

The Role of Fertility Policy Intervention in Population Aging: Taking China as an Example

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It is of great significance to discuss the role of fertility policy in coping with the challenge of population aging in China. The latest population prospect of the United Nations shows that fast population aging in China is coming soon and its degree will reach as high as the average of the developed countries when it comes (The United Nations, 2009). One of our recent quantitative studies further shows that population aging in China has already advanced and will continue to remarkably advance the economic development level. China will encounter huge economic pressure from population aging in the first half of this century and the aging problem will probably postpone the modernization of China (Mo Long, 2009; Mo Long and Wei Yuhong, 2009). Population regulation (including immigration and the increasing of birth population) and behavior regulation (including transformation and adaptation in economic, social and cultural aspects, etc.) are two basic means of human society to cope with the challenge from population aging (Henripin et Loriaux, 1995). Undoubtedly, the primary method and fundamental way for China to deal with population aging is behavior regulation (including quickening economic development, establishing and improving social security system for old people and carrying forward the social custom of respecting and caring old people). Meanwhile, all positive factors which can be mobilized shall be brought into play to cope with this complex and hard challenge, in which the questions of whether and how fertility policy shall play the regulative role are urgent to be studied.

In this respect, the research trends of the developed countries are worthy of notice. The relevant countermeasure the developed countries take is to work along both lines to cope with the severe challenge from population aging: except for improving social security system for the old people, prolonging retirement age and encouraging the young old to engage in labor and other behavior regulation measures, population regulation is studied deeply and adopted actively as well. For instance, the demographers of the developed countries, organized by the United Nations at the end of the twentieth century, have carried out large, systematic and deep international cooperative research on the feasibility of relieving their aging pressures through increasing immigration (The United Nations, 2001). On the other hand, more and more developed countries begin to carry out the population policy of birth encouragement to improve fertility level or stabilize the decreasing fertility level, so as to relieve aging pressure. The percentage of these developed countries has rapidly ascended from 41% in 1996 to 71% in 2007(The United Nations, 2008).

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China will probably become the largest social laboratory for human attempt to adjust population aging through fertility policy. In order to alleviate huge pressure of gross population upon resource environment and social and economic development, China started to carry out all roundly strict family planning policy from the seventies of the 20th century, which result in a rapid decline in the female-sum fertility rate, from 5.94 children per woman between 1965 and 1970 to 1.77 children per woman between 2000 and 2005(The United Nations, 2009). In the meantime, population aging in China started and the proportion of the old people of 65 years old and over rises from 4.3% in 1970 to 7.6% in 2005, and is predicted to rise to 23.3% in 2050(The United Nations, 2009). Facing fast population aging, Chinese demographers and policy makers are recently in hot discussion over whether fertility policy shall be adjusted. If it can be said that in the past 40 years China has succeeded in intervening population scale by means of fertility policy, in the future decades it is completely possible for China to succeed in intervening population structure by means of fertility policy.

This paper intends to become an experimental evaluation report for the large-scale social experiment of population studies mentioned above which has already taken place or will take place. Through reviewing, analyzing and foreseeing the situation in China, this research will study the following important issues: What impact does the practice of fertility policy with the goal of controlling population scale have on the process of population aging in China? Whether China can alleviate population aging pressure through the adjustment of fertility policy in the future decades? What kind of impacts do the adjustment of the time and opportunity and the extent of fertility policy have on the effect of policy adjustment?

1. Methodology and Data

1.1 Methodology

This study adopts comparative population simulation method. To construct this method, we use the following methods adopted by the United Nations for reference: one is comparative population prediction method, which evaluates the impact of the variation of population variables such as fertility rate, death rate and mobility rate upon the age structure of population (The United Nations, 1988); The other is the method to evaluate the long-term impact of the decline of death rate on the variation of gross population (The United Nations, 2000).

Our evaluation covers two successive periods: from 1970 to 2005 and from 2005 to 2050. The study starts from a retrospective analysis. On the one hand, the strict fertility control in China began from 1970s, and the rapid decline in fertility rate and population aging nearly started synchronically from the same period. On the other hand, fertility rate in China seemed to decline to the bottom line at the turn of the 21st century (The United Nations, 2003). Therefore, we select the period from 1970 to 2005 for the retrospective analysis to conclude and evaluate the impact on population aging from the decline in fertility rate caused by China's population control. As for the prospective analysis, we choose the period from 2005 to 2050 as China in this period will face especially strong aging problem and there is a necessity to alleviate

attack from the aging.

The population simulation adopts poly-factor method. In order to reveal the impact of fertility rate on population aging between 1970 and 2005, we simulate the process of China's population aging under the hypotheses of different fertility rates. Among these simulations, except that the fertility rates are set according to the needs of different simulations, all other population parameters are under control, that is, they are assumed to keep the same during the same period in each simulation. The decline in fertility rate is divided into two parts: the decline caused by fertility policy and that caused by non-fertility policy (such as social and economic development). This division enables us to draw possible routes of the change of fertility rate if no family planning policy is carried out. If the simulation routes of the change of fertility rate are included into the simulation modes and thereby simulation results are obtained through comparison, the impacts of fertility policy on China's population aging can be separated and quantified.

With regard to explore possible impacts of the adjustment of fertility policy between 2005 and 2050 on population aging, we design adjustment schemes for fertility policy under different adjustment extents and time and opportunities, simulate the variation of China's population during the period under these schemes, and further evaluate economic pressure from population aging under these schemes.

1.2 Data Sources

This study mainly adopts two types of data: population data and GDP per capita.

Population data: the fundamental data used to review and forecast the process of population aging in China include beginning population by age, life expectancy, total fertility rate, fertility rate by age, birth sex and international migrant population. Except that the total fertility rate has different designs in schemes according to different simulations of fertility policy, the data of all other parameter come from the United Nations (2009).

GDP per capita: except those have been stated specially, GDP are all counted according to purchasing power parity (PPP) and the invariant price in 2005 (international dollar) so as to guarantee the comparability of GDP data in various countries(districts) and in various years. The data of GDP per capita of each country in each year between 1980 and 2007 come from the World Bank's *World Development Indicators 2008*(World Bank, 2008).

2. The Impact of Fertility Policy on Population Aging (1970-2005)

With view to studying whether China's population aging can be intervened and regulated through fertility policy, this paper will examine two hypotheses pointed out by the present author. This chapter examines the first hypothesis: the family planning plays a key role in starting and accelerating China's population aging.

2.1 The Hypothesis of Contribution Rate of Family Planning and Social and Economic Development to the Decline in Fertility Rate

According to a research named *The Input and Output of Family Planning in China*, due to the decline in fertility rate, birth population decreases by 634 million

people from 1971 to 1998, among which 54% is resulted from the implementation of family planning and 46% is from social and economic development which leads to the decline in fertility rate (Zha Ruichuan, etc., 2000). This study was financed by national social science fund and completed in 1999. It is thus hypothesized that during the whole period from 1970 to 2005 the contribution rates of family planning and social and economic development to the decline in fertility rate keep the above-mentioned proportions, that is, 54% and 46% respectively. This hypothesis makes it possible to estimate how the fertility rate from 1970 to 2005 will change if no family planning is implemented (See Table 1). It is rightly this critical hypothesis that forms the basis to quantitatively analyze the impact of family planning policy on the population aging in China.

This hypothesis is reasonable. A great deal of researches from Chinese and western demographers reasonably demonstrate that both family planning and social and economic development have strongly pushed the decline in fertility rate since the seventies of the 20th century (Birdsall, etc., 1983; Tien, 1984; Poston, etc., 1987; Lavelly etc., 1990, Yuan Yongxi etc., 1991; Chen Wei, 1996; Zha Ruichuan etc., 1996; Zhang Fengyu, 1998; Li Jianming, 2009). As regards to the respective contribution rates of the two factors, a report published by the United Nations Population Fund shows that: In terms of the world average level, roughly one third of the decline in fertility rate from 1972 to 1994 is caused by family planning. Family planning has significant impact in Asia where the ratio is as high as more than 2/3 (The United Nations Population Fund, 2002). That is to say, the hypothesized contribution rate (54%) of family planning to the decline in fertility rate from 1970 to 2005 is slightly lower than that (more than 2/3) estimated by the United Nations Population Fund. If the following facts are concerned, it will be better understood why our hypothesis is reasonable. The first fact is that our hypothesis covers two more periods from 1970 to 1971 and from 1995 to 2005 than the above analysis from the United Nations Population Fund, and moreover the intensities of the family planning in these two periods are relatively weak. The second fact is that during the period from 1970 to 2005 not merely the extent of the family planning in China but also the speed of China's social and economic development are remarkably higher than those of other Asian countries.

Based on the above results, under the situation of the lack in other more convincing figures, it is reasonable to utilize the above hypothesis to quantitatively evaluate the impact of China's fertility control policy on its population aging from 1970 to 2005. Along with this evaluation, the impact of the decline in real fertility rate is evaluated. The decline in real fertility rate is resulted from the combined force of fertility policy and non-fertility policy, and the latter provides with a reference system as the effect of the impact of fertility policy on the population aging will in no circumstances exceed that caused by the decline in real fertility rate.

2.2 Simulation Schemes

In order to evaluate the impact of the implementation of family planning policy on population aging, three schemes are designed for population simulation: the scheme that the fertility rate remains unchanged from the initial level of 1970; the

Table 1. The Simulation Schemes for Chinese Population (1970-2005)

Indicators	Schemes	Hypotheses							
		Year 1970	Year 1975	Year 1980	Year 1985	Year 1990	Year 1995	Year 2000	Year 2005
Total Fertility Rate (Children number/Woman)	Implementing the Family Planning Policy	5.47	4.22	2.83	2.62	2.44	1.95	1.79	1.77
	The Fertility Rate Keeps Unchanged at the Level of the Year 1970	5.47	5.47	5.47	5.47	5.47	5.47	5.47	5.47
	Not Implementing the Family Planning Policy	5.47	4.90	4.26	4.16	4.08	3.85	3.78	3.77
Birth Expectation Male Lifespan (age) Female International Net In-Immigration (Thousand-person/ Year)	All Schemes	59.1	61.8	63.5	64.4	65.4	66.7	68.2	69.5
	All Schemes	60.6	63.3	65.4	66.8	68.2	69.6	71.1	72.7
	All Schemes	-100	-149	-73	-61	-120	-162	-163	-133

scheme that fertility rate declines under the implementation of the family planning; and the scheme that fertility rate declines not under the implementation of the family planning (that is, the decline in fertility rate caused by social and economic development and other non-fertility policy factors). And then by comparing the values of six aging indicators gained through simulation, the effect of the impact of the decline in fertility rate on the aging indicators and the contribution of fertility policy are quantitatively evaluated. See Table 1 for details.

2.3 The Analysis on the Simulation Results

As for the impact of the implementation of family planning policy on the process of population aging, the findings are as follows:

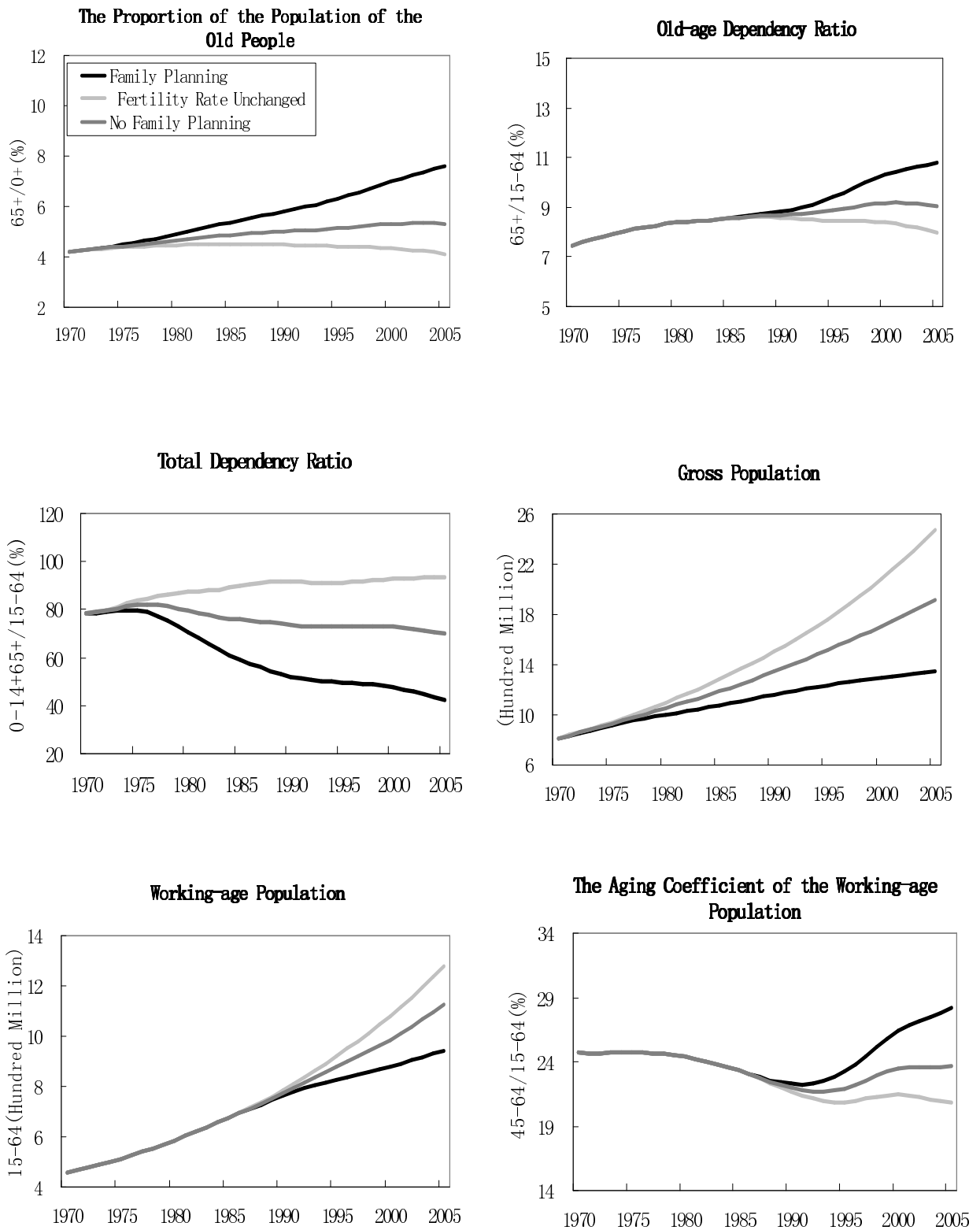
At first, a popular opinion holds that family planning policy just quickens population aging, but the simulation results correct that opinion. It is found out that family planning is the key factor which causes the appearance of population aging in China in the last three decades of the 20th century. According to the calculation, if family planning is not implemented from 1970 to 2000, the proportion of the population of 65 years old and over will nearly keep stable, only a slight increase from 4.2% to 5.3% in thirty years. In other words, if family planning is not implemented, the population aging will hardly appear until the end of the 20th century. On the contrary, with the implementation of family planning policy, population aging starts up in China and the proportion of the population aged 65 and over rises from 4.2% in 1970 to 7.0% in 2000, and reaches 7.6% in 2005(See Chart 1).

Second, different from its impact on fertility rate, that of family planning policy on the aging level shows an even distribution along with time from 1970 to 2005. Due to the population control, the total fertility rate declines in the first 25 years (1970-1995) by 64% (from 5.47 to 1.95), while unevenly in the last ten years (1995-2005) only declines by 9% (from 1.95 to 1.77). On the contrary, the proportion of the population aged 65 and over rises evenly in the two above-mentioned periods (Chart 1).

Third, the family planning causes the rise of the old-age dependency ratio. After 15 years' implementation of the family planning policy, the old-age dependency ratio is obviously rising, from 8.6% in 1985 to 10.8% in 2005, and keeps the rising tendency (Chart 1). If no family planning policy is implemented, the old-age dependency ratio rises slowly and keeps at the level of 9.1% from 2000 to 2005.

Fourth, the family planning causes remarkable decline in total dependency ratio. According to our simulations, if the fertility rate keeps unchanged at the initial level, the ratio (which shows the total dependency ratio of the total potential dependency burden of the working-age population) of the sum of the population aged from 0 to 14 and that aged of 65 and over to the population aged from 15 to 64 will increase significantly during the period from 1970 to 2005. If no family planning is implemented, the decline in the fertility rate caused by social and economic development will only lead to a decline in total dependency rate by 8.4 percentage points during the period. However, the fact is that due to the implementation of the family planning the total dependency ratio greatly declines from the highest level of 79.8% in 1974 to 42.3% in 2005(Chart 1). In other words, the family planning in

Chart 1. The Impact of China's Fertility Policy on the Aging Indicators (1970-2005)



Source: The Population Simulations of this Study

China successfully makes the total dependency ratio become more advantageous, remarkably lower than that of the average level of the developing countries during the same period (The United Nations, 2009), so that it makes historical contribution to “China’s Economic Take-off” during that period.

Fifth, the family planning makes the most direct contribution to effectively controlling the gross population. Based on the simulations, if no family planning is implemented, although social and economic development will also cause the decline in the fertility rate, the gross population will rise up to 1.91 billion in 2005. On the contrary, due to the implementation of the family planning, the real population in 2005 is 1.31 billion, that is, a decline by 0.6 billion. The latter is equal to the sum of the population of the United States, Canada, France, Britain, Germany and Italy (*China Statistical Yearbook 2007*) (Chart 1).

Sixth, the family planning slows down the increase of the working-age population. According to the simulations, if no family planning is implemented, the working-age population aged 15 to 64 will increase from 457 million in 1970 to 1124 million in 2005. In contrast, due to the implementation of the family planning, the increase of working-age population tends to slow down from the year 1985, and the working-age population in 2005 is only 924 million(Chart 1). In China, this will not lead to the shortage of the working force, but will instead lessen the employment pressure to a large extent.

Seventh, the family planning quickens the aging of the working-age population. After entering into 1990s, the implementation of the family planning makes the increase of the proportion of the population aged from 45 to 64 among the population aged from 15 to 64 gain apparent speed with 28.2% in 2005. In contrast, if no family planning is implemented, the said ratio is 23.7% in 2005(Chart 1).

Eighth, the family planning policy basically aims at controlling the number of population, but the extent of its impact on the population aging is greater than that on the population scale.

To quantitatively measure this phenomenon, *Ie* is used below to define “the index of the extent of impact” of population policy on the variation of certain aging indicator:

$$Ie = \left(\frac{Va - Vs}{Vs} \right) * 100\%$$

Va: The ending value of the said aging indicator if the population policy is implemented during that period

Vs: The ending value of the said aging indicator if the population policy is not implemented during that period

By using this indicator, it is found that: the family planning policy implemented from 1970 to 2005 has different impacts on the variation of the 6 aging indicators during that period. At first, it is especially notable that the proportion (*Ie*=42.5%) of the population of the old people of 65 years old and over and the total dependency ratio (*Ie*=-39.7%) are strongly impacted by the family planning policy: due to the family planning the former increases by 42.5% during that period, and the latter by 39.7%. Furthermore, the family planning policy also shows relatively remarkable extent of impact (*Ie*=-29.8%) on the gross population, but weaker than that on the proportion of the old people population and the total dependency ratio. At last, the family planning policy has noticeable impact on the dependency ratio of 65 years old and over (*Ie*=19.1%), on the ratio of the population aged from 45 to 64 among the population

aged from 15 to 64 ($I_e=19.1\%$) and on the working-age population aged from 15 to 64($I_e=16.1\%$) as well.

3. The Intervention of Fertility Policy in Population Aging (2005-2050)

This chapter testifies the second hypothesis: China, by means of the fertility policy, will probably effectively slow down the pressure on social and economic development caused by population aging. The effect is related to the time and opportunity at which and the extent to which the fertility policy is broadened.

3.1 “The Window of Opportunity” for China to Intervene in Population Aging through Fertility Policy

Modernization is the best contraceptive. With the economic development and social modernization, the variation of the fertility rate from high to low has become the unchangeable international tendency (Easterlin and Crimmins, 1985). According to the statistics from the United Nations, the average total fertility rate has decreased from 5.4 to 2.9 all over the world, among which the total fertility rate of the developing countries decreases from 5.9 to 3.9 and that of the developed countries from 2.3 to 1.4. After entering into the 21st century, the declining tendency of the fertility rate makes more and more countries step into the group of countries with low fertility level (when the total fertility rate decreases below the replacement level) and even extra-low fertility level(when the total fertility rate decreases below 1.3). In the 90s of the twentieth century, the phenomenon of ultra-low fertility rate firstly appeared in Italy and Spain and until the beginning of the 21st century such countries and districts increases to 23(Li Jianmin, 2005). It is noticeable that both Japan and South Korea which share the similar oriental culture to China appear in the group of the countries with ultra-low fertility rate. And the fertility rates of Singapore, Taiwan, Hong Kong and Macao which belong to the same grand Chinese cultural circle as China are extremely low with no exception, and have decreased below 1.2 children in recent years. Hong Kong and Macao even decrease below 1 child and become one of the districts with lowest fertility in the world,

Among the declining tendencies of the world fertility level since 1970s, China's fertility rate declines rather fast. The total fertility rate reaches as high as 5.47 in 1970 and declines below the replacement level in 1992 after more than 20 years while it will take more than one hundred years for the developed countries to complete this variation of the fertility level. China's fertility rate changes faster than the developed countries in that their decline modes of the fertility level differ greatly. The developed countries represented by Europe have a smooth and natural decline in the fertility rate, which is brought by the change in people's fertility concept caused by the rapid social and economic development under the push of the industrial revolution (Feng Xiaotian, 2002). This kind of decline is called as endogenous decline. However, China has the rapid and large-scale decline depending on the strong external force that is the strict family planning policy to control and impact people's fertility behavior under low level of social and economic development. After the reform and opening in 1978, social and economic development in China plays a more and more important role in changing people's fertility concepts and finally their fertility behaviors. This can be visibly seen from the decline in people's fertility desire. The analyses made by Feng Xiaotian and Zhang Qingsong from 51 pieces of research reports on the relevant fertility desires in China from 1979 to 1999 shows: in 1980s, the rural resident's ideal number of children is mainly 2 to 3 while the urban resident's mainly 1 to 2; in 1990s, the rural resident's ideal number of children is mainly 2 while the urban resident's mainly 1. “The Sixth National Population and Family Planning Sample Survey” in

2006 shows that the average ideal number of children of the reproductive women has declined to 1.73 (Li Jianmin, 2009). Some rural areas haven't used up the second child quota for many years (Deng Zhenzhen, 2004). "Dink" phenomenon (double incomes no kid) much found in the developed countries and districts even appears in Chinese cities. According to the web survey (www.Horizonkey.com), the proportion of the youth in Beijing, Shanghai, Guangzhou and Wuhan who want to be a "dink" rises from 1.1% in 1997 to 10.5% in 2004(Zeng Yi, 2009). Above all, the decline in China's fertility rate has transformed from the main policy intervention in early stages to the decline through policy intervention along with endogenous decline, and the role of policy intervention is weakening.

It is thus believed that with the rapid modernization China will have endogenous decline in fertility rate in near future, that is, the decline without policy intervention, which has already widely appeared in the developed countries. Before that happens, only by broadening fertility control can fertility rate rise up. After that happens, it will become very difficult to raise fertility rate, just like what is taking place in the developed countries today. Therefore, the period from the present to the time when the endogenous decline in fertility rate appears is the "window of opportunity" for China to intervene the population aging through fertility policy.

3.2 The Simulation Schemes

Based on the recognition of the existence of the "window of opportunity" to intervene the population aging through fertility policy, different schemes of fertility policies are designed to simulate the change of the population in China from 2005 to 2050, so as to disclose the relationship between the effect of the change of fertility policy and the extent and the time and opportunity to adjust fertility policy. And the control variables of the effect of the change of fertility policy are the indicators which reflect the gross population and the aging. The reason is that China is not only trapped in the huge pressure of the population scale, but also encountered with that of the rapid population aging. As far as China is concerned, the key to formulate fertility policy in the first half of the 21st century lies in finding a balance point between two contradicting choices: controlling the gross population and controlling the population aging.

The simulation schemes are designed according to two routes: respectively simulating the changes of the gross population and those of the aging extent and the economic pressure from the aging when the fertility policies are broadened to different extents and at different time and opportunities. In terms of the first route, Scheme 1 is hypothesized to keep the current fertility policy unchanged, with the fertility rate of the beginning level of 1.77; from scheme 2 to scheme 6 the fertility policies are loosened from a smaller extent to a larger extent, that is, the total fertility rate is gradually up-regulated in successive order from 2.0, 2.2, 2.4, 2.6 to 2.8 within 10 years beginning from 2010, and keeps unchanged until 2050. In terms of the second route, the total fertility rate is hypothesized to be up-regulated from the beginning 1.77 to 2.2 within 10 years, and then keeps unchanged until 2050. Scheme 3 and Scheme 7, 8, 9 start to loosen the fertility policy from the present to the future time, and the starting time is 2000, 2010, 2020 and 2030 successively. See Table 2 for details.

3.3 The Evaluation on the Economic Pressure from the Aging

Recently, we construct a new approach in another study, by which not only the type of the coordination (advanced, simultaneous or lagged) between the population aging in each country and its economic development can be judged, but also the extent of the coordination can be quantitatively measured and compared between each

Table 2. The Simulation Schemes of Chinese Population (2005—2050)

Time	<u>I. The Schemes of Broadening the Policies to Different Extents</u> Total Fertility Rate						<u>II. The Schemes of Broadening the Policies at Different Time and Opportunities</u> Total Fertility Rate					
	Scheme 1	Scheme 2	Scheme 3	Scheme 4	Scheme 5	Scheme 6	Scheme 7	Scheme 3	Scheme 8	Scheme 9		
2000							1.77	1.77	1.77	1.77		
2005	1.77	1.77	1.77	1.77	1.77	1.77	1.99	1.77	1.77	1.77		
2010	1.77	1.77	1.77	1.77	1.77	1.77	2.20	1.77	1.77	1.77		
2015	1.77	1.89	1.99	2.09	2.05	2.11	2.20	1.99	1.77	1.77		
2020	1.77	2.00	2.20	2.40	2.60	2.80	2.20	2.20	1.77	1.77		
2025	1.77	2.00	2.20	2.40	2.60	2.80	2.20	2.20	1.99	1.77		
2030	1.77	2.00	2.20	2.40	2.60	2.80	2.20	2.20	2.20	1.77		
2035	1.77	2.00	2.20	2.40	2.60	2.80	2.20	2.20	2.20	1.99		
2040	1.77	2.00	2.20	2.40	2.60	2.80	2.20	2.20	2.20	2.20		
2045	1.77	2.00	2.20	2.40	2.60	2.80	2.20	2.20	2.20	2.20		
2050	1.77	2.00	2.20	2.40	2.60	2.80	2.20	2.20	2.20	2.20		

country, so that the pressure brought by the population aging to economic development can be reflected. This approach will be applied below to analyze the coordination between China's population aging and its economic development from 2005 to 2050 under different adjusted schemes of the fertility policies, so as to evaluate the effects of the adjusted schemes of these policies on the alleviation of the economic pressure from the aging.

The application of the above-mentioned approach into this study shall be explained before the analysis.

First of all, both Chart 2 and Chart 3 describes the scatter distributions of the two variables concerning the ratio of the population aged 65 and over and the GDP per capita in the current year in 104 countries whose population in 2007 exceeds 5 million, and the general rule (that is, the regression curve of the scatter points of each country in 2007) of the relationship between the level of the population aging and the level of social and economic development represented by GDP per capita in the current year in these countries. According to the approach constructed, if the scatter points of a country in the chart fall on or near the regression curve, the coordination between the level of the population aging and that of social and economic development of this country in 2007 belongs to "simultaneous type". If the scatter points of a country deviates from the regression curve to the upper side (or the downside), the coordination between the level of the population aging and that of social and economic development of this country in 2007 belongs to "advanced type" (or "lagged type"). The farther the scatter points of a country deviates from the regression curve, the more serious the incoordination exists between the level of the population aging and that of social and economic development of this country.

Moreover, Chart 2 and Chart 3 reflect respectively the variation tendency of the coordination between China's population aging and its social and economic development under the fertility policies which are broadened to different extents and at different time and opportunities within the estimated period (altogether 9 schemes). In each scheme, China's irregular curves from 2007 to 2050 deviates obviously from the regression curve to the upper side, which shows that China's population aging remarkably advances its economic development during the period no matter in which scheme.

Finally, the economic pressure of the aging comes from the incoordination that the aging advances the economic development. The farther the aging advances the economic development, the greater the economic pressure is formed. Therefore, in Chart 2 and Chart 3, the farther the irregular curve deviates from the regression curve, the greater the economic pressure of China's population aging exists in the scheme the concerned irregular curve corresponds to.

Due to the limited space, this approach is not completely introduced here. Detailed references can be found in the relevant papers (Mo Long, 2009).

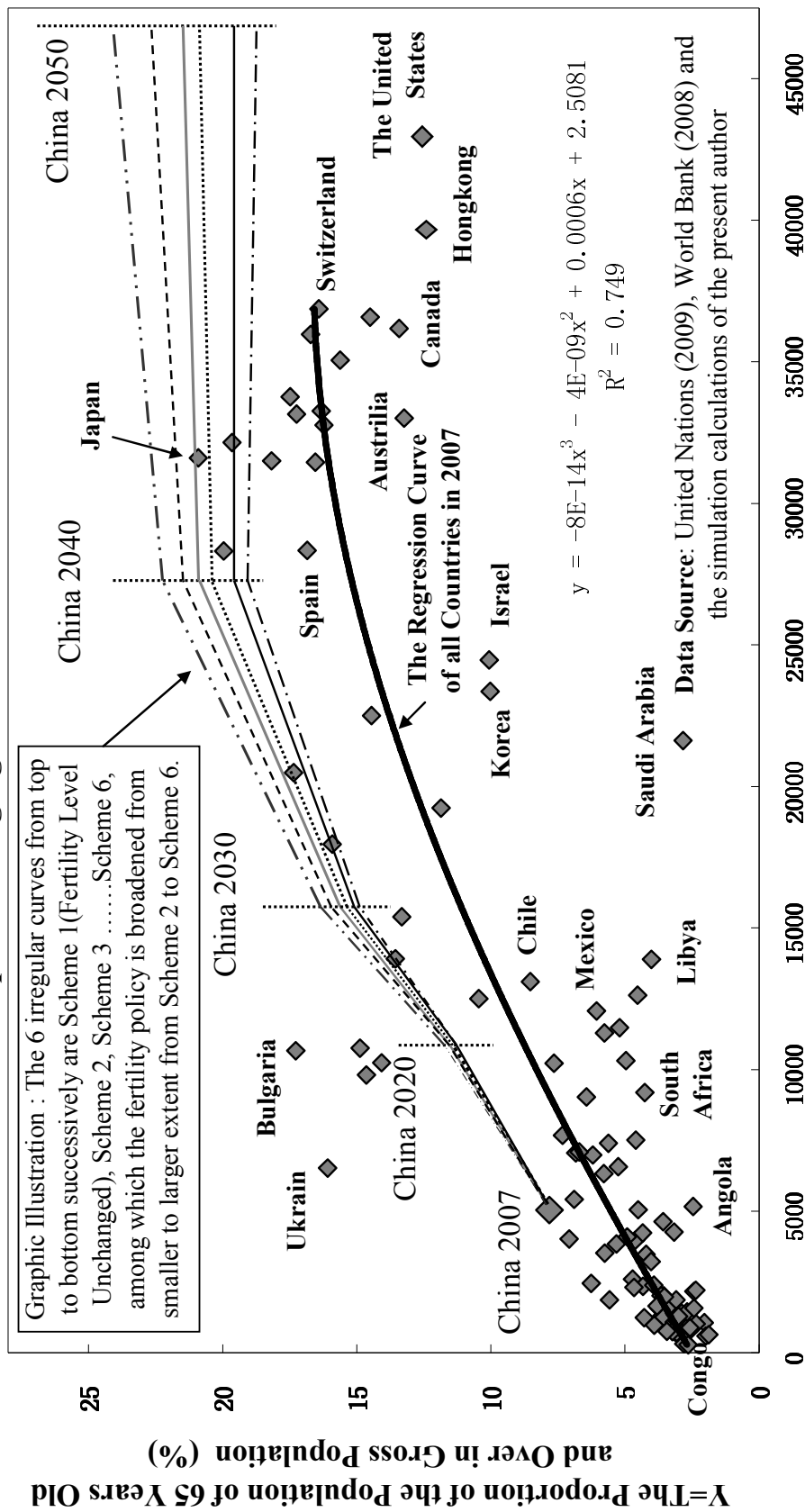
3.4 The Analysis on the Simulation Results

Based on the analysis of Chart 2 and Chart 3, the findings are as follows:

First, if the current fertility policy is kept unchanged and the total fertility rate maintains the present level of 1.77 throughout the first half of the 21st century, China will face very severe advanced aging of the population in the future. Especially from 2030 to 2050, the population aging in China will advance the economic development to the extent which far exceeds that of all the countries whose GDP per capita in 2007 has reached at the same level as China during the period from 2030 to 2050³. In other

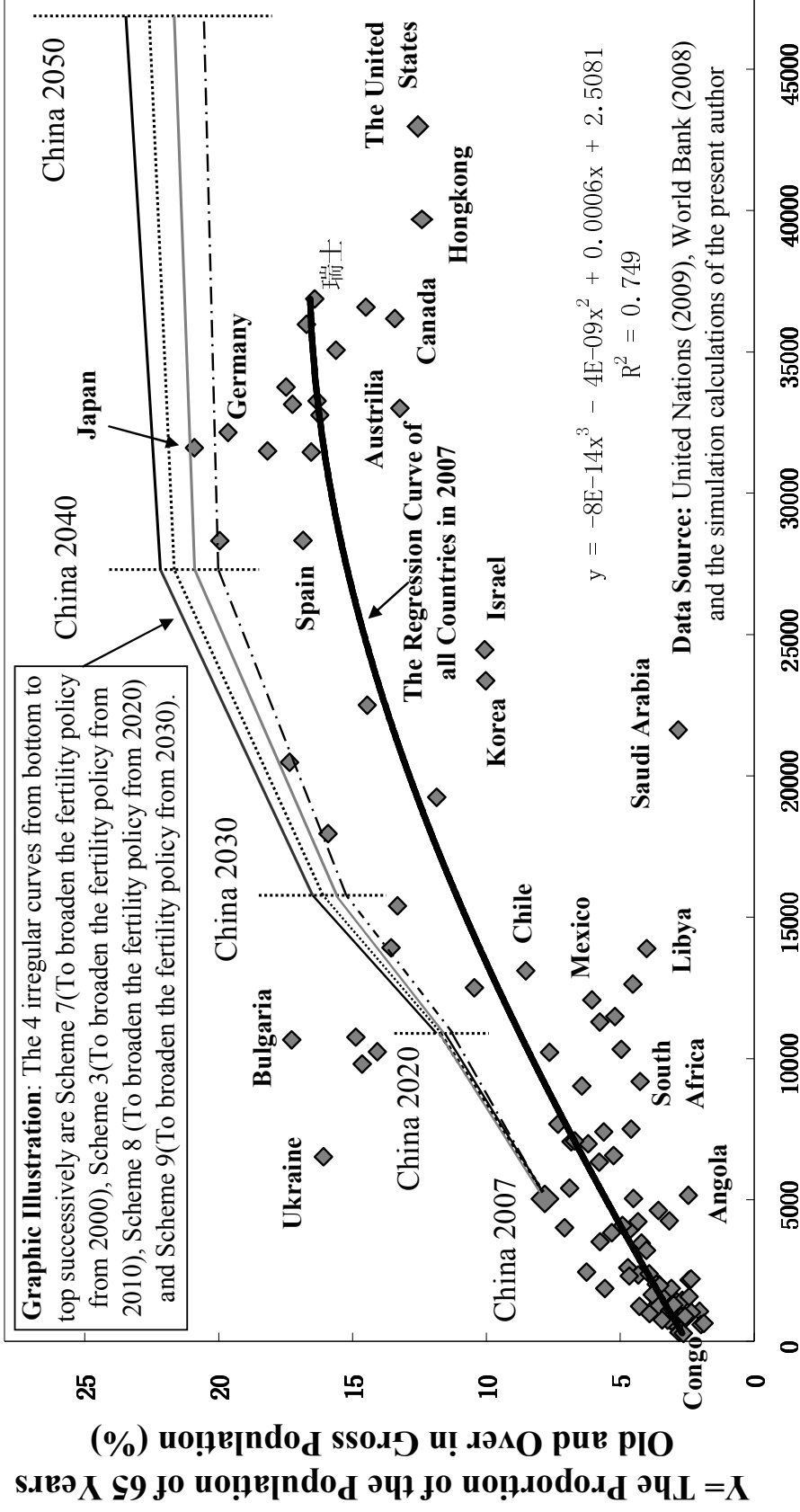
³ Chart 2 shows that the irregular curves of the scheme "No Change in Fertility Level" are much higher than the scatter points of all countries with the GDP per capita in 2007 in the same section as China.

Chart 2. The Impact of the Extent of Broadening Fertility Policy on Economic Pressure of China's Population Aging from 2007 to 2050



* Notes : The chart shows the scatter distributions of the 104 countries (districts) whose gross population in 2007 exceeds 5 million and have relevant data

Chart 3. The Impact of the Time and Opportunity of Broadening Fertility Policy on Economic Pressure of China's Population Aging from 2007 to 2050



* Notes : The chart shows the scatter distributions of the 104 countries (districts) whose gross population in 2007 exceeds 5 million and have relevant data

words, if there appears such situation, in the 30s and 40s of the 21st century the high extent to which the population aging in China advances the economic development has never appeared in human society so far⁴ (including Japan and Italy with the most serious situation at present) Second, the size of the extent to which the fertility policy is broadened will exert significant impact on the economic pressure of China's population aging in future. The more largely the fertility policy is broadened, the more closely the trend line (the irregular curve) of the variation of the coordination between the population aging and economic development approaches the regression curve, which means there will be smaller economic pressure from the population aging in the future(Chart 2). But in the mean time, the higher the extent to which the fertility policy is broadened, the greater the population scale. Take Scheme 6 for instance, in which the fertility rate is broadened to the highest extent. There will be smallest economic pressure from the population aging in the future while the population scale will keep rising and in 2050 reach the peak at 1.78 billion in the first half of the 21st century, which is much larger than the goal pointed out in *Research Report on National Population Development Strategy* to "control the population peak at 1.5 billion around until the middle of the 21st century". Under Scheme 1 to keep the fertility policy unchanged, the population will peak at 1.46 billion in 2030. Although the population scale is controlled within the scope of national goal, there will be extremely huge economic pressure from the population aging as stated above. Therefore, the necessity and the importance for China to find a balancing point between controlling the population scale and lessening the pressure from the population aging is verified once again.

Third, the choice of time and opportunity to broaden the fertility policy will also impact economic pressure of China's population aging in the future. The earlier the fertility policy is broadened, the more closely the trend line of the variation of the coordination between the population aging and economic development approaches the regression curve, which means there will be more obvious effects of the alleviation of the economic pressure of the population aging in the future(Chart 3). But it is also in contradiction with the increasingly larger population scale. Among the schemes to broaden the fertility policy in 4 different time and opportunities, Scheme 7 starts at the earliest in 2000, with the smallest economic pressure of the aging from 2007 to 2050. Scheme 9 starts at the latest in 2030, with the largest economic pressure of the aging in the future. However, the population of the first half of the 21st century peaks in Scheme 9 at the lowest (1.47 billion), while in Scheme 7 the highest (1.58 billion). Therefore, the time and opportunity to broaden the fertility policy shall be selected to gain a balance between relieving the population scale and lessening the pressure of the population aging.

Fourth, China can not completely eliminate the economic pressure of the population aging through broadening the fertility policy. Whether choosing to broaden the fertility rate to the highest extent or choosing to broaden the fertility rate at the earliest time, China's population aging will largely advance its economic development and the economic development will always face huge aging pressure. This point can

⁴ It has never appeared at the same level of economic development.

be directly noticed from each scheme in Chart 2 and Chart 3 where the irregular curves of China obviously deviates from the regression curve to its upper side from 2007 to 2050. All the results will be that China will still face relatively great economic pressure of the population aging from 2030 to 2050, even if the bearing capacity of China's population scale is not taken into consideration, whether to adopt Scheme 6 to broaden the fertility policy to the highest extent, that is, the fertility rate is adjusted beginning from 2010 and in 2020 reaches 2.8 far above the replacement level and keeps this figure until 2050, or to adopt Scheme 7 to broaden the fertility policy at the earliest time, that is, the fertility rate is adjusted beginning from 2000 and in 2010 reaches 2.2 above the replacement level and keeps this figure until 2050.

Fifth, although China can not eliminate the economic pressure of the population aging through broadening the fertility policy, it can definitely utilize this lever to reduce the aging pressure. Scheme 3 provides with the reference route to choose the time and opportunity and the extent to broaden the fertility policy. Scheme 3 starts to gradually broaden the fertility policy in 2010 and makes the target fertility rate increase in 2020 to 2.2 near the replacement level and keeps this figure until 2050. In this scheme, it is within the bearable scope where China's population of the first half of the 21st century peaks at 1.54 billion in 2046; the proportion of the old population aged 65 and over rises to 21.6%, and the economic pressure of the population aging at the peak period from 2030 to 2050 is obviously smaller compared with Scheme 1, 2, 8 and 9 (Chart 2, Chart 3). Although the economic pressure of the population aging in Scheme 4-7 is smaller than Scheme 3, the peak population in Scheme 4, 5 and 6 all exceed 1.6 billion and Scheme 7 just close to 1.6 billion. Compared comprehensively, among the 9 schemes designed, Scheme 3 is a relatively ideal compromised plan.

Considering the period from 2006 to 2014 is a new round of baby boom in China, each year the number of the reproductive women exceeds 0.36 billion(The United Nations, 2007). To make the population of the middle of the 21st century peak at about 1.5 billion as approximately as possible, a new route is attempted based on Scheme 3, that is, to stagger the baby boom and start to broaden the fertility policy from 2015 and make the target fertility rate reach 2.2 in 2025. As is shown in the results under this route, the population peaks at 1.51 billion in 2041, more than 30 million smaller than Scheme 3 and much closer to the goal controlled by the State; the proportion of the old people aged 65 and over rises up to 22.2% in 2050, 0.6 percent point higher than Scheme 3.

Through the above analysis are the inspirations: as far as the whole country is concerned, the suitable choice to reduce the economic pressure to the greatest extent on the premise of controlling the population scale is probably to start to gradually broaden the fertility policy around 2015 and spend 10 years making the total fertility rate increase to 2.2 nearby the regression level and keep unchanged until 2050. The combination of the time and opportunity and the extent to broaden the fertility policy is probably the balancing point between controlling the population scale and reducing the population aging.

4. The Conclusion

By adopting comparative population simulation method, the impact of China's family planning policy on population aging from 1970 to 2005 are quantitatively evaluated, and the effect of broadening the fertility policy to different extents and at different time and opportunities on the economic pressure of the aging from 2005 to 2050 are prospectively analyzed, so that a newer and deeper understanding of the feasibility and the effectiveness of intervening the aging through the application of the population policy is formed.

It is verified from the results that the family planning has contributed to controlling the fast population growth and lowering the total dependency ration from 1970 to 2005 through rapidly decreasing the fertility rate. However, in contrast with the people's opinions in the past, our analysis clears up the following three important facts. First, during the period from 1970 to 2005, family planning plays a key role in starting and accelerating China's population aging. Moreover, during this period the population control policy even exert a higher extent of impact on the aging than that on the population scale. Finally, if no family planning is implemented, China like most other developed countries will still hardly experience the aging until the beginning of the 21st century.

As to the possible role of the population policy in the regulation of the aging in the future, this study shows: the trend that the process of China's population aging advances the economic development can not be changed through the adjustment of the population policy in the first half of the 21st century, so that China can impossibly eliminate the economic pressure of the aging through broadening the current fertility policy. For all that, the simulation results also shows that population policy may still achieve something in finding a balancing point between controlling the population scale and reducing the population aging pressure. China can definitely control the population scale within a certain scope and reduce the population aging pressure at the same time through choosing appropriate time and opportunity and extent. The study in this paper brings beneficial inspirations in terms of the question of choosing the time and opportunity and the extent to broaden the fertility policy, and provides with thoughts and clues for more comprehensive and deeper study in this respect.

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