

The Evolution of China's One-Child Policy and Its Effects on Family Outcomes

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In 1979, China introduced its unprecedented one-child policy, under which households exceeding the birth quota were penalized. However, estimating the effect of this policy on family outcomes turns out to be complicated. China had already enacted an aggressive family planning policy in the early 1970s, and its fertility rates had already dropped sharply before the enactment of the one-child policy. The one-child policy was also enacted at almost the same time as China's market-oriented economic reforms that triggered several decades of rapid growth, which would also tend to reduce fertility rates. During the same period, a number of other developing countries in East Asia and around the world have also experienced sharp declines in fertility. Overall, finding defensible ways to identify the effect of China's one-child policy on family outcomes is a tremendous challenge, one that the literature has tended to underemphasize. Along with the issues just mentioned, most of the studies have not taken sufficient care to address the endogeneity of public policy (as emphasized by Besley and Case 2000). For example, regional variations in the enforcement of the one-child policy may also reflect prevailing family fertility preferences and regional socioeconomic conditions. However, compared with empirical studies on other developing countries that were mainly descriptive (for example, Alba and Potter 1986; Cho 1996), those on China appear to be much more rigorous.

This essay begins with a discussion of the evolution of the one-child policy in China, covering the lead-in to its inception, major modifications over time, and

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heterogeneity in enforcement between urban and rural areas and across provinces. I then turn to the general trends of fertility and development in China and other selected developing countries. Subsequently, I expound the main empirical approaches to the identification of the effects of the one-child policy, with an emphasis on their underlying assumptions and limitations. I then turn to empirical results in the literature. I discuss the evidence concerning the effects of the one-child policy on fertility and how it might affect human capital investment in children. Numerous studies have considered these two effects, but research on other potentially important effects of the one-child policy in China, including its potential effects on divorce, labor supply, and rural-to-urban migration, is lacking. For these issues, I will offer some exploratory and preliminary estimates.

The paper concludes with some remarks about China's future demographic challenges. Although the Chinese government has recently replaced the one-child policy with a universal two-child policy, the legacy of the one-child policy, which has affected millions of people for over 30 years, continues to be of great interest.

Evolution of Family Planning Policy in China

Mao Zedong, the supreme Chinese leader between 1949 and 1976, believed in the principle: "More people, more power." Such thinking may be due to Mao's military career and rise to power. For example, Mao wrote in 1949, "Any miracle can be created as long as there are people under the leadership of the Communist Party" (as quoted in Mao 1966, p. 1516). However, Mao acknowledged the hardships of overpopulation on many occasions during the 1950s and 1960s, and there were several times during these decades when it seemed as if China might adopt a national family planning policy.

For example, Deng Xiaoping, who was Vice Premier in 1952, called for increased contraceptive use. At that time, China's population size was 600 million, according to the first census conducted in 1953. When the famous Chinese economist Ma Yinchu (President of Peking University), first recommended family planning in China during 1955–1957, Mao was initially supportive and even considered setting up a national family planning commission. However, during the Great Leap Forward movement in 1958, Mao reverted to a belief that a larger population was better. Ma's population control theory was heavily criticized nationwide and he was labeled as a "rightist" (Tian 2009).

After the famine during the Great Leap Forward of 1958–59, China's fertility rebounded significantly, and China's total fertility rate reached more than six births per woman in the early 1960s (Banister 1987). In 1962, the central government first announced a position advocating "birth planning in urban areas and densely populated rural areas." Shortly afterward, family planning commissions were established at national and provincial levels (Tian 2009; Ebenstein 2010).

However, the Cultural Revolution in 1966 halted these early family planning operations. Deng was purged for a time, and would not rise again to full power

until after Mao's death in 1976. By the end of 1969, China's population exceeded 800 million. Economic growth stagnated. The deterioration in China's standard of living was often discussed in terms of overpopulation, and rather than reconsidering China's economic institutions, leaders in China again began to focus instead on the urgency of population control. In the early 1970s, Mao instructed: "Population growth must be controlled" (as quoted in Peng 1996).

A serious family planning campaign began in China in 1971, commencing with the propaganda theme: "One child isn't too few, two are just fine, and three are too many." In July 1973, the State Council established the Leading Group for Family Planning, which was responsible for calling a national birth planning conference in December that year. That conference endorsed the slogan: "Later, Longer, and Fewer." The term "Later" meant late marriage requirements of 23 years for women and 25 years for men. "Longer" signified a birth planning rule of more than three years between the first and second child. "Fewer" implied that a couple could have two children at most. This family planning campaign was successful; and China's overall fertility rate declined by half between 1971 and 1978.

China's family planning campaign in the 1970s was technically voluntary, but it had a number of coercive elements. As Whyte, Wang, and Cai (2015) pointed out: "[T]he state bureaucratic hierarchy in charge of enforcing birth control then oversaw grass-roots birth planning workers in each village, urban work unit and neighborhood. These birth planning enforcers kept detailed records on each woman of child-bearing age under their responsibility, including past births, contraceptive usage and even menstrual cycles, in many reported instances becoming 'menstrual monitors' who tried to detect out-of-quota pregnancies at an early stage." Whyte et al. also provided evidence that IUD insertions, sterilizations, and abortion increased sharply in the 1970s. However, although China's family planning campaign in the 1970s did have a number of coercive elements, it was significantly less coercive than the one-child policy that followed.

It's useful to place China's 1970s family planning policy in the context of its time, when global concerns about population growth were especially high. At that time, countries like India, Bangladesh, and Indonesia also had family planning programs with significant elements of coercion.¹ On the one side, China was a largely isolated or closed state at that time, and it was not clear how much China's policy was influenced by international concerns over population (Tian 2009). On the other side, China was at least aware of the global concerns and initiatives. Wang, Cai, and Gu (2013) noted that during the first UN-organized World Population Conference in

¹ Wang, Cai, and Gu (2013) observed (citations omitted from quotation for brevity): "India's notorious forced sterilization campaign was carried out between 1975 and 1976, during which more than 8 million sterilizations were performed. The campaign led to the collapse of Indira Gandhi's government in January 1977 ... In a number of other countries with large populations and rapid growth rates, such as Bangladesh and Indonesia, coercive methods of a lesser degree were also used. ... Between 1976 and 1996, the number of governments viewing their population growth rate as too high increased from 55 to 87. By launching a nationwide policy of limiting each couple to only one child, China, of course, established an unprecedented level of government control of births."

1974 in Bucharest, as well as other international forums, China denounced calls for family planning as part of an imperialist agenda. However, back at home, China was simultaneously implementing its population control policies.

Mao died in 1976. By 1978, Deng Xiaoping rose to leadership. Deng and other senior leaders stressed the importance of birth control policies for China (Peng 1996). Hesketh, Lu, and Zhu (2005) explained the reason for introducing the one-child policy: “At the time, China was home to a quarter of the world’s people, who were occupying just 7 percent of world’s arable land. Two-thirds of the population were under the age of 30 years, and the baby boomers of the 1950s and 1960s were entering their reproductive years. The government saw strict population containment as essential to economic reform and to an improvement in living standards.”

Deng’s position in support of population control had been consistent over many decades. Thus, when he assumed power in 1978, it was not surprising that a strong population control policy was enacted. Deng may have viewed population control as a method of raising the GDP per capita of China. For example, when Deng met with the Japanese Prime Minister in 1979 in Beijing, he referred to a development goal of quadrupling GDP per capita by the end of the century. He intended to raise the GDP through economic reforms and the “Open Door Policy” of reorienting China’s foreign trade away from the heavy dependence on the USSR. It was in the context of both a neo-Malthusian concern over population and ambitious economic development goals that the Chinese government launched the coercive one-child policy in 1979 (Peng 1991).

Scharping (2003) has carefully documented China’s birth control campaign from 1979 to 1983. In a circular addressed to all members of the Communist Party in January 1980, the Secretariat of the Central Committee called for legal, economic, and administrative measures in favor of one-child families. The Party Central Committee addressed an open letter to all members of the party and the Communist Youth League and reaffirmed the one-child policy on September 25, 1980. During this period, when the central government evaluated the performance of local officials, economic growth, social stability, and enforcement of the one-child policy were consistently among the highest priorities (Birney 2014). Provincial and prefectural officials had strong incentives to require or even force local residents to comply with the one-child policy (Hardee-Cleaveland and Banister 1988).²

Enforcement of the one-child policy did waver in the mid-1980s. Many rural families, particularly those with only one female child, strongly resisted the policy. Given the practical difficulties, the central government relaxed the policy to make it more feasible in rural areas (with the philosophy of “open a small hole to block

²Hardee-Cleaveland and Banister (1988) pointed out that, during 1979 and 1982, required abortions in the second and third trimester of pregnancies were mandated in some provinces. In 1983, the implementation of such compulsory measures reached a peak, and “China carried out a nationwide campaign of mandatory sterilization, abortion, and IUD insertion characterized by a degree of heavy handedness in family planning unprecedented in the world.” They also pointed out that, for those who escaped the forced abortion and continued an unapproved pregnancy, heavy fines were imposed, and those households often had to pay 10–20 percent of their family income for 7 to 14 years.

a big gap”) during 1984–1985. A list of 14 types of cases eligible for second-child permits was drawn up, with the most important rule being that rural couples with only one daughter could have a second child. Many local governments regarded this change as a signal that the central government attached less importance to the policy, and China’s fertility rebounded considerably from 1984 to 1986. In 1986, the State Council reiterated the one-child policy and retightened the policy across the country from 1986 to 1990. After 1990, the one-child policy became relatively stable.

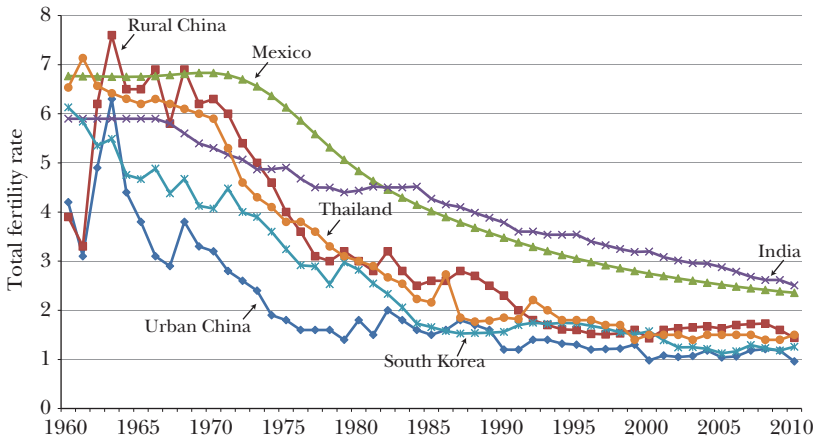
Although the one-child policy was applicable throughout China, local implementation of the policy, such as the actual penalties for above-quota births, often varied across rural and urban areas, regions, provinces, and even ethnicities. In particular, the government controlled the behavior of urban residents more easily than that of rural residents. Chinese urban residents can be more closely and directly affected by government policies and measures. For example, many urban residents worked in state-owned enterprises or institutions, and by having more than one child, they could lose their jobs and access to social welfare payments. In addition, sex-selection technology was somewhat available in urban areas for those with an especially high demand for sons. By contrast, rural residents received fewer benefits from the government than urban residents did. Furthermore, those carrying out agricultural work had a distinct need for a larger family, and sex selection technologies were mostly unavailable. A common punishment for rural residents who exceeded the birth quota was a one-time fine, and many rural families were so poor that they could not pay the fine, anyway. These complications resulted in a *de facto* two-tier policy: that is, urban couples were only allowed to have one child, whereas rural couples were often allowed to have a second child, particularly if the first child was female.

The policy variation was also considerable across regions. For example, in the less-developed western regions of China, the fertility level was significantly higher than that in the more-developed eastern regions before the one-child policy was introduced. Therefore, strictly implementing the one-child policy in the western regions meant enforcing a larger social change and was thus more difficult. Even within eastern regions, the enforcement of the one-child policy varied significantly. For example, Zhejiang and Jiangsu Provinces were close to each other and shared many similar characteristics, but the one-child policy was more strictly implemented in Jiangsu than in Zhejiang. Another variation was that the practical application of the one-child policy differed for the ethnic majority Han population and ethnic minorities. Specifically, Han women in urban areas were generally allowed to have only one child, whereas minority women were normally allowed to have two or more children.

Trends in Total Fertility Rates in China and Selected Countries: 1950–2010

A number of countries experienced sharp declines in fertility in recent decades. Does the timing or speed of China’s fertility decline—whether in urban or rural

Figure 1

Total Fertility Rate for Rural and Urban China and Four Selected Countries (1960–2010)

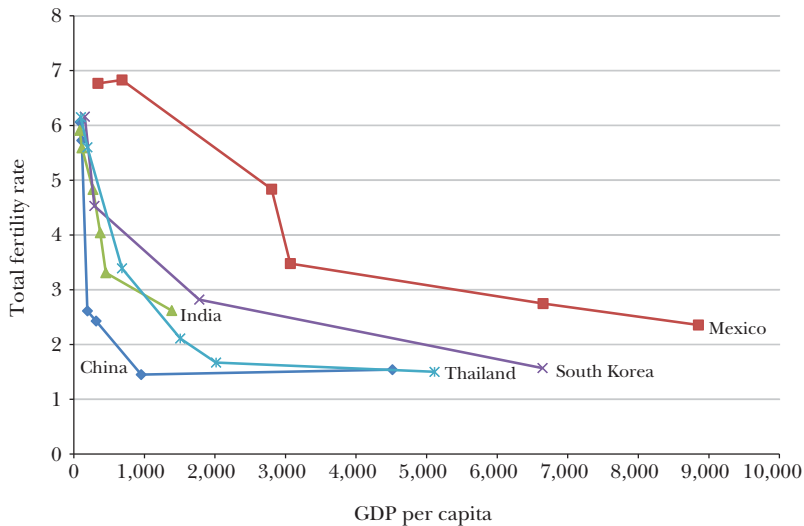
Source: The total fertility rate data for each country are from the World Bank (2016). China's urban and rural total fertility rate data are obtained from several sources: the 1960–1992 data are adopted from Peng and Guo (2000); the 1993–1999 data are from the 2001 National Fertility and Reproductive Health Survey; the 2001–2009 data are adopted from Hao and Qiu (2011); and the 2000 and 2010 data are obtained from the national population censuses in the respective years.

areas—look dramatically different from that in other developing countries like South Korea, Thailand, Mexico, or India?

Figure 1 illustrates total fertility rates between 1960 and 2010 for rural China, urban China, and a comparison group of four other developing countries that, like China, also had high fertility levels in the 1960s. The figure suggests that all these developing countries, even without a compulsory population control policy such as the one-child policy in China, exhibited rapid declines in fertility after 1970. South Korea and Thailand are Asian countries that had high economic growth rates after 1970 and implemented voluntary family planning programs. Their fertility rates fell more slowly than those for urban China in the 1960s and 1970s, but by 2010 their fertility was as low as that of China. Thailand is especially worth noting because it had fertility and GDP per capita similar to China's by 2010. Mexico had a weaker family planning campaign, but its fertility rate still reached a low level by 2010. Economic development seems to be a fundamental cause of such fertility decline. India's development level was similar to that of China in 1978. However, India's family planning initiative after 1978 was not as strong as China's, and its economic development was significantly less advanced than that of South Korea and Thailand. Nonetheless, India also saw a marked downward trend in fertility—although the decline was not as fast as other Asian countries in the figure. Given that the economic growth rate of China was higher than those of the four other countries from 1979, I believe that even without the one-child policy, China's fertility rate would have declined substantially after 1978.

Figure 2

Total Fertility Rate and GDP per capita for China and Four Selected Countries (1960–2010)



Sources: The total fertility rate and GDP data for each country are from the World Bank (2016), and the unit of GDP per capita is US dollars (2014 constant prices).

Notes: The figure plots each country's total fertility rate against its real GDP per capita, showing decadal points from 1960 to 2010. Each point represents, from left to right, the total fertility rate and GDP per capita of each country in 1960 (for China 1962 was chosen instead of 1960 to avoid the unusual famine effect in China), 1970, 1980, 1990, 2000, and 2010. When GDP per capita of a country exceeded \$10,000, that country actually stepped up to become a developed economy. Thus, I dropped two points with GDP per capita levels above \$10,000 for South Korea to make the figure compact.

Focusing on the trend of China's fertility decline, we can get some hints of the effect of the one-child policy. Given the vast socioeconomic differences between urban and rural areas in China, Figure 1 illustrates these areas separately. The relatively low rates of fertility in China in 1960 were due to the Great Famine. Fertility rebounded after the famine and maintained a relatively high level in the subsequent ten years, but it declined significantly and persistently from 1971 to the late 1970s. By 1978, the total fertility rates of the urban and rural areas dropped to 1.55 and 2.97 per woman, respectively. After the one-child policy was implemented, in 1979, fertility rates continued to decline. However, since the early 1990s, both rural and urban fertility rates have roughly stabilized over time. This pattern suggests that the one-child policy may have had a small short-term effect on fertility around 1979, but little or no additional long-term effect.

As this discussion has suggested, economic growth is also linked to declines in fertility. Figure 2 illustrates this relationship by plotting each country's total fertility rate against its real GDP per capita, showing decadal points from 1960 to 2010. Figure 2 indicates a negative correlation between total fertility rates and GDP per capita; indeed, for China, India, South Korea, and Thailand, their fertility rates had declined

sharply before their GDP per capita levels reached \$3,000. Mauldin (1982) argued that family planning programs played a significant role in the sharp decline of fertility rates in the four countries during 1960–1980, before they reached high levels of economic development. The fertility decline in these countries preceded economic development. By contrast, the pace of fertility decline was slower in Mexico, where the family planning campaign was much weaker than that in other four countries.

Focusing on China, it is important to note that the magnitude of the fertility decline in the post-1979 era was significantly smaller than that during the 1970s. Specifically, China's total fertility rate for all regions declined from 5.8 in 1970 to 2.7 per woman in 1978, whereas from 1979 to 1995 under the one-child policy, China's fertility rate decreased from 2.8 to 1.8 per woman. China's economic development was almost stagnant during the 1970s (as shown in Figure 2), so economic development was not the main cause of the fertility decline during that time. Instead, the birth planning campaign during that period was widely believed to be the main contributor to reducing China's fertility rate by half, which was a success that some hailed as representing an "induced fertility transition" (Mauldin 1982).

Empirical Approaches to Identifying the Effect of the One-Child Policy

Identifying the causal effect of the one-child policy requires care and caution. After all, the adoption of the policy was to some extent prompted by the prevailing socioeconomic considerations. It coincided with a change in leadership philosophy, including the beginning of economic reforms and opening to foreign trade. In this section, I discuss four main methodological approaches that have been used in the literature and consider some concerns about them. Some studies use several of these approaches. The next section then discusses the empirical findings on the effects of the one-child policy.

A first approach sought to compare the birth behavior of China's women before and after the one-child policy implementation (Ahn 1994; Ding and Hesketh 2006; Whyte et al. 2015). For example, using data from the 1985 China's In-depth Fertility Survey, Ahn (1994) studied the probability of the second and third births before and after 1979. He entered a policy dummy for before and after 1979 to capture the policy effect. Ahn (1994) also interacted the policy dummy with a set of family characteristics (which is equivalent to allowing the effect of the family characteristics on fertility to differ between before and after 1979). He also controlled a linear time trend (based on the calendar year at the previous birth) to account for the effect of economic development on fertility decline. Essentially, this approach makes a rather restrictive assumption that the fertility patterns for women giving first birth before and after 1979 had a common linear trend. Thus, any deviation from the linear time trend after 1979 was attributed to the one-child policy.

A second approach used cross-sectional and temporal variations on fines and/or the eligibility for a second birth (McElroy and Yang 2000; Liu 2014; Huang, Lei, and Sun 2016). For example, McElroy and Yang (2000) studied regional

variations in fines and rural fertility. However, using this variation in fines as an exogenous measure of the one-child policy is clearly problematic, because local governments may set the amount of fines according to local financial situations and local fertility demand. Huang et al. (2016) also used a similar approach, but argued that fines may be exogenously determined by the characteristics of local officials and used the fines as a measure for the one-child policy implementation to estimate its reduced-form effect on the educational attainment of girls. To support their argument, Huang et al. (2016) observed that the largest changes in the fertility penalties were associated with the arrival of new provincial officials immediately after the central government announced in the end of 1989 that the performance of the one-child policy implementation would be used as an additional factor to evaluate local officials for promotion. (As noted earlier, the implementation of the one-child policy was part of the evaluation of local officials before 1989, but the implementation of the policy fluctuated several times during the 1980s.) Although it is plausible that the arrival of new local officials may serve as an exogenous shock, a part of the fines remains unaccounted for by local officials' characteristics, which suggests that fines may remain endogenous in the schooling equation. An alternative approach that can avoid the endogeneity problem is to regress girls' education on the fines, with the turnover and characteristics of local officials as instrumental variables for the fines. This approach requires the exclusion restriction that the set of instrumental variables—in this case, the characteristics of local officials, such as how recently they assumed their position—does not directly affect child education other than through the level of fertility fines.

A third approach compared the fertility rates of Han and minority women in a difference-in-differences framework. In Li, Zhang, and Zhu (2005), we argued that Han women were required to follow the one child policy strictly, whereas ethnic minority women were often allowed to have two children. Thus, comparing the change in Han women's fertility or family behavior before and after 1979 with that of the minorities would identify the effect of a two child versus the one child policy. The underlying common trend assumption on fertility or family behavior would be easier to hold if women from minority groups had similar family behavioral patterns to those of the Han before the one-child policy. However, economic reforms may affect the Han and the minorities differently. Thus, the common trend assumption may be difficult to maintain. Along the same lines, in Li and Zhang (2007), we used the share of the minorities as an instrumental variable for fertility to estimate the fertility effect on economic growth in China.

A fourth approach is based on a recent work by Bingjing Li and Hongliang Zhang (forthcoming), which builds on a similar idea in Poston and Gu (1987). In this case, the empirical identification relies on exploring the heterogeneity of the intensity of the one-child policy implementation across prefectures and the differential length of exposure to the one-child policy of distinct birth cohorts. Specifically, they construct a measure based on excess births to Han women over and above the one-child rule in each prefecture. By looking only at Han women, they avoid the issue of differential enforcement of the one-child policy across ethnic groups.

They then control for differences in pre-existing fertility and community socioeconomic characteristics, seeking to take into account the local fertility demand and local government's response to the local fertility demand in setting this policy. The remaining residual after these controls is a proxy measuring largely exogenous regional policy stringency in the one-child policy implementation, which is taken as the pure policy variable. In the next section, I use this approach to estimate the effect of the one-child policy on various family outcomes. This approach is based on a common trend assumption that the strict and less-strict prefectures would exhibit the same family pattern in the absence of the one-child policy. The assumption implies more specifically that any unobserved prefecture-specific shocks to fertility or other family outcomes over time are uncorrelated with the cross-sectional measure of the one-child policy enforcement intensity.³ However, this strong assumption is more likely to hold when looking only at Han women, under the excess fertility residual approach, as opposed to doing a Han-minority comparison.

An ideal scenario for estimating the aggregate effects of the one-child policy would have some extremely strong conditions; for example, it would have been useful for research purposes if China had randomly selected a cross-section of prefectures to implement the one-child policy and then forbidden interprefecture migration. However, such conditions are unrealistic. Thus, the practical research approaches are based on key underlying assumptions and on answering specific questions only.

The first approach assumes that the introduction of the one-child policy was exogenous—that is, its introduction was not correlated with the change of socioeconomic factors that may directly affect fertility and other family outcomes. The third approach attempts to purge the confounding change of socioeconomic factors by using the minorities as a comparison group for the treated Han women, which requires a common trend assumption in the specific outcome for post-1979 Han women and minorities. The second and fourth approaches do not estimate the aggregate effects of a situation with the one-child policy versus a situation without such a policy; instead, what they estimate is the differential effect of the varying one-child policy implementation across regions or over time.

Micro Evidence

In this section, I discuss the empirical results in the literature on the effects of the one-child policy, largely drawing on the range of methodologies in the previous section.

³As noted in Bingjing Li and Hongliang Zhang (forthcoming), this specification is analogous to Duflo's (2001) difference-in-differences specification, which measured the regional intensity of the school construction in Indonesia by the number of schools constructed, controlling for the number of children in primary school age. In this study, we treat 1982 as a base year because of data availability. We can then look at the change in enforcement over time and the change in an outcome variable.

Effect of the One-Child Policy on Fertility

In general, very different views exist on how the one-child policy affected fertility: one group of studies argued that the one-child policy had a significant or decisive effect on fertility in China, while another group argued that socioeconomic development played a key role in China's fertility decline. A plausible reconciliation of these views is that the one-child policy accelerated the already-occurring drop in fertility for a few years, but in the longer term, economic development played a more fundamental role in leading to and maintaining China's low fertility level. To put it more bluntly, China's fertility might well have dropped to the current low level with rapid economic development, even without the one-child policy, although the timeline of the decline would not appear quite the same.

In an early study of the one-child policy, focusing on the short-term, Poston and Gu (1987) examined the relationships among socioeconomic development, family planning, and fertility across 28 subregions of China. They found that although the implementation of family planning programs had a large effect on fertility (a one-standard-deviation increase in the contraceptive prevalence/effectiveness rate would lead to a roughly 0.5-standard-deviation decrease in the total fertility rate), the effect of socioeconomic development on fertility decline was substantial even in the mid-1980s.

Other studies of the one-child policy carried out in the late 1980s and early 1990s, within a relatively few years after the launch of the policy, had similar findings. For example, Ahn (1994) estimated the effects of the one-child policy on second and third births in the provinces of Hebei and Shaanxi and the municipality of Shanghai. He found that urban families were less likely to have a second or third child than rural families, and this urban-rural gap was widened after the one-child policy: the birth likelihood of a second child in urban areas fell by 50 percent in Hebei and Shanxi and by 86 percent in Shanghai (almost no family had a second child in urban Shanghai after the one-child policy). McElroy and Yang (2000) found that China's population policies played a considerable role in fertility. Specifically, the family size is smaller in counties with higher penalties on above-quota births: an additional penalty of approximately \$177 would reduce the family size by 0.33 to 0.47 with different estimation methods. Ebenstein (2010) documented high ratios of males to females in China. By exploiting regional and temporal variation in fines levied on above-quota births, he found that higher-fine regimes (stricter fertility control) discouraged fertility and were associated with higher sex ratios (of males to females). In Li, Zhang, and Zhu (2005), we found a large effect of the one-child policy on the probability of not having a second child.

Although the one-child policy reduced China's fertility, particularly in the early period of its introduction, some researchers have argued that China's below-replacement fertility in the long run was mainly driven by socioeconomic development rather than the government policy. A study by Yong Cai (2010) is an example of those that emphasized economic development and compared China's fertility experience to that of other countries. This study points out that given a negative correlation between the total fertility rate and GDP per capita in the global

context, as well as China's rapidly growing economy over the past several decades, the country's fertility would have also reached a relatively low level even without the one-child policy. He exploited the differences in the policy intensity between urban and rural residents in two provinces and found that the pronounced difference in the one-child policy implementation intensity between Jiangsu and Zhejiang did not translate into substantially different fertility levels and that socioeconomic factors had significantly stronger effects on fertility. He concluded that the one-child policy may have accelerated China's drive to reach below-replacement fertility, but it was not the key driving force for the low fertility that emerged. Similar views have been shared by Wang, Zhao, and Zhao (2013) and Whyte et al. (2015). Whyte et al. (2015) argued that the total fertility rate in China had dropped from 6 per woman in 1970 to approximately 2.7 per woman at the end of the 1970s, which meant that roughly three-quarters of the decline in fertility since 1970 up to the present occurred before the introduction of the one-child policy. They attributed the substantial fertility decline to the "Later, Longer, and Fewer" campaign in the 1970s, and believed that China's rapid economic development since 1980 contributed significantly to China's additional fertility reduction.

Effect of the One-Child Policy on Child Education

The effects of the one-child policy may be expected to affect other family outcomes as well. If families expect to have only one child, they may invest more in the human capital of the child (Becker 1991).

Families that have twins can be considered as a natural experiment in the context of the one-child policy. In Rosenzweig and Zhang (2009), we exploited the incidence of twinning to estimate the effect of the fertility change induced by the one-child policy on other outcomes. Using the Chinese Child Twins Survey conducted in 2002 in Kunming City, we observed that the one-child policy had been strictly enforced in the urban area of Kunming: approximately 95 percent of households without twins had only one child, and over 99 percent of households with twins stopped at two children.⁴ In comparing one-child households to households with twins, we showed that the fertility decline induced by the one-child policy had a moderately positive effect on children's human capital at most. Even using the upper-bound estimates to compute the impact of the one-child policy on human capital development in China, the results suggested that the policy increased children's schooling attainment by at most 4 percent, the probability of attending college by less than 9 percent, school grades by 1 percent, and the incidence of good or excellent health by less than 4 percent.

Using twins as a natural experiment is a neat and worthwhile approach, but it has some limitations. For example, the health status of twins may not be comparable to singletons: for example, twins are more likely to have low birthweight, which is

⁴In the rural area of Kunming, a two-child policy was strictly enforced. Hence twinning at the second-parity was an exogenous break of the two-child policy. For brevity, I discuss here only the results for the urban sample.

often used as a simple measure of health status at birth. The Rosenzweig and Zhang (2009) dataset has birthweight information, which is often unavailable in other datasets. While the sample in the study is locally representative, a nationally representative twins survey with valid birthweight information is not yet available in China.

In a different approach, Liu (2014) made use of the variation in fertility induced by cross-community variations in the one-child policy, which as noted earlier was rigorously enforced in the early 1980s and then relaxed after 1984, to identify the effect of child quantity on child quality. He used the eligibility for having two children, fines for unsanctioned births, and their interactions as instruments for fertility. He found a quantity–quality trade-off in children's height: children born into settings with stricter enforcement of the one-child policy were taller. However, using three educational outcomes as quality measures—school enrollment, middle school graduation status, and years of schooling (normalized for age and gender)—he found the effect on educational attainment to be statistically insignificant in most cases, particularly for boys.

In a study mentioned earlier, Bingjing Li and Hongliang Zhang (forthcoming) provided evidence on the quantity–quality trade-off by exploiting regional differences in the one-child policy implementation intensity as an exogenous source of variation in family size. They constructed a quantitative indicator of the extent of local violation of the one-child policy and then used this measure as an instrumental variable for fertility. Using the 1 percent sample of the 1982 and 1990 Chinese Population Censuses, they found that prefectures that enforced the one-child policy more strictly experienced larger declines in family size and also greater improvements in child education. However, the magnitude of the effect was not large.

Education levels in China have been rising. However, the existing studies indicate either a modest or minimal effect of the fertility change induced by the one-child policy on children education. This is consistent with evidence from other developing countries. For example, Fitzsimons and Malde (2014) did not find evidence that family size had a detrimental effect on different measures of girls' education attainment in rural Mexico. They argued that households with more children might adjust on other margins such as increasing maternal labor supply. In Guo, Yi, and Zhang (2016), we presented a rationed fertility theory and some evidence showing that a forced reduction below an optimal fertility generated a utility loss and thus involved a negative income effect, which attenuated the schooling adjustment on the margin.

Effect of the One-Child Policy on Other Family Outcomes

Although the discussion here has focused on fertility and human capital investment in children, studies have also looked at a range of other family outcomes. Tuljapurkar, Li, and Feldman (1995) pointed out that the preference for sons was leading to a gender imbalance: for example, they found an “imbalance in the first-marriage market” with around one million more males than females by 2010. Zhang and Spencer (1992) investigated who complied with the one-child policy in China and why; for example, wife's education and husband's occupation were associated with compliance, but husband's education and woman's occupation were not.

Goodkind (2011) estimated that 19 percent of all children born in China at ages 0–4 were unreported to authorities in 2000, more than double the level in the 1990 census, following the wave of increased enforcement and penalization under the one-child policy that occurred in 1991.

However, a number of other outcomes might plausibly be influenced by the one-child policy, including marital status, labor supply, and migration. Here, I offer some exploratory results along these lines using the excess fertility residual approach discussed earlier, which is to construct a proxy for differences in enforcement of the one-child policy across prefectures in China.

Specifically, the approach proceeded in several steps. First, I constructed a measure of excess fertility for Han women above the one-child rule in each prefecture of China in 1982 and regressed it on a set of average household-level variables for that prefecture, including the mother's age at first birth, the first child's age, the mother/father's education level, and the mother/father's employment sector. By netting out the influences of these control variables, I obtained the excess fertility residual. Second, for the outcome variables, I conducted the same procedure on each outcome variable (in its first difference over 1982 and 1990 or 2000) and obtained the residual for the difference in the outcome variable as for the excess fertility residual. Third, I ran a reduced-form regression using the excess fertility residual—that is, the proxy variable showing the level of enforcement of the one-child policy—as the explanatory right-hand-side variable, and the residual for the differenced outcome variable as the dependent left-hand-side variable. For marital status and labor supply, I looked at the change in each of them from 1982 to 1990. For migration, because the migration information in the 1990 census was not comparable to that in the 1982 census, I compared 1982 and 2000 census data for the change in migration.

Table 1 shows the results.⁵ The first row shows the estimated result for the likelihood of divorce for females older than 19 years and males older than 21 years. The dependent variable is a dummy indicating whether an individual is divorced. The coefficient is negatively significant, indicating that a more relaxed one-child policy is associated with a lower likelihood of divorce. A possible explanation for this pattern is that a family with more children is less likely to divorce. But although the estimate is statistically significant, the magnitude is small. The standard deviation of the excess fertility rate residual is 2.55 percent, and its interquartile range equals 2.85 percent. A tightening of the one-child policy in terms of one interquartile range decrease of the excess fertility rate residual is associated with an increase in the probability of divorce by 0.0153 percentage points (that is, 0.0285×0.00538).

The second row reports the results with female labor supply as the dependent variable. The dependent variable is a dummy indicating whether a female household head (or the spouse of the household head) participated in the labor force.

⁵The online appendix available with this paper at <http://e-jep.org> offers more detail on these results, including a series of graphs that provide a visual representation of a difference-in-differences estimate of the effect of the variations in enforcement of the one-child policy.

Table 1

Regression Results for Changes in Enforcement of the One-Child Policy on Several Family Outcomes

(independent variable is the excess fertility residual; a higher residual indicates weaker enforcement)

| Dependent variable: | Coefficient | Standard error | Observations |
|---------------------|-------------|----------------|--------------|
| Divorce | -0.00538*** | 0.00139 | 586 |
| Female Labor Supply | 0.037 | 0.0731 | 586 |
| Male Labor Supply | -0.0387*** | 0.00942 | 584 |
| Rural Migration | -0.279*** | 0.052 | 530 |

Notes: I ran a reduced-form regression using the excess fertility residual—that is, the proxy variable showing the level of enforcement of the one-child policy—as the explanatory right-hand-side variable, and the residual for the differenced outcome variable as the dependent left-hand-side variable. For all of these regressions, the excess fertility rate residual was calculated using 1982 census data, and all the regressions used prefectural-level data weighted by the number of observations in each prefecture in 1982. The regression on divorce and labor supply used 1982 and 1990 census data, while the regression on migration used 1982 and 2000 census data.

The coefficient (0.037) is statistically insignificant. The third row of Table 1 shows the result for the labor force participation indicator of male household heads. The coefficient is negatively significant, indicating that a more relaxed one-child policy would reduce labor force participation of males. Again, the size of the effect remains rather small. A tightening of the one-child policy in terms of one interquartile range decrease of the excess fertility rate residual is associated with an increase in the probability of labor force participation of a male household head by 0.117 percentage points (that is, 0.0302×0.0387).

The fourth row shows the results with rural migration as the dependent variable: specifically, the dependent variable is the ratio of the number of individuals not living in the household for more than one year to the number of the labor force in a household in the rural areas. No migration information was available in the 1990 census in the same way as in the 1982 census. Thus, I looked at the 2000 census for the variable with the same form as the 1982 census question on migration. The coefficient has the expected negative sign—that is, having fewer children tends to be associated with a higher level of migration—and is statistically significant with a moderate-sized effect. A tightening of the one-child policy in terms of one interquartile range decrease of the excess fertility rate residual can increase the rural migration rate by 0.823 percentage points in 2000 (that is, 0.0295×0.279).

There has been little study of the effect of the one-child policy on these outcomes in China. As other countries consider the effects of declining birth rates or in some cases the effects of broad-based planning policies, further research on these topics seems especially useful. Overall, these findings suggest that when thinking about reductions in birth rates, effects of increasing male labor force supply and increasing migration may be especially worth taking into account.

Concluding Remarks

Although the literature on China's one-child policy has generally found a statistically significant effect on reducing fertility, most of the studies found the effect to be rather small, especially in the longer-term (Wang et al. 2016). However, this small effect must be understood in the context of the aggressive family planning program in the early 1970s. Given China's extremely high economic growth after 1979 and the fertility transition experienced in other East Asian countries, China's further decline of fertility after 1979—which was significantly smaller than what had already occurred during the 1970s—cannot be fully or even mainly attributed to the effect of the one-child policy. Using data from 16 countries with similar birth rates to that of China in 1970, Wang et al. (2013) found that the birth rate of these countries declined significantly and much more sharply than what the Chinese government predicted would have happened in China without the one-child policy, and concluded that China's government exaggerated the effect of the one-child policy. To further analyze the counterfactual scenario without the one-child policy, Wang et al. (2013) applied a Bayesian model that United Nations (2011) used for its population projections and established that “fertility in China would have continued to decline if the country's rapid fertility decline in the 1970s offers any hint about the country's future fertility trajectory. According to the Bayesian model, the decline would have continued after 1980. By 2010, fertility would have fallen to its currently observed level of around 1.5 children per woman.”

Although the enforcement of the one-child policy may have mildly accelerated the fertility transition in China, it also brought substantial costs, including political costs, human rights concerns, a more rapidly aging population, and an imbalanced sex ratio resulting from a preference for sons. In retrospect, one may question the need for introducing the one-child policy in China.

What lesson may other developing countries draw from China's one-child policy? If the country is already experiencing a decline in fertility rates, then a one-child policy doesn't seem useful. However, a country with a total fertility rate in the window of 5 or 6 children per women might be tempted. Implementing a coercive family planning program such as the one-child policy in a developing country that is not governed by an exclusive power such as the Chinese government would be difficult. Rather than focusing on a one-child policy, a developing country may want to consider an aggressive but less-coercive family planning program such as the policy implemented in China in the 1970s.

China has now experienced moderately low fertility for more than 30 years and will face the challenge of a declining and aging population in the near future. Numerous studies documented the falling youth dependency ratio in the short term and the rising elderly dependency ratio in the long term (Poston 2000; Hesketh et al. 2005; Zhang and Goza 2006; Hu and Yang 2012; Liu 2013). However, because fertility was in sharp decline before the one-child policy, economic growth was significant after the one-child policy, and longevity has been rising in China as

elsewhere, it seems plausible that China was going to experience a demographic transition at some point even without the one-child policy.

China now appears heading for a future of negative population growth. The *World Population Prospects* published by United Nations offers authoritative global demographic estimates and projections that are often used by researchers in this area. According to its medium fertility variant projection, China's total population will peak around 2030 with 1,416 million people, and then it will decrease to 1,348 million in 2050 (United Nations 2015). Using the data from the 2008 revision of *World Population Prospects* (United Nations 2009), Fang Cai (2010) found that China's working-age population would peak significantly earlier in 2015 with 998 million people and then begin to decrease. Based on the shortage of migrant workers and their increasing wages in China, the author concluded that China would have to face the challenge of getting old before getting rich. Yong Cai (2012) found that the proportion of the aging population in China would quickly increase to 30 percent or higher in the near future, and it would remain around 35 percent until the end of this century. Hu and Yang (2012) even argued that China's dependency ratio—that is, the number of children and the elderly divided by the number of working-age adults—would increase to more than 50 percent.

In 2016, China's government officially replaced the one-child policy with the two-child policy. However, this change seems unlikely to alter China's population decline. Wang et al. (2016) found that the increase in fertility in response to the two-child policy would be mild, within the range of 0.3 to 0.7 more births per woman. Even under the high-fertility variant in which fertility increases by 0.7, their simulation results showed that China's total population would still peak around 2030 at approximately 1,460 million. Wang et al. (2016) also simulated the proportion of the aging population under a one-child and a two-child policy for the next 30 years and found only a small difference under the two policies.

Given that the brand-new two-child policy cannot be expected to reverse the trend of a declining and aging population, the Chinese government will need to adapt to the predicted demographic changes in other ways. For example, China should speed up its discussion of postponing the usual retirement age. It should also move forward with the removal of the *hukou* registration system, in which people are designated as "rural" or "urban" and then hindered from migrating. The one-child policy has often been blamed for a labor shortage in China's urban areas. However, if the Chinese government would relax the *hukou* restrictions and phase in later retirement ages, the labor shortage in urban areas will be substantially improved. Finally, as China's population ages, the government needs to pay more attention to the reform of the pension systems in the urban and rural areas.

I have focused on the effects of the one-child policy on selected family outcomes. It would be valuable to analyze some important underexplored issues in future research. First, for a given supply of land, how did the one-child policy affect housing prices, the cost of living, and real incomes? Notably, the cost of living may affect family formation and ultimately family outcomes. Second, how did the one-child policy influence labor productivity, given labor supply? Higher schooling

(though a modest increase) should increase labor productivity. Third, how did the policy affect government budgets, given labor supply and productivity? An older population implies higher outflows, particularly for pensions and health.

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