitive to changes in the age of marriage and childbearing. Unfortunately, the survey imposes a time truncation on the successive marriage cohorts; a portion of the couples, especially those in the most

[11] Hazard analysis can be applied to deal with the problem of sample truncation for studying the spacing of births. However, while the hazard approach mitigates the censoring problem, it may introduce another bias. Without sufficient information, it assigns a positive probability of having a second child to couples who either do not intend to have additional children (owing to policy constraints) or are not capable of having children. (A high percentage of Chinese couples are sterilized after the first birth.) Therefore, hazard analysis could introduce an upward bias in the estimated birth spacing for the 1980s. Owing to these concerns, we do not present the results of hazard analysis.

Table 3. OLS estimates of total fertility rate and children per couple

	Total fertility rate		*Children per couple (adjusted by incomplete fertility)*					
	(1) All locations		*(2) City*		*(3) Town*		*(4) Village*	
Provincial average (rural, 1979)	2.81						2.07	
City dummy	−1.17	(−15.40)						
Town dummy	−0.86	(−11.35)						
Married in:								
1970	1.29	(6.54)	0.06	(0.47)	0.31	(2.33)	0.61	(4.74)
1971	1.92	(9.77)	−0.13	(−1.03)	0.06	(0.47)	0.50	(3.93)
1972	0.74	(3.76)	−0.33	(−2.59)	0.05	(0.41)	0.38	(2.99)
1973	1.08	(5.48)	−0.31	(−2.40)	−0.08	(−0.62)	0.40	(3.13)
1974	0.66	(3.35)	−0.40	(−3.16)	−0.31	(−2.45)	0.29	(2.30)
1975	0.49	(2.49)	−0.68	(−5.32)	−0.30	(−2.31)	0.12	(0.97)
1976	0.22	(1.10)	−0.82	(−6.38)	−0.45	(−3.44)	−0.06	(−0.45)
1977	−0.10	(−0.50)	−0.78	(−6.07)	−0.53	(−4.16)	0.02	(0.19)
1978	−0.13	(−0.65)	−0.87	(−6.83)	−0.68	(−5.35)	−0.05	(−0.38)
1979			−0.93	(−7.29)	−0.78	(−6.07)		
1980	−0.48	(−2.46)	−0.94	(−7.37)	−0.82	(−6.41)	−0.08	(−0.63)
1981	−0.10	(−0.49)	−1.02	(−7.98)	−0.73	(−5.74)	−0.13	(−1.01)
1982	−0.46	(−2.34)	−0.99	(−7.72)	−0.82	(−6.43)	−0.17	(−1.34)
1983	−0.42	(−2.13)	−0.97	(−7.58)	−0.89	(−6.99)	−0.24	(−1.86)
1984	−0.47	(−2.38)	−0.95	(−7.46)	−0.97	(−7.55)	−0.28	(−2.21)
1985	−0.29	(−1.50)	−1.02	(−8.00)	−0.99	(−7.72)	−0.37	(−2.91)
1986	−0.33	(−1.68)	−0.99	(−7.72)	−0.91	(−7.13)	−0.45	(−3.53)
1987	−0.38	(−1.93)	−1.02	(−7.98)	−1.01	(−7.91)	−0.46	(−3.61)
1988	−0.31	(−1.56)	−1.00	(−7.83)	−0.98	(−7.65)	−0.64	(−5.01)
1989	0.01	(0.05)	−0.96	(−7.48)	−0.99	(−7.73)	−0.63	(−4.94)
Mean of deviations in the 1970s (m_{70})	0.62	[21.81]	−0.47	[29.94]	−0.22	[8.17]	0.25	[6.74]
Mean of deviations in the 1980s (m_{80})	−0.32	[4.91]	−0.98	[108.12]	−0.89	[92.32]	−0.31	[13.31]
F-ratio for H_o: $m_{70} = m_{80}$	[228.05]		[13.47]		[245.99]		[197.81]	
No. of observations	600		597					
R^2	0.61		0.80					

recent marriage cohorts, may have not yet finished childbearing. Consequently, the reported number of births is likely to under-represent children per couple over their life cycle. In what follows, we first attempt to estimate for incomplete births. After adjusting for incomplete fertility, we will examine how the completed number of births per couple varies over time.

We adopt the following method for estimating the average children per couple for marriage cohort m:

$$C_m = \frac{1}{W_m} \sum_{t=1}^{T} C_m^t,$$

where $m = 1970, \ldots, 1989$; W_m is the total number of women in the marriage cohort; and C_m^t is the number of children born to women of this cohort in the t years since marriage. This equation suggests that for the 1970 marriage cohort, for instance, C_{70} is computed by adding all births born to the women of 1970 marriage cohorts during the 1970–89 period ($T = 20$) and then dividing this total by the number of women in this cohort. For this marriage cohort, an overwhelming majority of the women would have completed their fertility by 1989, so that this measure would accurately represent their lifetime births. However, the problem of accounting for total fertility arises for more recent cohorts because the survey has only incomplete childbearing information. For the 1989 marriage cohort, for instance, we have information only on the size of the cohort (W_{89}) and the total number of children born during the first year after marriage (C_{89}^1). The lack of childbearing information after the survey would result in an underestimation of these women's lifetime fertility. A similar problem exists for the 1988 marriage cohort (where the survey only reports two years of actual fertility) as well as for other earlier cohorts.

The adjustment that we use to amend incomplete fertility is to utilize available childbearing information from the nearest marriage cohorts. To continue our illustration for the 1989 cohort, we use (C_{88}^2/W_{88}) to approximate (C_{89}^2/W_{89}), which is absent in the data. Since C_{88}^3 is censored because of the timing of data collection, we therefore use the available information from the nearest cohort (C_3^{87}/W_{87}) to approximate for (C_3^{89}/W_{89}). Consequently, the average children per woman for the 1989 marriage cohort is approximated by

$$C_{89} = \frac{C_{89}^1}{W_{89}} + \frac{C_{88}^2}{W_{88}} + \frac{C_{87}^3}{W_{87}} + \ldots + \frac{C_{70}^{20}}{W_{70}}.$$

We apply the same method to all earlier cohorts whenever actual fertility is missing in the data. Moreover, we distinguish and utilize sector-specific fertility information for urban, town and rural regions, which assures more accurate adjustments in light of fertility gaps across the three locations. The results from carrying out these adjustments indicate that incomplete fertility is a non-negligible factor for rural couples, but is unimportant for urban and town families because, for the latter group, a majority of the 1980s couples had only one child under the restrictive policy.

Table 3 presents estimates on children per couple that are adjusted for incomplete fertility. As noted earlier, test statistics support the specification that allows for changes in the coefficients across urban, town and rural regions over time. Therefore, the parameters presented include the effects of location and marriage cohort interactions. These results indicate substantial changes in the number of children per family over the two policy regimes in the 1970s and 1980s. For urban, town and rural couples, the estimates for the average number of children per couple during the 1970s were 1.56, 1.80 and 2.32, respectively. During the 1980s these estimated averages were reduced to 1.09, 1.16 and 1.73, respectively.[12] For the whole of each decade and for each individual marriage cohort, the average number of children per couple in rural areas exceeded that in towns – which, in turn, exceeded that in cities.

One novel finding reported in Table 3 is that the declines in fertility exhibit remarkable differences across rural and urban/town regions. The patterns for urban and town regions closely follow the standard story of China's demographic transition: fertility declined most rapidly in the 1970s, but flattened out in the 1980s. In the first decade, children per couple dropped by 0.99 and 1.08 from 1970 to 1979, respectively, for families in urban and town areas, but the corresponding declines in the 1980s are 0.03 and 0.21. This pattern is consistent with our prediction 3 outlined earlier and the results of previous studies (e.g. Peng, 1996). In contrast, the children-per-family measure of fertility shows continuous declines in rural regions by 0.61 and 0.63 in each decade, reflecting the fact that policies were more restrictive in the 1980s and that there was room for rural families to reduce fertility further.[13] These results give much credit to the distinguishing of rural areas from urban/town regions in documenting China's demographic transition (pattern 3). They also demonstrate that the standard TFR measure may well exaggerate the declines in fertility over the 1970s and understate the declines in fertility in the 1980s.[14]

5.3. *Gender composition*

We discussed earlier two forms of gender discrimination: (1) sex-based stopping behavior in childbearing in favor of boys, and (2) sex-selective abortion, girl infanticide, abandonment and neglect of nutrition and health care, leading to higher female mortality. To measure the extent of various discriminations, we define an aggregate fraction of boys (F^B) for a marriage cohort as the percentage of males among all living children at the time of the survey born

[12] These children-per-couple numbers for the 1980s appear to be low in light of national statistics. We note that these numbers count only living children, and that there could be under-reporting of births in this survey.

[13] For the urban and town samples, test statistics strongly reject the null hypothesis of an equal rate of declines in fertility over the two decades, and support the conclusion of much faster fertility reduction in the 1970s. For the rural sample, however, test statistics cannot reject the hypothesis of equal and continuous declines in fertility between 1970 and 1989 (see Addendum for details).

[14] One could adjust the standard TFR measure by computing a childbearing-age constant TFR (see Ryder, 1964; Foster, 1990). This topic goes beyond the scope of the current paper, and we shall leave it for future research.

by women of that marriage cohort. (No information was reported on children who did not survive.) We determine the household fraction of boys (F^b) for a marriage cohort by first computing the percentage of boys at the family level and then averaging all families of the same cohort. Following the results of Yang (2001), F^B contains information on only type (2) discrimination, but F^b also contains information on type (1) discrimination. Therefore, in the presence of gender discrimination and without taking account of higher mortality rates for boys, the estimated fractions of boys would take the values of $0.515 \leq \hat{F}^B \leq \hat{F}^b$, where 0.515 is the biologically natural percentage of males in the absence of social and behavioral interference. The results $\hat{F}^B > 0.515$ would imply the evidence of type (2) discrimination, and $\hat{F}^B = 0.515$ would suggest the absence of such discrimination. Similarly, $\hat{F}^B = \hat{F}^b$ indicates no gender-based stopping behavior in childbearing in favor of boys, while $\hat{F}^B < \hat{F}^b$ suggests the existence of discrimination.

Column (1) of Table 4 presents OLS estimates of F^B. Using the 1979 rural marriage cohort as the reference, and combining information on location and cohort effects, the aggregate fraction of boys for 1970s marriage cohorts worked out at 50.7, 54.5 and 55.6 of their surviving children in cities, towns and rural

Table 4. OLS estimates of gender composition

	(1) Aggregate fraction of male children		*(2) Household fraction of male children*	
Provincial average (rural, 1979)	0.567		0.593	
City dummy	−0.042	(−3.949)	−0.056	(−4.925)
Town dummy	−0.001	(−0.095)	−0.008	(−0.607)
Married in:				
1970	−0.036	(−1.414)	−0.045	(−1.368)
1971	−0.013	(−0.504)	−0.026	(−0.784)
1972	−0.024	(−0.863)	−0.039	(−1.146)
1973	−0.026	(−0.972)	−0.045	(−1.349)
1974	−0.031	(−1.166)	−0.041	(−1.255)
1975	−0.036	(−1.359)	−0.042	(−1.323)
1976	0.008	(0.299)	0.005	(0.182)
1977	−0.017	(−0.654)	0.009	(0.293)
1978	−0.043	(−1.652)	−0.056	(−1.901)
1979				
1980	−0.031	(−1.326)	−0.030	(−1.146)
1981	−0.024	(−0.983)	−0.026	(−0.947)
1982	−0.013	(−0.521)	−0.021	(−0.739)
1983	−0.024	(−0.922)	−0.041	(−1.451)
1984	0.009	(0.344)	−0.005	(−0.158)
1985	−0.006	(−0.228)	−0.022	(−0.807)
1986	−0.009	(−0.355)	−0.028	(−1.007)
1987	0.013	(0.461)	−0.015	(−0.506)
1988	−0.041	(−1.413)	−0.066	(−2.241)
1989	0.010	(0.332)	−0.007	(−0.229)
Mean of deviations in the 1970s (m_{70})	−0.022	[1.533]	−0.025	[1.537]
Mean of deviations in the 1980s (m_{80})	−0.012	[0.575]	−0.026	[1.965]
F-ratio for H_o: $m_{70} = m_{80}$	[0.557]		[0.246]	
No. of observations	596		596	
R^2	0.97		0.96	

villages, respectively. The corresponding percentages for the 1980s married couples were 51.7, 55.5, and 55.6. For towns and villages, these results reject the null hypothesis of no discrimination against girls in the form of sex-selective abortion, infanticide, abandonment and higher mortality rates after birth, a result that is consistent with pattern 5 discussed earlier. In cities, however, the fractions of surviving boys were not statistically different from the biologically natural percentage of males, thus revealing little of gender discrimination.

Column (2) of Table 4 presents the household-based measure of sex ratio that embodies gender-related stopping behavior in childbearing. For couples married in the 1970s, the average fractions of boys constituted 51.6, 55.9 and 56.5 of surviving children in cities, towns and rural villages, respectively. The corresponding percentages for families of the 1980s cohorts were 51.8, 56.1 and 56.7. As expected, each of these estimates (F^b) is higher than the corresponding aggregate measure (F^B), revealing evidence of stopping behavior in childbearing in favor of boys, although the differences between the two sets of estimates are not statistically significant at the conventional levels. Test statistics also show that for both measures the average percentages of boys for the 1980s cohorts are not statistically different from those for the 1970s. Hence we found little evidence over the two decades that the more coercive One Child policy exacerbated discrimination against girls at the levels found under the LLF policy.

The results in Table 4 indicate considerable yearly variations. We mentioned earlier that the proposal for a single-child policy was announced in 1978, implementation began in 1979 and the policy was most strict in the earlier 1980s. In anticipation of a permanent policy, families of the late 1970s marriage cohorts may have resorted to drastic measures of discrimination, such as girl infanticide or abandonment, in order to secure a son in their families. The results in Table 4 contain some evidence supporting this conjecture for villages and towns, in which the highest percentages of male children are found in marriage cohorts of the late 1970s, particularly in the 1979 and 1976 cohorts; these couples would have borne their first and second children, respectively, around the inception of the single-child policy. For instance, the provincial averages for the 1979 marriage cohort in rural villages reveal that 56.7% and 59.3% of their children were males. The test statistics of F-ratio = 14.91 and F-ratio =15.25 reject the null hypotheses that $\hat{F}^B = 0.515$ and $\hat{F}^B = \hat{F}^b$, suggesting the existence of both gender-based stopping behavior in childbearing and other forms of anti-girl discrimination in rural villages. The estimated fractions of boys in towns are 56.6 and 58.5, which also indicate the existence of gender discrimination. In comparison, the corresponding fractions are much lower in cities, at 52.5 and 53.7; the corresponding F-statistics cannot reject the absence of discrimination, even for this urban cohort, which experienced the most dramatic policy changes.

6. SUMMARY AND CONCLUDING REMARKS

Our endeavor in this paper has been systematically to relate the time sequence of policy announcements and implementations between 1970 and 1989 to a

wide range of observed demographic behavior over these two decades. In particular, we suggest that women's age at first marriage and at first birth may follow closely the guidelines for 'later marriages' and the consequent relaxation of late marriage restrictions. The '*longer policy*' of the 1970s may have prolonged intervals between first and second births. In the 1980s, the coercive implementation of the One Child policy in cities and towns may have constrained an overwhelming majority of families to a single child; and stricter population controls in rural regions may have resulted in continuous fertility declines. In addition, several demographic variables seem to have interacted with each other, posing a set of complicated changing relationships. The changes in women's age of childbearing may have affected the computation of period-based TFR which, without proper adjustments, would contain biases in depicting fertility changes overtime. We emphasize that the children-per-couple measure, with proper adjustments for incomplete fertility, serves as an alternative measure to examine fertility transition.

Our empirical analysis is based on household survey data from ten Chinese provinces. The results of regression analysis presented in Tables 2–4 have systematically documented China's changing demographic patterns between 1970 and 1989 covering eight demographic variables, with separate accounts for city, town and rural regions. We find, among other things, several major demographic patterns.

First, women's average age at first marriage and at first births rose from the beginning and during the early period, and then fell significantly; an inverted 'V' shape reflects changes in rules and regulations of the minimum marriage age. Second, in rural areas the number of children per couple declined continuously over the two decades; this pattern of continuous secular decline contrasts markedly with conventional findings based on TFR that rural fertility declined mostly in the 1970s, but flattened out in the 1980s. Third, in rural areas sex-ratios among children indicate discrimination against the survival of girls; family size-specific sex ratios indicate gender-based stopping behavior in childbearing in favor of boys. These observed patterns are broadly consistent with the expected impact of population control policies implemented in China.

However, we must point out that population policies represent only one set of factors that influence behavior. The fundamental socioeconomic changes that occurred in China during the 1970s and 1980s could have made an additional contribution to China's demographic transitions. Further investigation into the interactive relationship between socioeconomic changes and population policies is essential to explain China's changing demographic patterns, and to improve existing policies for the future.

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