CHINA'S POPULATION POLICY AND ITS IMPACT ON ECONOMIC DEVELOPMENT

By

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A C K N O W L E D G E M E N T S

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L I S T O F T A B L E S

L I S T O F F I G U R E S


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TAIWAN
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GUANGXI
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CHAPTER ONE

INTRODUCTION

1. STATEMENT OF THE PROBLEM

The July 1, 1982 census announced that with 1,008,288,000 people, China[5] had become the first country to pass one billion, and had gained 314 million in the 18 years since the last census in 1964. The annual average increase since 1964 had been 17.4 million people, or 2.1 percent. No other country comes close to China in population size. To slow down the rate of population growth rate in order to cope with problems emerging from its fast growing population, the government launched the most ambitious family planning campaign in the world. A specific policy in this campaign is to limit each couple to only one child. If this policy is successful, China would stabilize its population at 1.2 billion, a target announced in 1979, by the end of the century or soon after. The ultimate goal set up in 1979 is to achieve zero population growth by the year 2000.[6] However, according to a population projection,[7] if the one-child-per-family policy can be strictly and successfully implemented, the average population growth rate in the year 2010 will be -2 per thousand, and will

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5. China in this paper means the China mainland, or the People's Republic of China.

6. Qian Xinzhong, "Discussion on Family Planning", Beijing Review, vol. 22, no. 28, 1979

7. Song Jian, Tian Xuyuan, Population Projection and Population Control, Beijing: 1982, (in Chinese). Details of the projection are reported in chapter five.

decline thereafter. The impact of such a rapid reduction in population growth rate may in fact lead to unforeseen demographic, social and economic problems in the near future. For example, such a policy would make the Chinese population the most aged one in the world.[8] Frequent reports of interference of human rights in China as the direct result of the one-child-per-family policy implemented in 1979 has drawn worldwide concern.

Many previous studies of Chinese population policy either have emphasized the positive necessity of population control while ignoring the human rights and the aggregate social welfare aspects of the policy, or have emphasized the moral side of the problem while ignoring population pressure in China. Main attention has been focused on how population policy itself affects target population. Little work has been done beyond official guidelines and limitations to study the coercive or incentive mechanisms of population control program, the impact of economic policy and its effectiveness on people's preference for children and on the extent of success of population planning program. In addition, the negative impact of the one-child policy is not widely studied.

2. OBJECTIVES

The objectives of this paper are to discuss the current

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[8]. Wu Cangping, "Some Population Problems That Should be Deliberated Upon at an Early Stage", World Economic Herald, no. 165, 1983 and "The Two Problems Which We Should Pay Attention to", Economic Digest, no. 4, 1984.

population policy in China, and to discuss an alternative policy option. The current One-Child policy in China and its impact on Chinese economic development will be discussed. More specifically, I will:

1) review the main streams of population theory;

2) discuss China's population in a historical perspective;

3) discuss China's population policy in a historical perspective;

4) discuss the One-Child-Per-Family policy, including its shortcomings, its interference with human rights, and the resistance to the policy;

5) present population trends and projections to examine issues related to population size and age structure, especially population aging in China;

6) discuss the effects of the One-Child policy on China's economic development by using a simple economic growth model; and

7) present some alternative policy options in population control.

3. LIMITATIONS

As a new discipline, Chinese population research is hampered by inadequacies in the underlying theory as well as methodological shortcomings. An additional problem is the severe shortage of information, especially statistical data. It is extremely difficult to get relevant, up-to-date, information,

especially on the negative aspects of the current population policy. Data and information from unofficial channels are inappropriate to be referenced. For these reasons, the majority of references in this paper are to publications in western countries. Some direct observations are also reported in the paper.

4. CONCLUSIONS OF THE STUDY

The study concludes that although the current one-child-per-family policy in China is making and will make progress on reaching its target of slowig population growth, it impedes the realization of the national governing principles of this socialist country to satisfy people's growing material and cultural demands and to maximize social welfare of all the people, and it impedes the development planning objectives of social justice, rapid economic growth and sustained development. The policy causes frustration, human misery and will have a sustained negative impact on China's long-run modernization plans, despite efforts made to promote economic development. The result of the study indicates that under the current one-child-per-family policy, China will face sharp population decline, and accompanied problems such as population aging and labor shortage relative to the number of dependents. The study also suggests that instead of putting all emphasis in population control itself, China should adopt a more open and liberal economic policy. This will not only promote voluntary family planning,

public social security system and internal migration, but will also help solve the ultimate problem of economic backwardness.

CHAPTER TWO

LITERATURE REVIEW

1. SCHOOL OF THOUGHT 1: RAPID POPULATION GROWTH CONTRIBUTES TO POVERTY AND ECONOMIC BACKWARDNESS

The argument that rapid population growth is harmful is supported by two points of view. First, it is argued that, in third world nations, food production and economic growth often cannot keep up with the needs of rapidly-growing populations. The most famous representative of this school, Thomas Robert Malthus, pointed out:

> Population, when unchecked, increases in a geometrical ratio. Subsistence increases only in an arithmetical ratio. ... This implies a strong and constantly operating check on population from the difficulty of subsistence. This difficulty must fall somewhere and must necessarily be severely felt by a large portion of mankind.....[9]

U Thant, the former secretary general of the United Nations, expressed the viewpoint that rapid population growth hinders economic development:

> There is ever-increasing realization that too rapid population growth constitutes a major obstacle to education and the promotion of the welfare of the young in general, the attainment of adequate standards of health, the chance of earning a decent living, and in many cases even the availability of food at subsistence level. We must conclude from the demographic projections that the task of providing opportunities for the world's as yet unborn children and developing their talents and their capabilities to the full appears in a number of countries well-nigh insuperable, unless

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[9]. T. R. Malthus, An Essay on the Principle of Population, ed. Phlip Appleman (New York: W.W.Norton, 1976).

> action is taken to moderate the population growth rate.[10]

Secondly, it is argued that curbing population growth is necessary to avoid damage to the environment. Paul Ehrlich and his colleagues insist that if we do not limit population, we are headed for a global catastrophe:

> The nature of exponential growth is such that limits can be approached with surprising suddenness. The likelihood of overshooting such a limit, with catastrophic results, is made even greater by (a) the momentum of human population growth, (b) by the delays between cause and effect in many environmental systems, and, (c) by the fact that some kinds of damage are irreversible by time they are visible....[11]

They believe that the momentum of human population growth has two origins. First, attitudes toward childbearing have deep biological and cultural roots, and therefore resist change. Second, today's population is heavily weighted with young people. This means that there are far more young people who will soon be reproducing than there are old people who will be dying. Thus, even if every pair of parents in the world had only enough children to replace themselves, the present imbalance between young and old would cause the population to grow for another 50 to 70 years before it leveled off. This phenomenon is called population "momentum".

There are some who claim that we cannot continue to be "our

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10. United Nations, Secretariat, Text of Statement by Secretary-General, U Thant, at Opening of Orientation Course for Population Programme Officers(Press Release SG/SM/1055, SOC/3624), 14 January 1969.

11. P. R. Ehrlich, Human Ecology (San Francisco: W. H. Freeman, 1973).

brother's keeper" if the consequence is no survival for everyone. Garrett Hardin holds another alternative, that is, not to lower death rate, because "we must recognize the limited capacity of any lifeboat....".[12]

2. SCHOOL OF THOUGHT 2: POPULATION GROWTH DOES NOT CONTRIBUTE TO POVERTY

Proponents of this school of population theory offer various points of view: (1) Population growth is a blessing to humanity; (2) Plenty of food is available, new resources will be discovered, and these will continue for the foreseeable future; (3) Hunger and poverty result from structural imbalances in the society, so the focus should be on these imbalances rather than on population control; (4) Hunger and poverty are caused by consumption patterns of the rich.

Julian Simon argues that more people means more knowledge. "Because improvements--their invention and their adoption--come from people, it seems reasonable to assume that the amount of improvement depends in large measure on the number of people available."[13] He and other proponents believe that people, even poor people, are assets, at least when they are given enough incentives and means to work. Population is a stock of creators

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12. G. Hardin, "Lifeboat Ethics: The Case Against Helping the Poor", Psychology Today, September 1974.

13. Julian L. Simon, "The Case for More People", American Demographics, 1, no. 10(November-December 1979).

of new knowledge. Thus an increase of population will mean additional knowledge-creators. The productive effect of increments to knowledge will contribute to the aggregate output as well as output per capita. His judgment about the welfare of a community depends both on the average income per person and on the number of people who partake of that standard of living. Simon indicates that "moderate population growth has positive effects on the standard of living in the long run after, say, 30 to 100 years, in both more developed and less-developed countries-as compared to a stationary population and to very fast population growth."[14] He holds that previous studies in the area of population growth and economic development are flawed, because they have placed too much weight on the present, relative to the future. He states, "any one who takes a long run view and gives high weight to the welfare of future generations should prefer a growing population to a stationary one now or in the near future." I believe that the difference among economists on the population growth problem are exaggerated. Simon's position has been misunderstood. He thinks that a moderate growth rate is preferable to a zero, or a high growth rate. The problem is that Simon did not give an operational definition of what he meant by moderate growth, nor is any empirical information provided. Without precise definition, people have problems understanding each other on what is meant by "low", "high", and "moderate". It

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14. Julian L. Simon, The Ultimate Resource, (Princeton, NJ: Princeton University Press, 1981).

is true that the probability of creating more geniuses is positively related to the size of a population, but it seems to me that it may be too simple and too naive to conclude that more people means more geniuses and more inventions. People cannot become geniuses naturally without training and education. If Simon's view is correct, we should expect to see more geniuses in the world's most populous developing countries than in the less populous developed countries. An interesting phenomenon is that many excellent scholars and students from developing countries become more successful in the developed countries than in their own. Many factors are responsible for this, but one reason is probably that a person's potential can be well developed only with better support. I believe that Simon's essential point is that population is not the main factor contributing to poverty and economic backwardness. Instead, social and economic policies and other factors restrict the full utilization of people's productivity. People cannot simply become productive with their bare hands.

Peter Bauer and Basil Yamey, like Simon, believe that an increased population growth rate indicates an increased standard of living: "The so-called population explosion is the result of sharp fall in mortality, unaccompanied by corresponding decline in birth rate."[15] They also think that per capita income is not

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15. P. Bauer and B. Yamey, "The Third World and the West: An Economic Perspective", The Third World: Premises of U.S. Policy, ed. W. Scott Thompson (San Francisco: Institute for Contemporary Studies, 1978).

an appropriate way to measure economic well-being, otherwise an increase in the death rate of the poor in a country would have to be regarded as economic improvement.

Roy Prosterman observed the relationship between infant mortality and death of young children and family size, and argued that with a high death rate of children, parents must have large families to ensure that some children will survive to be able to help support the family and the parents in illness and old age. Mary Alice Caiendo, based on the results of a computer simulation study, indicates that with current infant and adult mortality rate in India, "a couple must have 6.3 children to ensure a 95 percent chance of one son living until the father's sixty-fifth birthday."[16]

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16. M. A. Caiendo, Nutrition and the World Food Crisis (New York: Macmillan, 1979).

CHAPTER THREE

BACKGROUND OF CHINA'S POPULATION PROBLEM

In this chapter, a short historical background of China is presented reviewing population growth in China since 2100 B.C.. China's population growth was fairly slow and smooth for a long time until the 1800s when it entered the rapid growth period and showed an exponential growth property. Then a brief review of the major events that occurred after 1949 when the communist party established the new government and the underlying policies which caused the events are presented. These events and policies determined the direction of Chinese population growth trend. Inconsistent population policy and inappropriate economic policy were mainly responsible for the current population problem. Next, the origin of the current one-child-per-family policy will be described to formulate the problem of this study. Although the policy originally promoted voluntary family planning, it later turned out to be coercive and has caused a worldwide debate.

1. POPULATION GROWTH BEFORE 1949[17]

Although demographic data goes back over 4,000 years, the validity of the figures for China's early population is open to question. However, the dubious validity of the specific figures

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17. Data in this section are from Fan Wenlan, The General History of China, (in Chinese).

does not prevent us from getting a picture of the historical trends. Chinese population growth over the past 4,000 years can be divided into three stages. The first was from the Xia to the beginning of the Qin Dynasty (2100 B.C.--221 B.C.). The second was from the Qin to the Qing Dynasty (221 B.C.--1650 A.D.). The third stage is from Qing to the present.

The first stage to 221 B.C. was a long period of slow growth during which the population remained small and somewhat stable. The first farming communities grew up along the lower Yellow River and their agriculture was based on wheat, not rice. By 3000 BC we can think in terms of a million peasants in the area on either side of the lower Yellow River. Together with another million food-gatherers elsewhere in China, this gives a total figure of China's population then of 2 million. With the collapse of the Shang Dynasty around 1000 BC, civilized China split up into a dozen warring states, but the rate of population growth increased. This was partly because an irrigation system was being developed in the Yellow River basin, and partly because the Yangtze River valley was then being brought under cultivation. By 400 BC there were about 25 million. The population may have stabilized around 20 million during the 2,000 years period before the country was first unified under the Qin Dynasty in 221 B.C.. From figure 1, we can see that the population reached its first maximum at about that time.

The breakthrough to new demographic ground came during the

Song Dynasty[18] around 1000 AD. The basis for the new advances was fuller exploitation of the rice-growing potential of the Yangtze valley, and the consequent southward shift in the country's political center of gravity. Mongol Khans ruled China for a little more than a century since 1211, when there was one of the bitterest and most prolonged wars of conquest in world history. The loss of the country's population in Yuan Dynasty[19] was estimated at 35 million. Demographic recovery started from the Ming Dynasty[20] in the late 13th century and on the eve of the Ming Dynasty there was around 150 million population. The Manchu conquest costs China about 25 million people. By 1700 this loss was made up and in the political calm of the 18th century there came a population surge that carried the total past 300 million. The rate of growth--100 percent in 100 years--was too high to be good. The Malthusian specter of overpopulation had arrived. By 1949, China's population growth had for years been about 25 percent, while the world population during the same period rose by more than 100 percent[21]. But until that time, even small percentage rises could result in colossal absolute gains when the existing population was measured in hundreds of millions. This can be easily seen from the following population growth curve.

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18. Song Dynasty(960 -- 1279 A.D.).

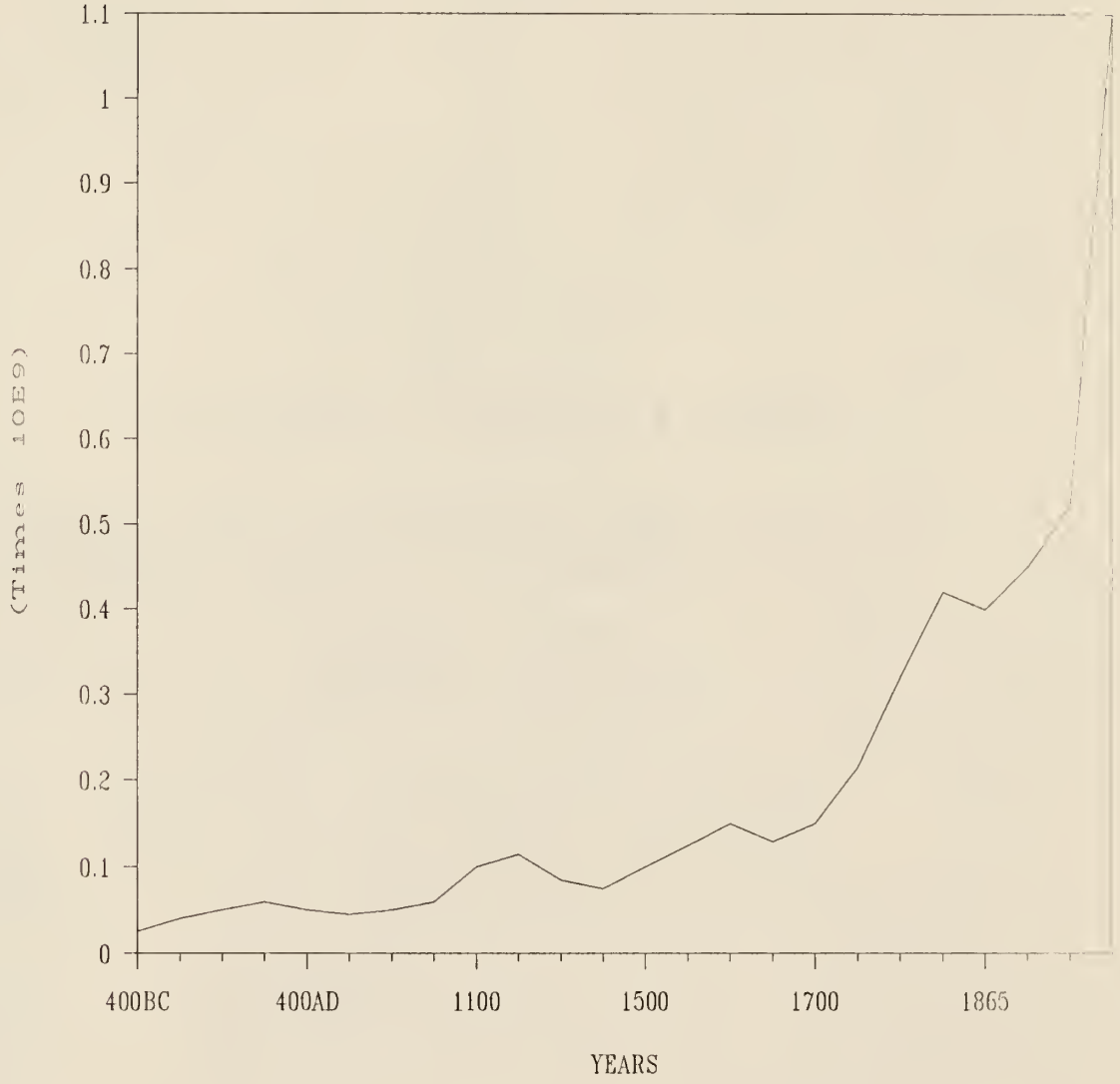
19. Yuan Dynasty (1271 -- 1368 A.D.).

20. Ming Dynasty (1368 -- 1644 A.D.).

21. C. McEvedy and R. Jones, Atlas of World Population History, Britain, 1978.

#1. POPULATION GROWTH TREND

(400 B.C.--1983 A.D.)



From Figure 1, we can see that the population growth trend began to exhibit the shape of strict exponential property.

In feudalist China, from 221 B.C. to 1911 A.D., 50 to 60 million seems to have been the ceiling of China's population in most of the times. Increases to this level must have been related to the economic prosperity of feudal civilization. During the 1,650 years after the first peak size was reached, the population went up and down drastically, and these fluctuations occurred in quite regular cycles approximately equal to the average length of a dynasty. In other words, these variations appear to have been associated with the rise and fall of dynasties. The population usually began to grow with the establishment of a new dynasty, reach its ceiling, and then, as the dynasty started to fall, would decline until a new dynasty was set up. Then the population would grow again. The creation of a dynasty brought political stability and economic prosperity. Whatever their political, economic, and social causes, the population cycles took place through the fluctuation of mortality.

2. POPULATION GROWTH SINCE 1949

China has almost completed its population transition from high mortality and high fertility to low mortality and low fertility between 1949 to 1984. The establishment of the People's Republic of China in 1949 marked the end of over a century of national and civil wars in Chinese territory and

brought the country to peace, as well as a period of unprecedented population growth. Restoration of peace, and the extension of health and medical services drastically reduced death rates while birth rates remained high. Starting from a population estimated at some 540 million in 1949, the annual rate of growth was above 2 percent a year from 1949 through 1957, largely due to the rapidly falling death rate. Over 104 million people were added in these eight years. This was the first of the two population booms since 1949, with the second coming between 1963 and the early 1970s.

The 1953 census reported a total population of 583 million, and the 1964 census a total of 695 million. The total gain within this interval was 112 million, or an average annual growth of about 2.3 percent. This gain would have been higher had it not been interrupted by the sharp drop in birth rate and rise in death rate after the Great Leap Forward when China was facing famine, resulting from Mao Zedong's crash program to decentralize industry and to collectivize agriculture. The radical economic policies of the Great Leap Forward caused a temporary reversal of the sharp declining trend of mortality. Right after the Great Leap Forward, the total population decreased in 1960 and 1961 for the first time since 1949, and went back to the 1959 level in 1962. Rural population decrease was the major share. The death rate reached the ever high record and the natural growth rate for the first time appeared to be negative.[22] Note that the infant

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22. See figure 2, constructed with the data from table 2.

death rate increased drastically after 1958 after a smooth decrease period since 1949.[23] As infants are more sensitive to any change of environment and living condition, such a sharp increase of infant death rate is the main reason for the sharp increase of the aggregate death rate. Also note that after another smooth decrease, the infant death rate started to increase in 1979, which was the year when the government began to introduce the one-child-per-family policy. Like the case from 1958 to 1961, this increase, accompanied by the continuous improvement of medical care and social service system, can only be the result of unusual external disturbance.

Soon after the crisis, a more liberal economic policy was launched, and population growth returned to its normal trend, averaging over 2.6 percent a year from 1964 to 1970--the highest level since 1949. The recovery in 1962 reached a level similar to the total fertility rate in 1950s, and peaked at 7.5 in 1963. The total fertility rate in the mid- to late 1960s remained close to level of the mid-1950s except for a temporary decline in 1967 coinciding with one year after the start of the Cultural Revolution. The 130 million net gain marked the second population boom.

The total population increased in the 1970s and reached 970.9 million by the decade's end. While the natural growth rate since early 1980s has been lower than any time since 1949 as the direct result of the new one-child-per-family policy, the

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[23]. See figure 3, constructed with the data in table 2.

increase in absolute numbers has been increasing substantially because of the huge population base and the age structure of the population.

The present condition in China's population can be summed up in the following features:

(1) The population base is huge. By the end of 1980, the total population exceeded 1,000 million.

(2) Despite the sharp fall in the rate of population growth, the rate is still above 10 per thousand. Because of the large absolute size, the net absolute increase per year remains anywhere between 11 and 12 million, basically the same as in the 1950s.

(3) The population displays a young age structure. According to the 10 percent sample of the third census, children of 14 and under make up a large proportion - 33.6 percent. The young age structure means that a huge number of people will soon enter marriage and child-bearing age, which will exert a tremendous influence on the rate of population growth in the future.

(4) Since 1949, there were two boom periods of population growth, each lasting several years. The first boom began in 1950 and continued through 1957. The annual birth rate in this period was above 30 per thousand, and the yearly births topped 20 million. Most of the people born then have now married and produced their own children. The second boom lasted from 1962 to 1971, with the annual birth rate again above 30 per thousand.

Each of the ten years saw the birth of more than 25 million people, with the exception of 24.6 million in 1962. The highest number was 29.54 million in 1963.

(5) The rural proportion of the population is large. In 1983, the rural population made up 76.5 percent of the nation's total. Although this number is lower than the 89.4 percent in 1949, the absolute number has risen sharply--from 484 million in 1949 to 784 million in 1983. The birth rate in the rural areas is 30 percent higher than in the cities. The big size and the high birth rate of the rural population will have a direct bearing on the future trend of population growth. Table 2 shows the close correlation of the net national population growth trend and the net rural population growth trend.

Table 3 is the result of 1982 census. Figure 4 is constructed from this table. The figure indicates that after the start of a peaceful and relatively stable society in China, mortality came down and fertility rate went up substantially. The peak in figure 4 represents the baby boom, following the economic adjustment after the Great Leap Forward and great depression. Figure 4 shows a significant change of age structure, represented by a large number of young people in age group 5-19. This huge young population will affect China's population for years, thus a radical population policy will speed up the process of aging population, which will be discussed later.

Table 1. TOTAL POPULATION
(End of the year)

(Million)

YEAR	TOTAL POPU.	MALE	FEMALE	URBAN	RURAL
1949	541.67	281.45	260.22	57.65	484.02
1950	551.96	286.69	265.27	61.69	490.27
1951	563.00	292.31	270.69	66.32	496.68
1952	574.82	298.33	276.49	71.63	503.19
1953	587.96	304.68	288.38	78.26	509.70
1954	602.66	312.42	290.24	82.49	520.17
1955	614.65	318.09	296.56	82.85	531.80
1956	628.28	325.36	302.92	91.85	536.43
1957	646.53	334.68	311.84	99.49	547.04
1958	659.94	341.95	317.99	107.21	552.73
1959	672.07	348.90	323.17	123.71	548.36
1960	662.07	342.83	319.24	130.73	531.34
1961	658.58	338.80	319.79	127.07	531.52
1962	672.95	345.17	327.78	116.59	556.36
1963	691.72	355.33	336.39	116.46	575.26
1964	704.99	361.42	343.57	129.50	575.49
1965	725.38	371.28	354.10	130.45	594.93
1966	745.42	381.89	363.53	133.13	612.29
1967	763.68	391.15	372.53	135.48	628.20
1968	785.34	402.26	383.08	138.38	646.96
1969	806.71	412.89	393.82	141.17	665.54
1970	829.96	426.86	403.06	144.24	685.68
1971	852.29	438.18	414.10	147.11	705.18
1972	871.77	448.13	423.64	149.35	722.42
1973	892.11	458.76	433.35	153.45	738.66
1974	908.59	467.27	441.32	155.95	752.64
1975	924.20	475.64	448.56	160.30	763.90
1976	937.17	482.57	454.60	163.41	773.76
1977	949.74	489.08	460.66	166.69	783.05
1978	962.59	495.67	466.92	172.45	790.14
1979	975.42	501.92	473.50	184.95	790.47
1980	987.05	507.85	479.20	191.40	795.65
1981	1,000.72	515.19	485.53	201.71	799.01
1982	1,015.41	523.10	492.31	211.54	803.87
1983	1,024.95	528.65	496.30	241.26	783.69

Source: China Statistical Year Book, 1984, The State Statistical Bureau, p. 81, (in Chinese).

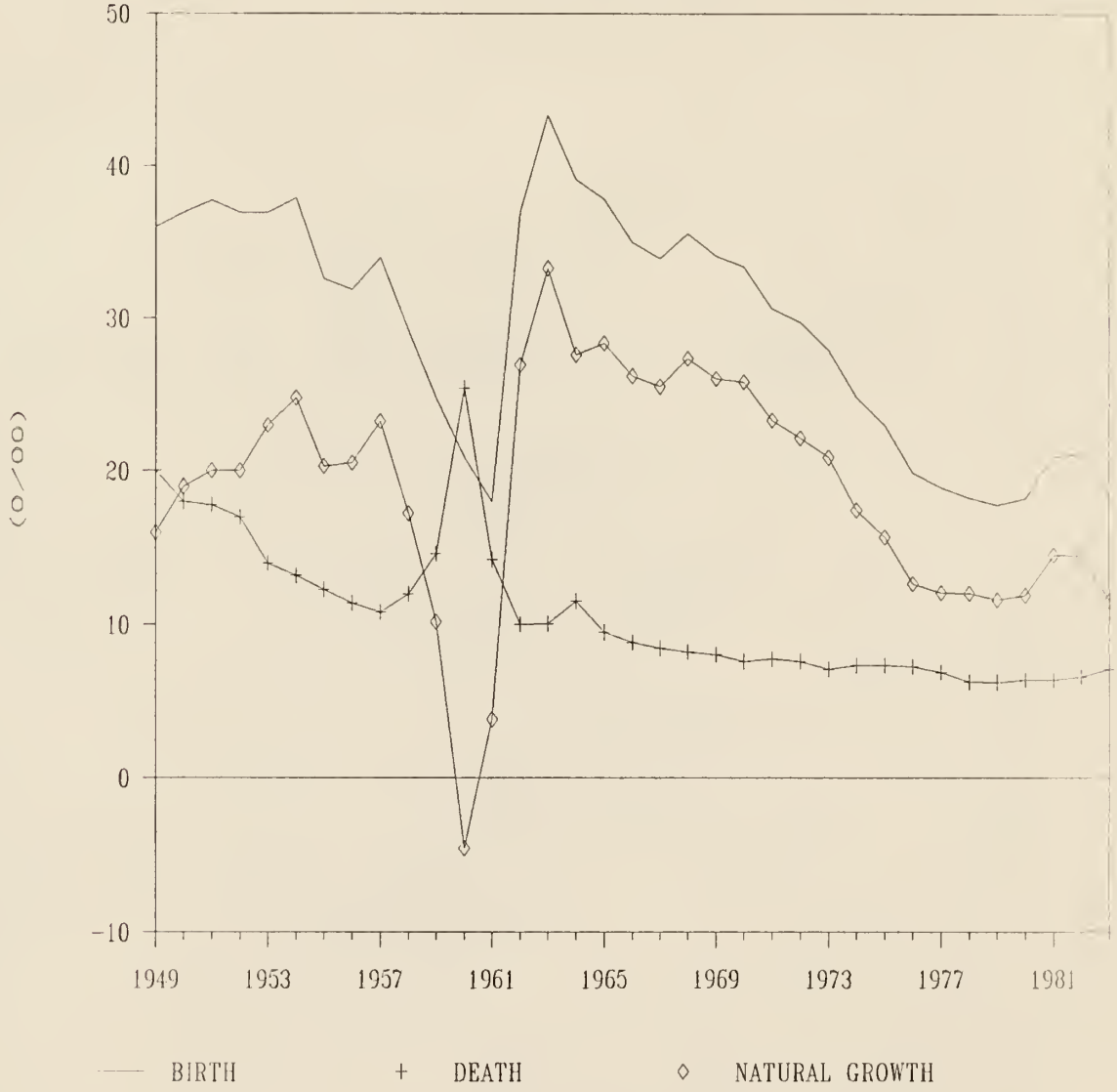
Table 2. BIRTH, DEATH AND NATURAL GROWTH RATES
(Rate per 1,000)

YEAR	BIRTH RATE	DEATH RATE		NATURAL GROWTH RATE		
		Total	Infant	Nation	Urban	Rural
1949	36.00	20.00	-	16.00	-	-
1950	37.00	18.00	-	19.00	-	-
1951	37.80	17.80	-	20.00	-	-
1952	37.00	17.00	-	20.00	-	-
1953	37.00	14.00	175	23.00	-	-
1954	37.97	13.18	164	24.79	34.38	23.80
1955	32.60	12.28	154	20.32	31.37	19.14
1956	31.90	11.40	143	20.50	30.44	19.40
1957	34.03	10.80	132	23.23	36.01	21.74
1958	29.22	11.98	146	17.24	24.33	15.91
1959	24.78	14.59	160	10.19	18.51	9.17
1960	20.86	25.43	284	-4.57	14.26	-9.23
1961	18.02	14.24	183	3.78	10.24	2.41
1962	37.01	10.02	89	26.99	27.18	26.95
1963	43.37	10.04	87	33.33	37.37	32.70
1964	39.14	11.50	86	27.64	24.90	28.10
1965	37.88	9.50	84	28.38	20.90	29.47
1966	35.05	8.83	83	26.22	15.26	27.24
1967	33.96	8.43	82	25.53		
1968	35.59	8.21	81	27.38		
1969	34.11	8.03	76	26.08		
1970	33.43	7.60	70	25.83		
1971	30.65	7.73	65	23.33	15.95	24.29
1972	29.77	7.61	60	22.16	14.01	23.26
1973	27.93	7.04	56	20.89	12.39	22.03
1974	24.82	7.34	52	17.48	9.26	18.60
1975	23.01	7.32	49	15.69	9.32	16.58
1976	19.91	7.25	45	12.66	6.52	13.50
1977	18.93	6.87	41	12.06	7.87	12.64
1978	18.25	6.25	37	12.00	8.44	12.49
1979	17.82	6.21	39	11.61	8.60	12.04
1980	18.21	6.34	42	11.87	8.69	12.35
1981	20.91	6.36	44	14.55	11.31	15.02
1982	21.09	6.60	46	14.49	12.96	14.97
1983	18.62	7.08	48	11.54	10.07	12.20
1984	-	-	50	-	-	-

Source: China Statistical Year Book, 1984, The State Statistical Bureau, p. 81, (in Chinese).

#2. BIRTH, DEATH & NATURAL GROWTH

(1949--1983)



#3. INFANT MORTALITY

(1949 - 1984)

Table 3. POPULATION DISTRIBUTION IN AGE GROUPS
10 % SAMPLE OF THE THIRD CENSUS
(Third Census, July 1, 1982)

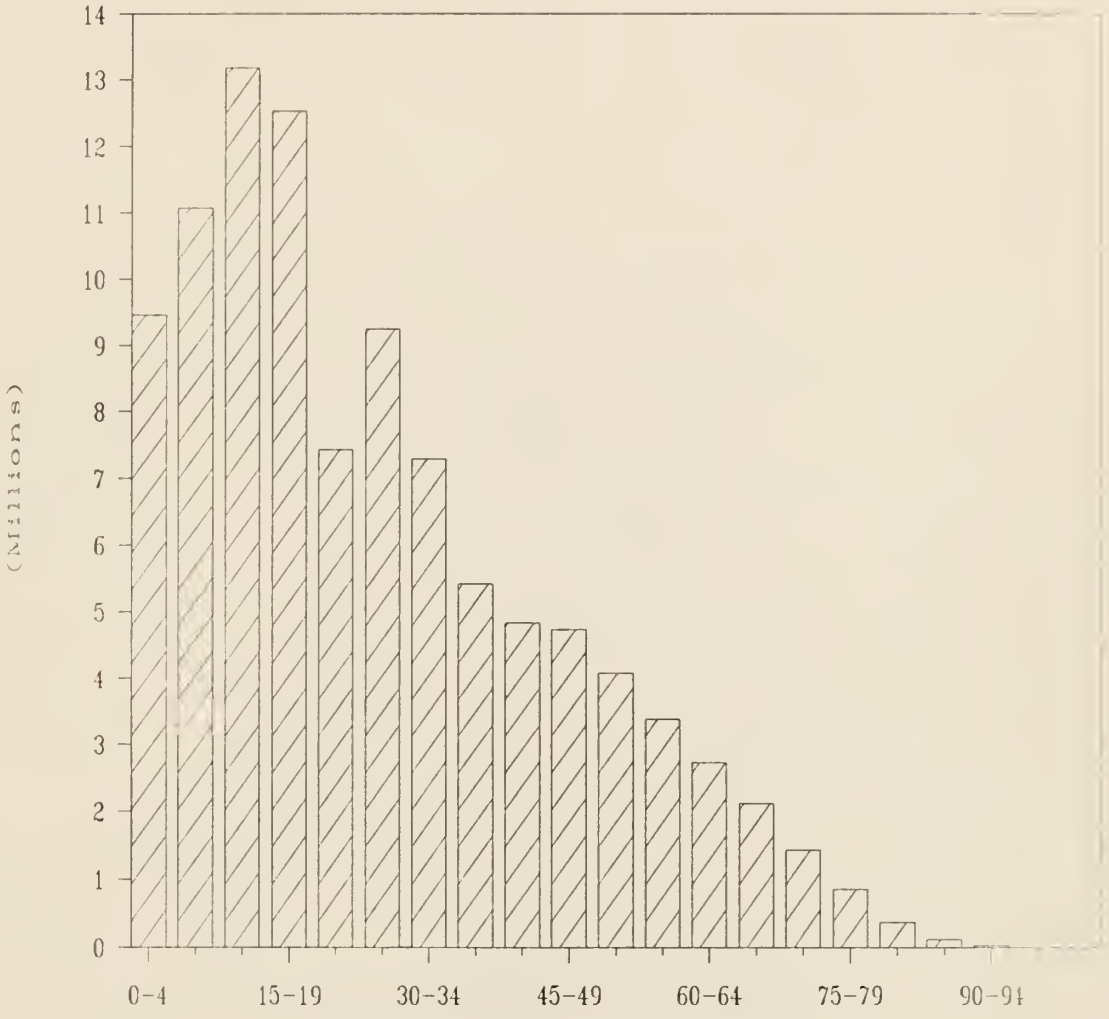
(Million)

AGE GROUP	TOTAL POPU.	0/0 IN TOTAL POPU.			SEX RATIO
	(person)	total	male	female	(female=100)
TOTAL	100.38	100.00	51.33	48.67	105.46
0-4	9.47	9.44	4.88	4.56	107.15
5-9	11.07	11.03	5.68	5.35	106.24
10-14	13.18	13.13	6.76	6.37	106.13
15-19	12.53	12.48	6.35	6.13	103.55
20-24	7.43	7.40	3.77	3.63	103.84
25-29	9.26	9.22	4.76	4.46	106.63
30-34	7.30	7.27	3.78	3.49	108.15
35-39	5.42	5.40	2.84	2.56	111.26
40-44	4.84	4.82	2.57	2.25	114.18
45-49	4.74	4.72	2.50	2.22	112.23
50-54	4.09	4.07	2.15	1.92	111.77
55-59	3.39	3.38	1.74	1.63	106.64
60-64	2.74	2.73	1.37	1.36	100.34
65-69	2.13	2.12	1.01	1.11	91.73
70-74	1.43	1.43	0.64	0.79	81.40
75-79	0.86	0.86	0.35	0.51	68.43
80-84	0.37	0.37	0.13	0.23	57.26
85-89	0.11	0.11	0.03	0.07	46.18
90-94	0.02	0.02	0.01	0.02	37.16
95-99		...	...	...	41.60
above 100		...	...	...	39.11

Source: China Statistical Year Book, 1984, The State Statistical Bureau, p. 97 (in Chinese)

#4. AGE COMPOSITION

(JULY 1, 1982)



Note from figure 4 the big shortfall in the 20-24 age group. Such a significant shortfall can only be the result of war or other severe disasters. In reality, this is the result of the high mortality during depression and famine caused by the radical economic policy during the Great Leap Forward. Everything else looks normal. Some western scientists believe that China lost over 30 million population in that period. From the big shortfall, we find that estimation reasonable. Without that external policy disturbance, we should expect a smooth population curve. From this result, we should have an idea on the effect of that disaster. As mentioned before, unstable population is caused by external disturbances. In the Chinese case, most of the ups and downs of population are the result of internal policy disturbances.

The 1982 census revealed that Chinese population is characterized by relatively small cohorts in the age group 0-4 years because of the reduced number of children born in the low fertility period since late 1970s, when the new population policy was implemented. We can see from the preceeding figure that there is a large bulge in the age group 5-19 years; about 36.79 million young people were born during the high fertility period from mid-1962 to 1978. We have sufficient reason to conclude that this large group of young people is the result of the Great Leap Forward and the Cultural Revolution, or wrong political and economic policies. During the ten years of Cultural Revolution, the social and economic systems and life were out of order,

people had nothing meaningful to do, and family planning system was also destroyed. Many people viewed that period as the "golden time" to have children, and bearing children was the only meaningful thing to do. We can conclude that unstable and inconsistent policies are responsible for the unstable population. Without such external disturbances, we might expect a smaller population size and a more normal population age structure.

3. THE ORIGINS OF THE ONE-CHILD POLICY

Since 1949, the science of demography has been viewed with suspicion and hostility by most of China's party and government leaders. This is an unfortunate legacy of the writings of Karl Marx a century ago attacking Thomas Malthus' views of the relationship between population growth and food supply. Social scientists who warned of the potential economic problems of continued rapid population growth were denounced as "Malthusianists" and were severely criticized. Chief among them was the famous economist Ma Yinchu, who was removed from his position as the president of Beijing University and not rehabilitated until 1978. The chairman of the Chinese Communist Party Mao Zedong believed that revolution plus production would solve the problem of feeding and employing China's people. Mao's opinion in population can be viewed as "supply-side" perspective on population size and growth. This view sees each person as supplying a pair of hands--hands that when better organized

through revolution--can enhance production. The larger the population, the greater the supply of hands, and thus the greater the total production. Maybe this is due to Marx's theory that only labor can create value, although without some other factors of production, people simply cannot be productive. And instead of coming only with hands, each person comes also with a mouth, needing to be fed immediately. Demand for goods and services shoots up as mouths-births-multiply, straining resources. With the cohorts of the baby boom of the 1960s about to enter the marrying and childbearing ages, some 10 million couples every year, a second baby boom will inevitably push up natural growth rate and absolute numbers, even if all couples merely reproduce themselves with an average of two children per couple. This is the background of the one-child-per-family policy.

Deputy Qian Xinzhong, minister of public health, said in 1979: "At the existing rate of population growth, China will have a population of 1,300 million by the end of the century....We plan to slow the country's natural rate of population growth to around 5 per 1,000 by 1985....This means that on the average each couple as of now can have only one child."[24] Since 1979, the government position has changed from simple encouragement of the one-child family to insistence that almost all couples stop at one healthy living child, in order to achieve the ambitious targets of 0.5 percent growth in 1985 and zero growth rate in the year 2000.

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24. Qian, Xinzhong, "Discussion on Family Planning", Beijing Review, vol. 22, no. 28, 1979.

4. CONCLUSION

From the historical review of the Chinese population, we can find out that social transformations were the main factors that caused the population to experience substantial ups and downs. After each of these transformations, population would increase a great deal because of the following peace and relatively stable society. It is therefore reasonable to conclude that in order to reach and to keep a stationary population, a stable and peaceful social and economic condition is crucial. The main reasons for the current population pressure in China is the wrong population theory and economic policy.

CHAPTER FOUR

EVALUATION OF CHINA'S CONTEMPORARY POPULATION POLICY

1. RESISTANCE TO THE ONE-CHILD POLICY

Although the practical necessity of limiting population growth has become increasingly accepted in China, the one-child policy has certainly not gone without opposition. This is not surprising because a nation of one-child families naturally means that about half the couples will have no sons, a fact that is bound to lead to difficulties, given the traditional Chinese values and practical importance of male offspring within Chinese society. Opposition to current population policy is great, and reports of female infanticide, abuse of women who give birth to daughters, and other manifestations of this continuing preference for sons show clearly that such opposition is often translated into active forms of resistance.

This resistance is highly important because of the human misery involved. When the government adopted the one-child-per-family policy in 1979, it claimed that the purpose was to encourage and protect voluntary decision by couples on family planning, and to compensate the one-child family. But in reality the policy relies on coercion, economic penalties, and forced abortion for refusal to comply, and imposes penalties on families with two children, regardless of the fact that two children are allowed according to the Marriage Law. As a direct result of this policy, more than 54 million unborn children are estimated

to have been killed in China.[25] The incidence of female infanticide in China has also increased drastically to several hundred thousand deaths per year.

The policy also makes use of a "birth quota" system that gives family planning officials the power to dictate to couples if and when they may have even the one child permitted under the new policy. Since all citizens are subject to strict monitoring by State officials through the rationing of "birth coupons", those officials often invade individual privacy, violate a woman's right to privacy by monitoring private details of her life (including releasing the woman's menstruation information in order to track compliance with the policy), intimidate couples verbally and threaten them with force to pressure compliance. According to State guideline, each province sets its own guidelines for the desired number of children to be born during the year. These guidelines are often translated into rigid quotas at the unit level, such as factories, communes, and universities. Couples must apply for permission from their unit to have a child; some have to wait until quotas are available. Many couples becoming pregnant without quota or permission are

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25. U.S. Government Document, 99th Congress, 1st Session, H. CON. RES. 102, Concerning United States Policy Toward the One-Child-Per-Family Program and Forced Abortion Policies of the People's Republic of China. Also refer to S. RES. 275 and H. RES. 212.

Some unpublished information and predictions I received from medical agencies in China, though not to be adopted as reference, indicate that the real number is higher than figures in the above reports. This at least convinces me that the figure provided by the above documents is reasonable.

forced to have abortions, even in the ninth month of the pregnancy. An official of the State Family Planning Commission said "The principle of population control and family planning in China is people's voluntary decision in accordance with state guideline." For women who are pregnant without quota or permission, "We will try to persuade them to terminate pregnancy." For those who refuse to accept the persuasion, "We will take some actions, such as put economic penalties."[26] Many workers and farmers leave their jobs and hide in order to save the unborn children. In these cases, the government and officials reduce the family's basic means of living such as salaries, wages, rations, housing and garden allotments,[27] and apply various other discriminations and penalties, such as in work assignment, promotion, and even welfare for their children. For example, families with more than one child will have trouble sending their children to school, and the children will face discrimination of various types simply because they are not the only child in their family.

The use of contraceptive pill and devices is mandatory. Women are compelled to forced IUD (intra-uterine device) implementation even right after their delivery. For those with more than two children, at least one individual of the couple

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22. The above talk was made by a top official of the State Family Planning Commission when he was answering questions during a visit by a British journalist in late 1986. People's Daily, (Overseas Edition), November 22, 1986, (in Chinese).

27. In cities, employees are given housing through their working units at low rents. Private housing is not common.

might be forced to receive sterilization. With the social, cultural, economic and family pressure, many couples are driven to practice infanticide of female babies in order to assure that their only child is male.

The recent reappearance of female infanticide in China is a complex phenomenon, one that must be understood on its own terms, as the result of specific cultural, historical, and above all, economic factors. If these factors are not taken into account, it can all be easily misunderstood. Traditionally, female infanticide was the last resort of farmer families threatened by starvation. When parents were driven to kill their own children, it was a sign of how severe their situation was. Female infanticide happened in Chinese history when severe famine occurred. If parents want and can afford to have children, but for some reason they have to kill their children, it is obviously a human misery. Nowadays Parents take the risk and kill their female baby because they want to have a son. Even though the Chinese government denies the fact that female infanticide exits in China, it can be observed almost anywhere in the country since the one-child policy was put into practice, not only in poor rural area, but also in prosperous cities. Even though some parents have been put into jail for killing their babies, others are still doing it. Some kind of therapies become quite popular because people believe that these therapies can determine the sex of the unborn child. Result of sex test during early pregnancy are not reported if the baby is female, since knowing that they

are going to have a girl, those parents may choose to have what the government calls "voluntary" abortion.

2. CULTURAL AND ECONOMIC BACKGROUND OF ANTI-FEMALE BIAS

The fact that daughters were killed first when the parents had difficulty was a reflection of the anti-female bias embedded in traditional Chinese culture, Confucius, Mencius and folk alike, and the fact that sons had much greater potential for benefiting the family economically. At present, we should expose and criticize such reactionary notions as "males are exalted, females are demeaned" and "the more sons the more blessings".

"Males are exalted, females are demeaned" is an important dimension of the doctrine of Confucius and Mencius. As expressed in marriage, it meant that man took a wife, that the wife obeyed the husband, and the wife was a maid to the husband and to the household as well as being a breeding machine. As reflected in childbearing, it meant that boys were valued more than girls.

The notion that "the more sons the more blessings" is the result not only of cultural but also economic factors. Given that the Chinese kinship system is both patrilineal and patrilocal, only sons were full and permanent members of, and contributors of labor power to, their parents' family. To have at least one son was therefore seen as one of life's most basic necessities. Only a son could guarantee that the family name would survive and that the parents would be taken care of in their old age. Traditionally, sons fulfilled vital symbolic and

economic functions, whereas daughters were seen as merely temporary members of the family. Contemporary female infanticide is, like that of earlier times, the result of a combination of ideological and material factors. Some people are no doubt still influenced by traditional ideas concerning ancestor worship and keeping the family line alive. On the other hand, in the absence of a developed social welfare system, the only way parents can feel secure about their old age is to have a son to take care of them later on. Living out one's life in one's family is the Chinese tradition and this enables the old to enjoy domesticity as well as being taken care of by their family members. "This should be the main way for the old to spend their remaining years, complemented by society-run old folks' homes and apartments."[28] Female infanticide is thus the last resort of those hoping to ensure their survival. It is easy to criticize the feudalist philosophy and to blame those parents or grandparents who strongly prefer boys to girls, but not much can really be done to reverse this attitude before the level of education, or more directly, the level of economic development, is increased.

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28. By Yao Shuben, director of the Policy Research Institute at the National Committee for Old People, and Wang Ruoyu, vice-director of the institute. China Daily, Vol. 5, No. 1507, May 24, 1986.

CHAPTER FIVE

POPULATION PROJECTIONS

To fully understand Chinese population policy and its impacts on economic development and social welfare requires careful studies of Chinese population structure and future trends. Population projections are the ideal approach to analyze population policy implications, since demographic dimensions are essential to most policy concerns. In this chapter, I will discuss some population models and analyze the impacts of current Chinese population policy on economic development and social welfare. First I introduce the population growth function and the population projections based on different assumptions. The crucial determinant in the population growth function is the number of children per woman in fertility age, or the average total fertility rate (TFR). This variable will affect not only population size, but also affect population structure. Under the assumption of one-child-per-family, which is the current population policy, China will face a high dependency ratio in the near future, and this will hinder China's Four Modernization Plan.[29] Secondly, sex ratio is discussed. With Chinese people's strong preference for son and the government's strict restriction for each couple to have only one child, female infanticide has reappeared. If this policy continues, it will cause frustration

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29. Modernization in industry, agriculture, science and technology and defence.

and human misery, and create social, psychological and demographic problems. Thirdly, population age composition is discussed. According to the population projection, Chinese population will age significantly during the coming decades. The more rapidly the fertility declines, the earlier the population ages. The projection indicates that the more serious consequences of aging population will not come until about early next century, therefore current Chinese government tends to concentrate on the immediate problems of population size and defer consideration of the problems resulted from population aging. Finally, we project output growth and output per capita under different population policy assumptions.

1. POPULATION GROWTH FUNCTION

The population growth function can be defined as:

$$B(a, t) = N(t)\int_{18}^{50} s(a, t) * h(a, t) * p(a, t)da,^{30} \quad (1)$$

where a is age, t is time, s(a, t) is the female ratio function, representing the percentage of female from the total population within a given age interval a at year t, p(a, t) is the population density function, representing the percentage of population of certain age interval from the total population, h(a, t) is the ratio of a certain time interval to a woman's

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30. Mathematical derivation of this model is prepared in appendix 2 of chapter five.

entire fertility age, B(a, t) is the number of new borne children in year t, and N(t) is the number of children each woman produces in her fertility age period.

With this model, we can express the effects of China's population policy quantitatively. For example, "To encourage late marriage and late childbearing" will have the impact of increasing the value of lower limit a_1, which will reduce the fertility interval; If all women get married at 20, a_1 will increase from 18 to 20. If all women have their first child at age 25, then the fertility interval will be [25, 50] instead of [18, 50]. "To encourage late birth" will postpone the peak value of h in the model; and "To encourage fewer children" will reduce the average fertility ratio N, and so on.

The major concern in this paper is to examine the policy implications of different level of N. The current Chinese population policy is equivalent to N = 1. A simulation done by a group of Chinese scientists in demography, computer science and control theory revealed some interesting inferences. According to the projection,[31] there are several possible outcomes in the next 100 years, based on different population policy assumptions, ranging from no government intervention to the strict implementation of the one-child-per-family restriction which is

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31. The result of the projection was briefly introduced by the head of the project, Song Jian, in 1982. Population Projection and Population Control, (Song Jian, Tian Xueyuan, Beijing: 1982, in Chinese).

the current policy.[32] The most important determinant is the average total fertility rate, the N in the model discussed above. Five projections have been made, for N = 3, 2.3, 2, 1.5 and 1. The different projections of population are summarized below, starting with N=3.

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32. This is not assumed by the scientists of the original projection.

(1) Population projection with N = 3.0. With N = 3.0, which is the actual fertility rate in 1975, the total population will be 1.42 billion in 2000, 1.915 billion in 2020, 2.949 billion in 2050 and 4.308 billion in 2080. That is, China's total population then will approximately be equal to the aggregate world population today.[33] Under this situation, the growth trend exhibits exponential growth property and will increase in an increasing speed.[34]

Table 4. POPULATION PROJECTION WITH N = 3.0

(Million)

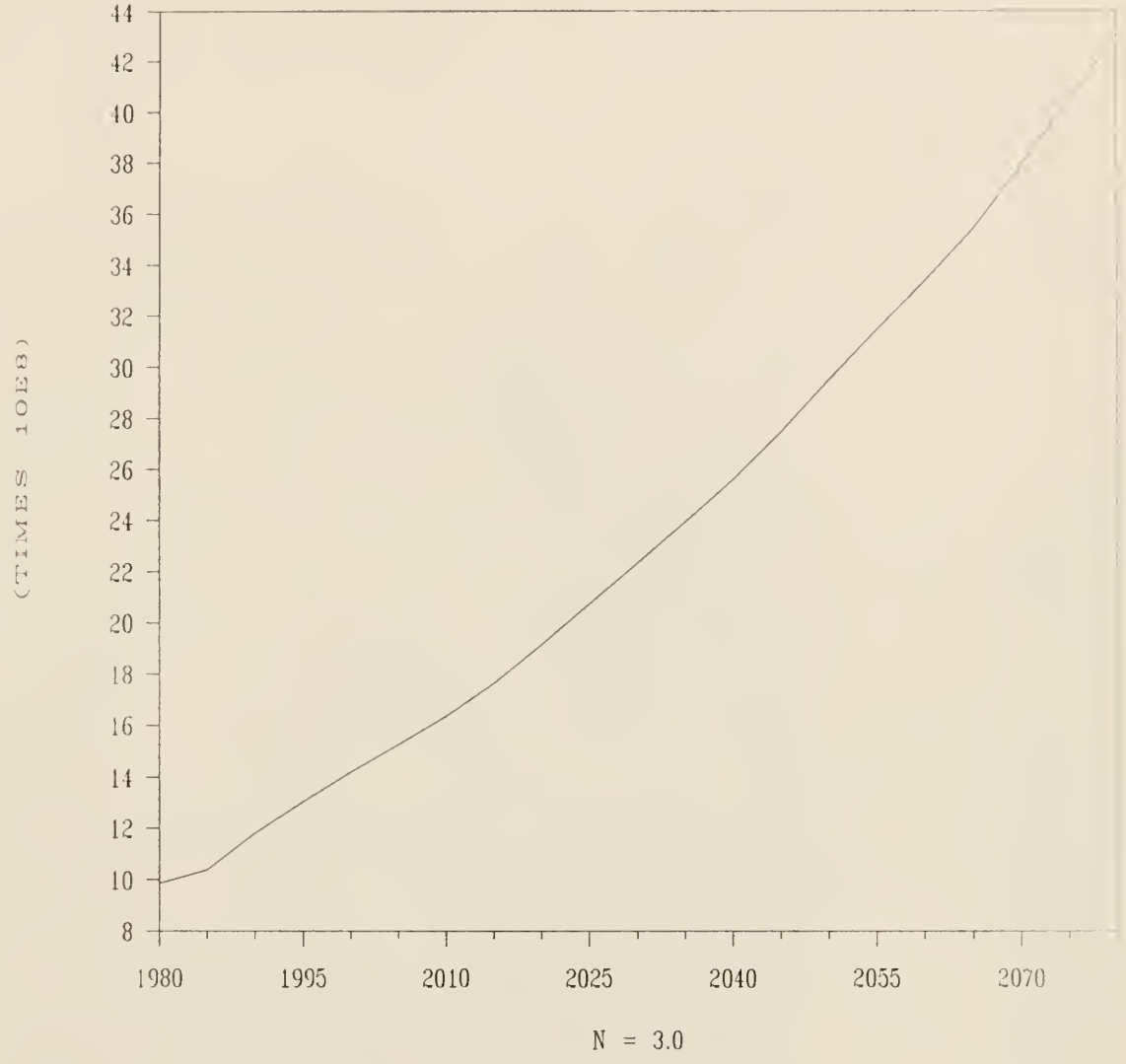
YEAR	TOTAL POPU.	MALE	FEMALE	OLD POPU. (Above 65)	YOUNG POPU. (0-14)
1980	986	506	480	50	332
1985	1,037	550	523	58	322
1990	1,180	605	575	68	347
1995	1,303	668	635	79	419
2000	1,420	728	692	94	460
2005	1,526	783	743	108	469
2010	1,636	839	797	123	465
2015	1,765	905	860	150	484
2020	1,915	982	933	191	537
2025	2,075	1,064	1,011	221	594
2030	2,233	1,145	1,088	281	631
2035	2,393	1,227	1,166	348	649
2040	2,562	1,314	1,248	400	672
2045	2,745	1,408	1,337	417	717
2050	2,949	1,512	1,437	459	800
2055	3,147	1,614	1,533	507	839
2060	3,338	1,712	1,626	556	883
2065	3,542	1,816	1,726	602	922
2070	3,794	1,946	1,848	664	972
2075	4,051	2,077	1,974	712	1,041
2080	4,308	2,209	2,099	755	1,117

33. See table 4. The projection was done in 1980. N=3.0 was the average fertility rate in 1975. The table assumed that N=3.0 is kept throughout.

34. See figure 5, constructed with the data in table 4.

#5. POPULATION PROJECTION (1)

(1980--2080)



(2) Population projection with N = 2.3. With N = 2.3, which was the fertility level in 1978, the total population will be 1.286 billion in 2000, 1.544 in 2020, 1.913 billion in 2050 and 2.132 billion in 2080.[35] Under this assumption, the population growth will increase in a decreasing rate. However, by 2080, China will have over 2 billion population, and this giant size is still too big to be good, since it exceeds the capacity of Chinese resources to support such a huge population.

Table 5. POPULATION PROJECTION WITH N = 2.3

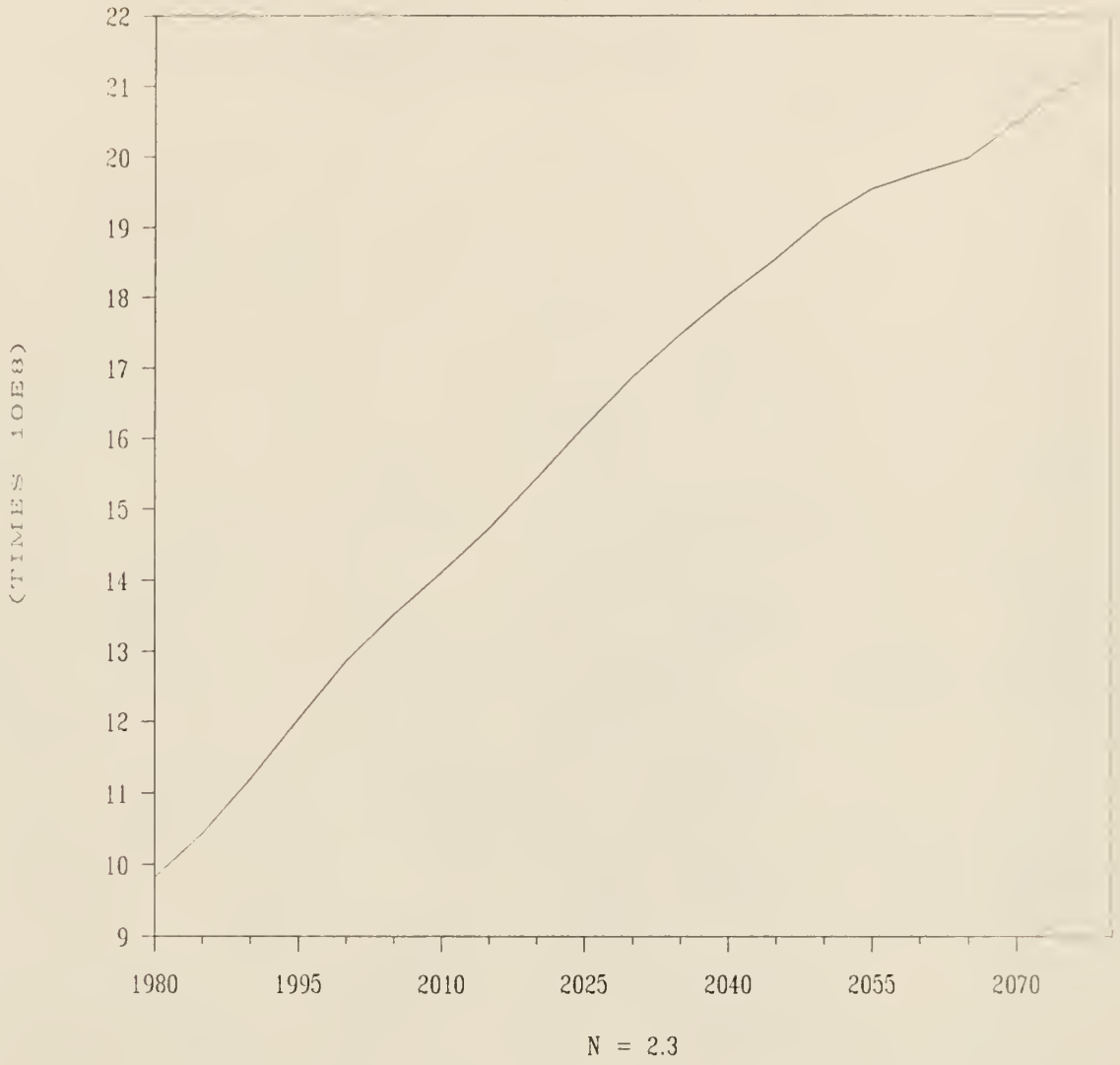
(Million)

YEAR	TOTAL POPU.	MALE	FEMALE	OLD POPU. (Above 65)	YOUNG POPU. (0-14)
1980	982	504	478	50	328
1985	1,044	535	509	58	293
1990	1,119	574	545	68	285
1995	1,204	617	587	79	324
2000	1,286	659	627	94	354
2005	1,353	694	659	108	356
2010	1,411	724	687	123	337
2015	1,473	755	718	150	325
2020	1,544	792	752	191	335
2025	1,618	830	788	221	357
2030	1,687	865	822	281	370
2035	1,749	897	852	348	368
2040	1,805	926	879	400	360
2045	1,856	952	904	414	360
2050	1,913	981	932	433	372
2055	1,955	1,002	953	452	385
2060	1,978	1,014	964	468	391
2065	1,999	1,025	974	482	390
2070	2,047	1,050	997	510	390
2075	2,095	1,074	1,021	528	395
2080	2,132	1,093	1,039	537	405

35. See table 5. N=2.3 is the average fertility ratio in 1978. Table 5 assumes that N=2.3 is kept throughout.

#6. POPULATION PROJECTION (2)

(1980--2080)



(3) Population projection with N = 2.0, that is, each couple has two children; the total population will keep increasing for 72 years. Total population will be 1.222 billion in 2000, 1.388 billion in 2020, 1.542 billion in 2050 and will reach the maximum of 1.55 billion in 2052, as can be seen from figure 7. Then it will begin to decrease in 2053 and in 2080, total population will be 1.483.[36] If everything else remains stable, the population will decline smoothly thereafter and eventually reach the stage of stationary population, though this is a fairly long period.

Table 6. POPULATION PROJECTION WITH N = 2.0

(Million)

YEAR	TOTAL POPU.	MALE	FEMALE	OLD POPU. (Above 65)	YOUNG POPU. (0-14)
1980	978	502	476	50	325
1985	1,028	527	501	58	277
1990	1,088	558	530	68	255
1995	1,157	593	564	79	280
2000	1,222	627	595	94	306
2005	1,272	652	620	108	305
2010	1,310	672	638	123	281
2015	1,346	690	656	150	260
2020	1,388	712	676	191	258
2025	1,431	734	697	221	269
2030	1,469	753	716	281	275
2035	1,498	768	730	348	269
2040	1,518	778	740	400	255
2045	1,529	784	745	410	247
2050	1,542	791	751	419	247
2055	1,540	790	750	425	250
2060	1,517	778	739	427	249
2065	1,491	765	726	426	243
2070	1,488	763	725	439	236
2075	1,492	765	727	448	232
2080	1,483	760	723	446	231

36. See table 6. The result in the table assumes that N=2.3 in 1978 decreased for two years and became N=2.0 in 1980. This level is kept throughout.

#7. POPULATION PROJECTION (3)

(1980--2080)

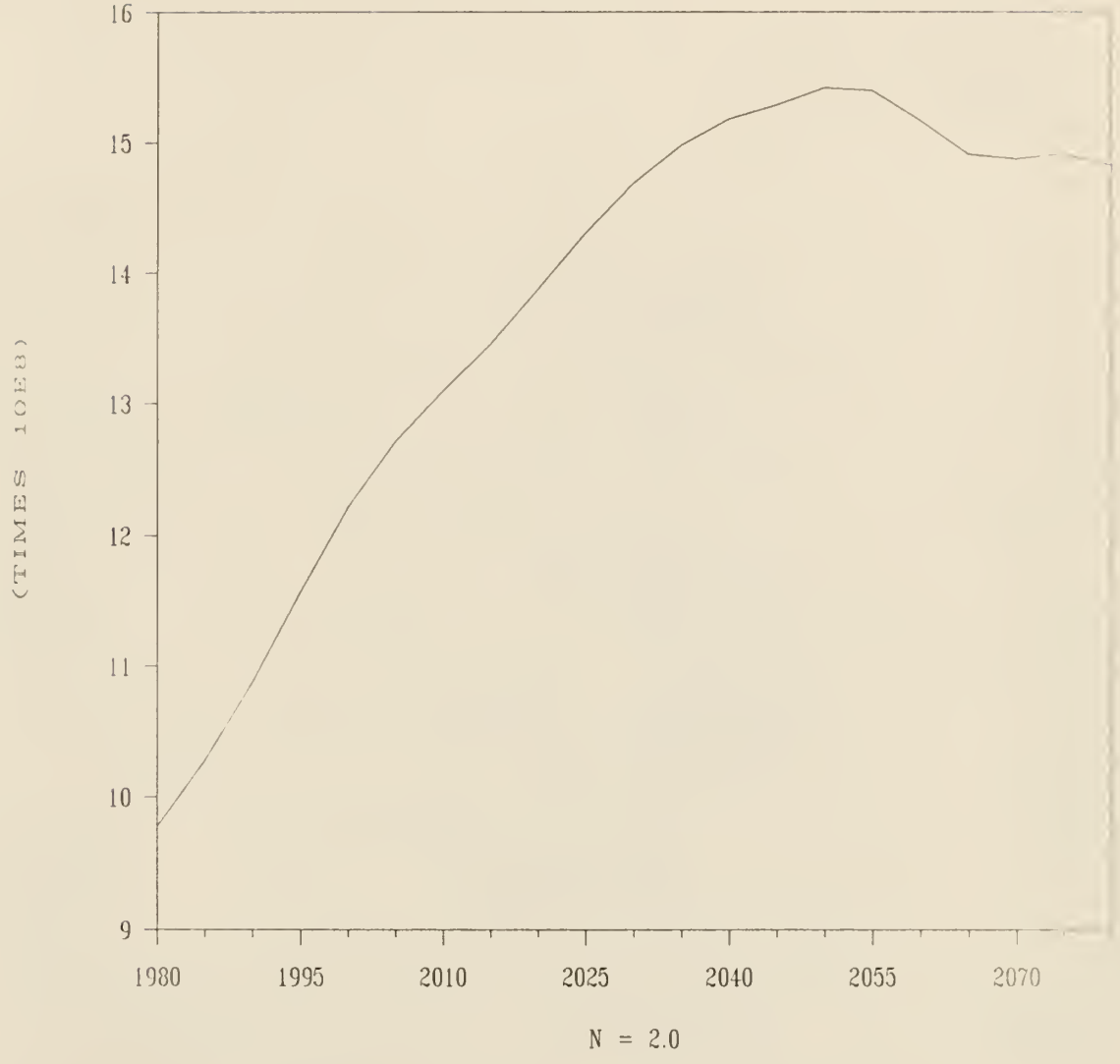


Table 7. POPULATION PROJECTION WITH N = 1.5

(Million)

YEAR	TOTAL POPU.	MALE	FEMALE	OLD POPU. (Above 65)	YOUNG POPU. (0-14)
1980	978	502	476	50	325
1985	1,012	519	493	58	261
1990	1,048	537	511	68	215
1995	1,091	559	532	79	214
2000	1,130	579	551	94	229
2005	1,155	592	563	108	227
2010	1,167	598	569	123	203
2015	1,171	600	571	150	175
2020	1,175	603	572	191	159
2025	1,178	604	574	221	156
2030	1,177	604	573	281	155
2035	1,169	599	570	348	147
2040	1,150	590	560	400	133
2045	1,119	574	545	410	120
2050	1,087	557	530	405	113
2055	1,039	533	506	390	108
2060	972	498	474	367	104
2065	901	462	439	343	097
2070	853	437	416	334	090
2075	819	420	399	329	083
2080	781	401	380	316	078

(4) Population projection with N = 1.5. With N = 1.5, that is, half of the families have one child and half have two children, and the nation's population will still be increasing for 47 years. Total population will be 1.13 billion in 2000, 1.175 billion in 2020 and reaches the maximum value of 1.178 billion in 2027.[37] It will begin to decrease in 2028 and the total population in 2050 will be 1.087 billion. In 2080, the total population will decrease to 0.781 billion, approximately equivalent to the level

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37. See figure 8, constructed with the data in table 7.

#8. POPULATION PROJECTION (4)

(1980--2080)

in 1968.[38] This assumption will lead to the most ideal target population, estimated by scientists based on China's resources, including space, in about a century.

If we further assume that everything else remains stable and that the government can successfully adjust its population policy step by step, China's can reach the target of stationary population.

(5) Population projection with N=1.0. If the average fertility rate has a substantial drop after 1980 and is kept at N=1.0, which means that every couple is allowed to have only one child for a century, the total population will still increase for 25 years and will reach its maximum level of 1.053 billion in 2004.[39] Total population will begin to decrease in 2005 and will reach 1.003 billion in 2020, 0.771 billion in 2050, and 0.37 billion in 2080.[40]

From table 8, we can see that, based on pure computation, the dependency ratio will be over 50 percent after the year of 2040, and in 2080 only 40 percent of the total population is of working age. It is obviously another extreme of policy effect,

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[38]. See table 7. N=1.5 means that N decreases from N=2.3 in 1978 smoothly to N=1.5 in 1980 and then is kept throughout.

[39]. See figure 9, constructed with the data in table 8.

[40]. See table 8. Recently, the government allows some couples with special reasons and some of those in rural areas to have second child. This in some extent indicates that the radical one-child approach is not practical. The result of the projection with N=1.0 shows that this approach is very unrealistic and very difficult to achieve.

compared to the first scenario with N = 3, as we discussed earlier. As we continue our study, we will find out that this option is harmful to Chinese economy.

Table 8. POPULATION PROJECTION WITH N = 1.0

(Million)

YEAR	TOTAL	MALE	FEMALE	OLD (Above 65)	YOUNG (0-14)	Old Ratio[41]
1980	978	502	476	50	325	0.05
1985	1,008	517	491	58	257	0.06
1990	1,021	524	497	68	188	0.07
1995	1,037	532	505	79	160	0.08
2000	1,050	538	512	94	153	0.09
2005	1,053	540	513	108	151	0.10
2010	1,044	535	509	123	133	0.12
2015	1,025	526	499	150	108	0.15
2020	1,003	514	489	191	88	0.19
2025	978	502	476	221	76	0.23
2030	951	488	463	281	71	0.30
2035	919	471	448	348	65	0.38
2040	878	450	428	400	56	0.46
2045	825	423	402	410	47	0.50
2050	771	395	376	402	40	0.52
2055	701	359	342	366	35	0.52
2060	613	314	299	319	32	0.52
2065	523	268	255	271	28	0.52
2070	457	234	223	241	24	0.53
2075	407	209	198	219	21	0.54
2080	370	190	180	203	18	0.55

Note the last column, the old ratio. In 1980, the old ratio was 0.05, which means that only 5 percent of the total population was aged people. However, by 2045, 50 percent of the total population will be aged people, and in 2080, if we assume the policy is still in place, the old dependents will comprise 55

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41. The old ratio at year t is computed with the following formula:

Old Ratio(t) = O(t) / P(t)

where O(t) is the number of old dependents, and P(t) the total population at year t, respectively.

#9. POPULATION PROJECTION (5)

(1980--2080)

percent of the total population. Such an aging population will put a heavy burden on the working people.

The above projections are mathematical computations, but they can be used for reference when thinking about population policy and program. From these mathematical projections, we can find that the population growth trend is strongly influenced by the government's policy.[42] If each couple has more than two children, the total population will have a substantial increase. But under the current one-child-per-family policy, with the current population structure and base, the Chinese population will decrease substantially. Our discussion also demonstrates the well-known phenomenon of demographic momentum, which is the tendency for population growth to continue beyond the time that replacement fertility has been achieved. This is because of a relatively high concentration of population in the childbearing years. The large cohorts of those born in the 1960s and 1970s will cause population to continue to grow for many years.

2. SEX RATIO

The sex ratio, the number of males per 100 females, is an important indicator to sociologists and economists, since the sex ratio has significant impact on socioeconomic development. Many aspect of economic planning require separate population data for males and females. The balance of the sexes affects social and

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42. In China, the central government can strongly influence the most important variable N in our population growth function by strictly regulating the number of children per couple.

economic relationships within a society. Social roles and cultural patterns may be affected. For example, under the condition of the male "shortage" brought about by World War II, the labor force participation and the occupational distribution of women in the United States, Canada, and several European countries underwent considerable change and a new pattern of social relationships between sexes emerged, including a greatly increased independence of women from the home. The sex ratio of a population largely depends upon the relative mortality of males and females and, where there is substantial migration, on the age-sex distribution of the migrants inflow or outflow. Because of war, immigration, natural disaster and national tradition, the sex ratio varies from country to country. Major wars generally lower the sex ratio due to substantial male mortality. Obviously, a population which receives more male than female migrants tends to have a higher sex ratio. Without these influences, males and females in a nation are usually equal.

In the population growth function, we introduced a female population ratio function s(a),

$$s(a, t) = F(a, t) / P(a, t). \qquad (2)$$

where F(a, t) is the number of females aged a at time t, and P(a, t) is the total population aged a at time t.

A more widely used measure of sex composition in technical studies is the sex ratio defined as the number of males per 100 females. Here I define this ratio MS as a function of time and age,

$$MS(a, t) = [M(a, t) / F(a, t)] * 100 \quad (3)$$

where M(a, t) is the number of males aged a at time t. One hundred is the point of balance of the sexes according to this measure. A sex ratio above 100 denotes an excess of males and a sex ratio below 100 denotes an excess of females. In general, national sex ratios tend to fall in the narrow range from about 95 to 102, barring special circumstances, such as a history of heavy war losses or heavy immigration. National sex ratios outside the range of 90 to 105 are to be viewed as extreme.[43] It has been observed that in many parts of China, especially in some rural areas, the infant sex ratio has already lost balance. Although empirical data about the sex ratio in the nation as a whole are not available, regional imbalance of sex ratio are often reported by the official media. The public has begun to worry if there will be enough women to match men in the next generation, and worry about the severe social and psychological problems which a continuation of female infanticide will create. It is quite obvious what will happen if all couples want their only child to be a boy. Assume this extreme happens, who can guarantee that they will have grandchildren if their sons cannot find girls to marry. Another problem arises: according to Chinese tradition and life style, at least one son of a family will live with the parents after he gets married so that there will be somebody to help the parents when they get older. The

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43. The Methods and Materials of Demography, p. 191, volume 1, U.S. Bureau of the Census, U.S. Government Printing Office, Washington D.C., 1971

wife is therefore supposed to live with the husband's family. This is a important factor to keep Chinese families stable. Even if we assume there is no female infanticide, and the sex ratio is exactly 1:1, this will still mean that the fifty percent of parents with only a daughter will have to live alone for their rest of life after their daughters get married. The government has realized the problem and has been trying to encourage newly-wed husbands to live with wives' families and protect their legal right. However, in an one-child-per-family society, there will still be fifty percent parents living a sad and lonely old life. This will not change at least before a well-developed social security and welfare system is established, without taking into account people's preference for big family life style.[44]

From table 1, we find that the male and female ratio reached the closest point during the late 1960s period. During that time, China was in the big mess of the Cultural Revolution and everything, including population planning, was out of order. The female ratio began to decrease in 1980.

3. AGE COMPOSITION

Age composition is one of the most important economic and social aspects of a population. The economic, political, and other behavior of the representative individual changes with age

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44. In addition to the traditional belief that more children means more blessing, as we discussed before, Chinese also believe that three or more generations living in a family means special blessing and is a sign of prosperity to the family clan.

both because mental and physical abilities improve with age up to a certain level and eventually deteriorate, and because intangible capital--such as concrete knowledge, learning skills, etc.--accumulates with training and experience and with age up to a certain level. Social scientists of many types have a special interest in the age structure of a population since social relationships within a country are considerably affected by the relative numbers at each age. Age is an important variable in measuring potential school population, potential voting population, potential manpower and labor force, and even in projecting consumption patterns.

A population's age structure is governed by the behavior of its age-specific mortality and fertility, particularly the latter. "A population whose mortality and fertility remain invariable tends to become the stable population corresponding to such levels of mortality and fertility."[45] The constant rate of population growth (whether positive, negative, or zero) characteristic of this stable population depends upon the sets of age-specific fertility and mortality rates underlying this population. If age-specific fertility and/or age-specific mortality vary over time, the crude rate of natural increase and the age structure of the population will vary. For instance, the heavy mortality associated with war, famine, or virulent epidemics gives rise to ups or downs in the segments of the age

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45. United Nations, "The Concept of a Stable Population", Population Studies, No. 39. New York, 1968, p. 5.

structure most vulnerable to these events, as was the case of China's great depression and famine from 1960 to 1962. Similarly, an upsurge of fertility after a war or a great economic depression will give rise to abnormally large cohorts, which thereafter move through a population as a pig swallowed by a large serpent moves through its body. In other words, great upsurges in births give rise to a series of echo effects every 20 or more years, but with each smaller than its predecessor until the echo effect disappears. This is why even though Chinese government tried every effort to keep the fertility rate down, the absolute increase now is still significant. As we discussed earlier, the echo effect of the baby boom in 1960s will keep China's natural population growth rate high for years.

The wealth of a society is created by human beings, especially by people with working ability. People without working ability--senior citizen, handicapped, and children--need to be supported with the wealth produced by them when they had the working ability and by the current labor force. If labor force has to support a large non-working population in a country, the burden to the country is heavy.

In order to reflect this characteristics quantitatively, we now introduce the dependency ratio. The dependency ratio is defined as the number of persons in a population who are not economically active per 100 economically active persons in that population.

The dependency ratio SD at time t is the ratio between

non-labor force and labor force, and it can be defined as

$$SD(t) = \{ P(t) - L(t) \} / L(t) \qquad (4)$$

where P(t) is total population at time t and L(t) is labor force at time t. Here L is defined to be everyone from 15-64.

The so-defined SD here measures how many non-working population each working person has to support. China's dependency ratio in 1983 was 0.62. This means that each worker supports 0.62 non-worker.

In real life, senior citizens and children have different consumption function and social activity structure, and the needs for goods and services are different. This difference has a substantial influence upon economic activity, such as the production, consumption and social welfare system. In order to solve this problem, we now bring in old dependency ratio and young dependency ratio.

The old dependency ratio of a country at time t OD(t)can be defined as

$$OD(t) = O(t) / L(t) \qquad (5)$$

Similarly, we can define young dependency ratio as

$$YD(a, t) = Y(t) / L(t) \qquad (6)$$

The following table shows the different dependency ratios resulting from different population policy assumptions, ranging from N=1.0, 1.5, 2.0, 2.3 to 3.0.

Table 9.[46] 100-YEAR PROJECTION OF DEPENDENCY RATIO (1980-2080)

Year	N = 1.0	N = 1.5	N = 2.0	N = 2.3	N = 3.0
1980	0.62	0.62	0.62	0.62	0.62
1985	0.45	0.46	0.48	0.51	0.58
1990	0.33	0.37	0.42	0.46	0.54
1995	0.30	0.37	0.45	0.50	0.62
2000	0.31	0.40	0.49	0.53	0.64
2005	0.33	0.41	0.48	0.52	0.61
2010	0.32	0.39	0.45	0.48	0.56
2015	0.34	0.38	0.44	0.48	0.56
2020	0.39	0.42	0.48	0.52	0.61
2025	0.44	0.47	0.52	0.56	0.65
2030	0.59	0.59	0.61	0.63	0.69
2035	0.82	0.73	0.70	0.69	0.71
2040	1.08	0.86	0.76	0.73	0.72
2045	1.24	0.90	0.75	0.72	0.70
2050	1.34	0.91	0.76	0.73	0.74
2055	1.34	0.92	0.78	0.75	0.75
2060	1.34	0.94	0.80	0.77	0.76
2065	1.33	0.95	0.81	0.77	0.76
2070	1.38	0.99	0.83	0.78	0.76
2075	1.44	1.01	0.84	0.79	0.76
2080	1.48	1.02	0.84	0.79	0.77

The computation indicates that the tighter the population policy, the higher the dependency ratio will be. It must be pointed out that under any of the five assumptions, the weights of dependent age groups in dependency ratio will gradually shift from 0-4 to 65 and over, so the aged dependency ratio rises in all series. It must also be pointed out that not only the

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46. The computation of this table is based on the data from tables 4, 5, 6, 7, 8, respectively, with equation (4), that is, the dependency ratio(SD) at time t is:

$$SD(t) = \{ P(t) - L(t) \} / L(t),$$

where L(t), the total labor force, is defined as the age group 15-64.

proportion 65 and over in all five series rises, but also the proportion 15-64 decreases, causing a greater dependency burden, with smaller N than with greater N. These results can be seen in tables 4, 5, 6, 7 and 8. We should realize that even though the dependency ratio does not vary so much in the next one or two decades, the aged dependents need much more costly services than young dependents. The more rapid the decline in fertility, the faster the population aging. This is because the effect of fertility reductions will immediately cause low proportions of younger ages and high proportions of older ages. In addition, when mortality is already at low levels at young and adult ages, it is clear that further reduction can only occur at older ages. Thus the different total fertility rates of the different population policies will have different effects on dependency ratio.

According to definitions used by United Nations organizations, a person who is above 60 years old is regarded as an old person. A country or region where 10 percent of the total population are over 60--or 7 percent of the population over 65--falls under the category of "aging nation." The aging problem and its growth trend are attracting national and world attention. At the end of this century, Chinese population will start to become aged. Long time sustained low fertility rate and low death rate will lead to a aging society. According to a projection, as the fertility rate declines, the proportion of population 65 years and older will increase and reach about 7.2

percent of the total population in the year of 2000.[47] It will have some impacts upon the quantity and quality of China's labor force. This will also increase the burden of the society.

The median age of the Chinese population declined from 1953 to 1964 and then started to increase up to 27.1 in 1982; it is expected to continue to increase until the large cohorts of mid-1962 to 1978 disappear. Given the rapidly declining fertility and relatively steady and low mortality, the Chinese population is therefore expected to age significantly during the coming decades. According to the result of a one-percent sample survey conducted in July 1, 1987, compared to the result of 1982 census, the proportion of young population aged 0 to 14 decreased from 33.45 percent in 1982 to 28.68 percent, while aged population increased from 4.89 percent to 5.46 percent.[48]

According to the 1982 census, people over 60 made up 7.6 percent of the total nation, but this figure is expected to rise to 10 percent by 1995, when there will be 120 million elderly people.[49] Some big cities have already become or are bordering on aging status. In Shanghai, 12.5 percent of the city's population are over 60. In Beijing and Tianjin, the figures are

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47. "The Growth Trend of Our Aging Population", by the Population Division, the State Statistical Bureau, Guangming Daily, February 24, 1986, (in Chinese).

48. Report from the State Statistical Bureau regarding to the July 1, 1987 one percent sample survey, People's Daily, (Overseas Edition), November, 12, 1987, (in Chinese).

49. "The Aging Problem Looms Large in China", China Daily, Vol. 5, No. 1507, May 24, 1986.

9.2 percent and 9.6 percent, respectively. In Shanghai, the number of retired people increased by 170 percent between 1978 and 1984, and pensions spending went up to 18.5 percent of the municipal wage bill. In addition, medical care, social welfare, and daily services for the old also require money.

The negative impacts of aging population upon production and economic development also include:

1) The pension is counted into the total cost of production in Chinese accounting system. The ever-increasing retired population will boost costs and thus reduce profits. This has already become a painful problem in some developed industrial countries.

2) The increase of the proportion of old population will cause expansion of aggregate consumption expense. In China, the demand for old people's clothing, food, entertainment, health care and other services is among the biggest in the world. This will reduce capital accumulation and severely slow down the expansion of reproduction.

3) The aging population will deepen the existing conflict in national income distribution. In 1985, Chinese government paid 14.56 billion Yuan[46] to 16,370,000 retired State- and collective-owned business and institution employees, the average pension per worker was 935 Yuan, which was no less than the average wage on-job employees. The extent of such an irrational income distribution will increase as the aged population

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46. Chinese currency unit.

increases. These problems all need to be taken care of before they start to slow down the economic development.

Some people suggest that we raise fertility level later to offset the growing number of aged population in order to reduce its proportion in the total population. However, this approach does nothing to reduce the burden on working age population, since it adds more young dependents but does not reduce the number of old people the workers must support. Thus, in order to ease the dependency burden, such an approach as raising the fertility level must be initiated well before the beginning of the population aging. Therefore, we need to take into account the time lag of implementation of a policy and the response to it. When the negative effects of aging population becomes visible, it is too late to implement policy changes.

4. OUTPUT PER CAPITA

One common challenge to rapid population growth is that such rapid growth population will reduce the growth of output per capita. The larger the population size is, the lower the output per capita will be, holding total output constant. However, total output is not fixed. Instead, it is a function of labor force which itself is a function of population, therefore population can also affect output.

In this section, I project output per capita under different fertility assumptions (N). I assume a Cobb-Douglas production function, characterized by constant returns to scale, with only

two inputs, capital(K) and labor(L). The model takes the form:

$$Q(t) = K(t)^{\alpha} L(t)^{1-\alpha} \qquad (7)$$

where α is the exponent on capital, representing the elasticity of output with respect to capital. Different values of N and will be used in the simulation to determine how sensitive the path of output per capita is to different N and α. Labor force projections are those presented in the first section of this chapter. Since we have already argued there that N=2.3 and N=3 are clearly not desirable population policies, our interest here is to see what will be the desired policy among N=1, N=1.5 and N=2. Therefore, only these three assumptions for N will be used.

Capital is assumed to grow through time as a function of total output. Specifically, capital at any year time t is equal to capital at year t-5 plus an amount proportional to total output at year t-5. In order to simplify the model, I also assume that there is no technical change during the whole projection period. The assumption is not important because the impact of technical change would be to increase the absolute values of the output index under any fertility assumption by a same proportion.

The simulation procedure operates as follows. The earlier population forecasts for N=1.0, N=1.5 and N=2.0 determine total population and labor force for each fifth year from 1980 to 2080. Output in year t is then determined as a function of labor and capital available in year t. Capital in year t+5 is then determined as a function of capital in year t and output in year

t. Then, along with labor in year t+5, the production function determines output in year t+5. The model is thus driven by the exogenously determined labor force and endogenously determined capital stock.

The results of the projection are contained in three tables in the appendix. Each of these table contains three population-labor forecast(N=1.0, N=1.5, and N=2.0). To ease comparison, the variables(population, labor, capital stock and output) are all indexed, with 1980=1.000. The three tables use different combination of α and k. The first table assumes α =0.15 and k=0.30, which means that the index of capital stock in year t+5 is equal to the index of capital in year t plus 30 percent of the output index in year t. The second table uses α =0.25 and k=0.30, and the third uses α =0.25 and k=0.15.

The first projection assumes α =0.15 and k=0.30. This means that capital stock at every 5-year interval is equal to capital stock 5-year earlier plus 0.3 of the output index in that year. Under N=1 assumption, in 2080 total population will be 0.614 of total labor force of 1980, and total labor force in 2080 is only 0.247 of total labor force of 1980. There is a 66.8 percent increase in output per worker, as the result of higher K/L ratio, but note that total output decreases by 58.8 percent because of the decline of working population. There is a slight increase in output per capita. The high dependency rate almost offsets the result of higher productivity per worker. On the other hand, the more moderate fertility assumptions N=1.5 and N=2, not only give

higher total output and therefore greater capital stock accumulation, but also give higher output per capita in the long-run. The N=1.5 assumption gives the highest output per capita after 2035. In comparison to the N=1.0 case, in these latter two cases, the lower output per worker is more than offset by the lower dependency ratio (the ratio of dependents to workers).

In the second simulation we keep k=0.3, but now assume that α=0.25. The N=1.5 assumption gives higher total output, and higher capital accumulation and output per capita, compared to the corresponding results assuming N=1. However, N=2 gives a lower output per capita, even though it gives the highest total output and capital accumulation. In this case, it is true that the larger population increases the denominator under a given output level, and such a larger population more than offsets the additional output produced by a larger labor force. Note that the absolute differences of output per capita among three sets are smaller with α=0.15 (simulation 1) than with α =0.25 (simulation 2). The more labor-intensive the economy is, the more sensitive the output is to population growth rate.

In the third simulation we assume α =0.25 and k=0.15. The projection gives us almost the same result as under α =0.25 and k=0.3, as we see from computation of comparisons, except that higher capital growth gives same proportional increase of absolute total output under any of fertility assumptions. This finding also indicates that capital stock growth assumption will not have significant impact on the validity of the projection.

APPENDIX 1. PER CAPITA OUTPUT PROJECTIONS

Table 10. Projection 1.

Assumptions: 0.15 (the exponent on capital(K) in Cobb-Douglas CRS production function)
0.30 (5-year growth of capital stock as proportion of output at beginning of period)

Year		1980	1985	1990	1995	2000
N = 1	Population	978	1008	1021	1037	1050
	Labor	603	693	765	798	803
	Dependents	375	315	256	239	247
Population (Index)		1.622	1.672	1.693	1.720	1.741
Labor (Index)		1.000	1.149	1.269	1.323	1.332
N = 1.5	Population	978	1012	1048	1091	1130
	Labor	603	693	765	798	807
	Dependents	375	319	283	293	323
Population (Index)		1.622	1.678	1.738	1.809	1.874
Labor (Index)		1.000	1.149	1.269	1.323	1.338
N=2	Population	978	1028	1088	1157	1222
	Labor	603	693	765	798	822
	Dependents	375	335	323	359	400
Population (Index)		1.622	1.705	1.804	1.919	2.027
Labor (Index)		1.000	1.149	1.269	1.323	1.363
K stock (N=1)		1.000	1.300	1.651	2.047	2.471
Output		1.000	1.171	1.320	1.413	1.461
Output/Popu.		0.617	0.700	0.779	0.822	0.839
Output/Labor		1.000	1.019	1.040	1.068	1.097
K stock (N=1.5)		1.000	1.300	1.651	2.047	2.471
Output		1.000	1.171	1.320	1.413	1.467
Output/Population		0.617	0.698	0.759	0.781	0.783
Output/Labor		1.000	1.019	1.040	1.068	1.096
K stock (N=2)		1.000	1.300	1.651	2.047	2.471
Output		1.000	1.171	1.320	1.413	1.490
Output/Population		0.617	0.687	0.731	0.736	0.735
Output/Labor		1.000	1.019	1.040	1.068	1.093
Comparisons	O/P	1.000	1.004	1.026	1.052	1.072
(N=1)/(N=1.5)	O/L	1.000	1.000	1.000	1.000	1.001
Comparisons	O/P	1.000	1.020	1.066	1.116	1.141
(N=1)/(N=2)	O/L	1.000	1.000	1.000	1.000	1.004

Table 10. (continued)

2005	2010	2015	2020	2025	2030	2035	2040
1053	1044	1025	1003	978	951	919	878
794	788	767	724	681	599	506	422
259	256	258	279	297	352	413	456
1.746	1.731	1.700	1.663	1.622	1.577	1.524	1.456
1.317	1.307	1.272	1.201	1.129	0.993	0.839	0.700
1155	1167	1171	1175	1178	1177	1169	1150
820	841	846	825	801	741	674	617
335	326	325	350	377	436	495	533
1.915	1.935	1.942	1.949	1.954	1.952	1.939	1.907
1.360	1.395	1.403	1.368	1.328	1.229	1.118	1.023
1272	1310	1346	1388	1431	1469	1498	1518
859	906	936	939	941	913	881	863
413	404	410	449	490	556	617	655
2.109	2.172	2.232	2.302	2.373	2.436	2.484	2.517
1.425	1.502	1.552	1.557	1.561	1.514	1.461	1.431
2.909	3.354	3.806	4.256	4.691	5.111	5.492	5.825
1.483	1.505	1.499	1.452	1.398	1.270	1.112	0.962
0.849	0.869	0.882	0.873	0.862	0.805	0.730	0.660
1.126	1.152	1.179	1.209	1.238	1.279	1.325	1.374
2.911	3.368	3.846	4.336	4.824	5.307	5.766	6.195
1.524	1.592	1.632	1.627	1.612	1.530	1.430	1.341
0.796	0.823	0.840	0.835	0.825	0.784	0.737	0.703
1.121	1.141	1.163	1.189	1.213	1.245	1.279	1.310
2.918	3.394	3.903	4.438	4.985	5.542	6.094	6.637
1.586	1.698	1.783	1.822	1.857	1.839	1.810	1.801
0.752	0.782	0.799	0.792	0.783	0.755	0.729	0.716
1.114	1.130	1.148	1.170	1.190	1.215	1.239	1.259
1.067	1.057	1.049	1.045	1.045	1.027	0.990	0.940
1.005	1.009	1.013	1.017	1.020	1.027	1.036	1.049
1.129	1.112	1.104	1.102	1.101	1.067	1.002	0.923
1.011	1.019	1.026	1.033	1.040	1.052	1.070	1.092

Table 10. (continued)

2045	2050	2055	2060	2065	2070	2075	2080
825	771	701	613	523	457	407	370
368	329	300	262	224	192	167	149
457	442	401	351	299	265	240	221
1.368	1.279	1.163	1.017	0.867	0.758	0.675	0.614
0.610	0.546	0.498	0.434	0.371	0.318	0.277	0.247
1119	1087	1039	972	901	853	819	781
589	569	541	501	461	429	407	387
530	518	498	471	440	424	412	394
1.856	1.803	1.723	1.612	1.494	1.415	1.358	1.295
0.977	0.944	0.897	0.831	0.765	0.711	0.675	0.642
1529	1542	1540	1517	1491	1488	1492	1483
872	876	865	841	822	813	812	806
657	666	675	676	669	675	680	677
2.536	2.557	2.554	2.516	2.473	2.468	2.474	2.459
1.446	1.453	1.434	1.395	1.363	1.348	1.347	1.337
6.114	6.372	6.609	6.829	7.026	7.199	7.352	7.488
0.862	0.789	0.733	0.657	0.577	0.508	0.453	0.412
0.630	0.617	0.631	0.646	0.666	0.671	0.671	0.672
1.413	1.446	1.474	1.512	1.554	1.596	1.635	1.668
6.597	6.988	7.370	7.739	8.087	8.414	8.723	9.021
1.301	1.274	1.230	1.161	1.089	1.031	0.991	0.954
0.701	0.707	0.714	0.720	0.729	0.729	0.729	0.737
1.332	1.350	1.371	1.398	1.425	1.449	1.468	1.487
7.177	7.729	8.289	8.849	9.401	9.947	10.493	11.043
1.839	1.867	1.866	1.840	1.821	1.820	1.832	1.835
0.725	0.730	0.731	0.731	0.737	0.737	0.741	0.746
1.272	1.285	1.301	1.319	1.336	1.350	1.361	1.373
0.899	0.873	0.883	0.897	0.913	0.921	0.920	0.912
1.061	1.071	1.075	1.082	1.091	1.102	1.114	1.122
0.869	0.845	0.863	0.883	0.904	0.910	0.906	0.900
1.111	1.125	1.133	1.146	1.163	1.183	1.202	1.215

Table 11. Projection 2.

Assumptions: 0.25 (the exponent on capital(K) in Cobb-Douglas CRS production function)
0.30 (5-year growth of capital stock as proportion of output at beginning of period)

Year		1980	1985	1990	1995	2000
N = 1	Population	978	1008	1021	1037	1050
	Labor	603	693	765	798	803
	Dependents	375	315	256	239	247
Population (Index)		1.622	1.672	1.693	1.720	1.741
Labor (Index)		1.000	1.149	1.269	1.323	1.332
N = 1.5	Population	978	1012	1048	1091	1130
	Labor	603	693	765	798	807
	Dependents	375	319	283	293	323
Population (Index)		1.622	1.678	1.738	1.809	1.874
Labor (Index)		1.000	1.149	1.269	1.323	1.338
N=2	Population	978	1028	1088	1157	1222
	Labor	603	693	765	798	822
	Dependents	375	335	323	359	400
Population (Index)		1.622	1.705	1.804	1.919	2.027
Labor (Index)		1.000	1.149	1.269	1.323	1.363
K stock (N=1)		1.000	1.300	1.656	2.062	2.506
Output		1.000	1.185	1.356	1.479	1.560
Output/Popu.		0.617	0.709	0.801	0.860	0.896
Output/Labor		1.000	1.031	1.069	1.117	1.171
K stock (N=1.5)		1.000	1.300	1.656	2.062	2.506
Output		1.000	1.185	1.356	1.479	1.566
Output/Population		0.617	0.706	0.780	0.817	0.835
Output/Labor		1.000	1.031	1.069	1.117	1.170
K stock (N=2)		1.000	1.300	1.656	2.062	2.506
Output		1.000	1.185	1.356	1.479	1.587
Output/Population		0.617	0.695	0.752	0.771	0.783
Output/Labor		1.000	1.031	1.069	1.117	1.164
Comparisons	O/P	1.000	1.004	1.026	1.052	1.072
(N=1)/(N=1.5)	O/L	1.000	1.000	1.000	1.000	1.001
Comparisons	O/P	1.000	1.020	1.066	1.116	1.144
(N=1)/(N=2)	O/L	1.000	1.000	1.000	1.000	1.006

Table 11. (continued)

2005	2010	2015	2020	2025	2030	2035	2040
1053	1044	1025	1003	978	951	919	878
794	788	767	724	681	599	506	422
259	256	258	279	297	352	413	456
1.746	1.731	1.700	1.663	1.622	1.577	1.524	1.456
1.317	1.307	1.272	1.201	1.129	0.993	0.839	0.700
1155	1167	1171	1175	1178	1177	1169	1150
820	841	846	825	801	741	674	617
335	326	325	350	377	436	495	533
1.915	1.935	1.942	1.949	1.954	1.952	1.939	1.907
1.360	1.395	1.403	1.368	1.328	1.229	1.118	1.023
1272	1310	1346	1388	1431	1469	1498	1518
859	906	936	939	941	913	881	863
413	404	410	449	490	556	617	655
2.109	2.172	2.232	2.302	2.373	2.436	2.484	2.517
1.425	1.502	1.552	1.557	1.561	1.514	1.461	1.431
2.974	3.458	3.958	4.465	4.965	5.456	5.912	6.322
1.614	1.667	1.689	1.667	1.635	1.521	1.367	1.213
0.924	0.963	0.994	1.002	1.008	0.964	0.897	0.833
1.226	1.275	1.328	1.389	1.448	1.531	1.629	1.734
2.976	3.472	3.997	4.544	5.098	5.656	6.196	6.711
1.654	1.752	1.823	1.847	1.859	1.800	1.715	1.637
0.863	0.905	0.939	0.948	0.952	0.922	0.885	0.859
1.216	1.256	1.299	1.350	1.400	1.465	1.534	1.600
2.982	3.496	4.053	4.645	5.259	5.893	6.531	7.168
1.714	1.856	1.973	2.046	2.114	2.127	2.124	2.141
0.812	0.854	0.884	0.889	0.891	0.873	0.855	0.850
1.203	1.235	1.271	1.314	1.355	1.405	1.454	1.496
1.071	1.064	1.059	1.058	1.059	1.046	1.014	0.971
1.008	1.015	1.022	1.029	1.035	1.045	1.062	1.083
1.138	1.127	1.124	1.127	1.132	1.105	1.049	0.980
1.019	1.033	1.045	1.057	1.069	1.090	1.120	1.159

Table 11. (continued)

2045	2050	2055	2060	2065	2070	2075	2080
825	771	701	613	523	457	407	370
368	329	300	262	224	192	167	149
457	442	401	351	299	265	240	221
1.368	1.279	1.163	1.017	0.867	0.758	0.675	0.614
0.610	0.546	0.498	0.434	0.371	0.318	0.277	0.247
1119	1087	1039	972	901	853	819	781
589	569	541	501	461	429	407	387
530	518	498	471	440	424	412	394
1.856	1.803	1.723	1.612	1.494	1.415	1.358	1.295
0.977	0.944	0.897	0.831	0.765	0.711	0.675	0.642
1529	1542	1540	1517	1491	1488	1492	1483
872	876	865	841	822	813	812	806
657	666	675	676	669	675	680	677
2.536	2.557	2.554	2.516	2.473	2.468	2.474	2.459
1.446	1.453	1.434	1.395	1.363	1.348	1.347	1.337
6.686	7.019	7.329	7.622	7.888	8.128	8.342	8.537
1.110	1.033	0.975	0.889	0.797	0.716	0.649	0.599
0.812	0.808	0.838	0.875	0.919	0.944	0.961	0.976
1.819	1.894	1.959	2.047	2.147	2.248	2.343	2.424
7.202	7.685	8.163	8.630	9.078	9.504	9.912	10.308
1.610	1.594	1.558	1.492	1.419	1.360	1.321	1.285
0.867	0.884	0.904	0.925	0.950	0.961	0.973	0.992
1.648	1.689	1.737	1.795	1.856	1.912	1.958	2.002
7.811	8.472	9.149	9.833	10.515	11.197	11.883	12.579
2.205	2.258	2.280	2.273	2.272	2.289	2.321	2.341
0.869	0.883	0.893	0.903	0.919	0.928	0.938	0.952
1.524	1.554	1.589	1.630	1.667	1.698	1.724	1.752
0.936	0.914	0.927	0.945	0.968	0.982	0.988	0.984
1.104	1.121	1.128	1.140	1.156	1.176	1.197	1.211
0.933	0.915	0.939	0.968	1.001	1.018	1.025	1.026
1.193	1.219	1.233	1.256	1.288	1.324	1.359	1.384

Table 12. Projection 3.

Assumptions: 0.25 (the exponent on capital(K) in Cobb-Douglas CRS production function)
0.15 (5-year growth of capital stock as proportion of output at beginning of period)

Year		1980	1985	1990	1995	2000
N = 1	Population	978	1008	1021	1037	1050
	Labor	603	693	765	798	803
	Dependents	375	315	256	239	247
Population (Index)		1.622	1.672	1.693	1.720	1.741
Labor (Index)		1.000	1.149	1.269	1.323	1.332
N = 1.5	Population	978	1012	1048	1091	1130
	Labor	603	693	765	798	807
	Dependents	375	319	283	293	323
Population (Index)		1.622	1.678	1.738	1.809	1.874
Labor (Index)		1.000	1.149	1.269	1.323	1.338
N=2	Population	978	1028	1088	1157	1222
	Labor	603	693	765	798	822
	Dependents	375	335	323	359	400
Population (Index)		1.622	1.705	1.804	1.919	2.027
Labor (Index)		1.000	1.149	1.269	1.323	1.363
K stock (N=1)		1.000	1.150	1.322	1.515	1.720
Output		1.000	1.149	1.282	1.369	1.420
Output/Popu.		0.617	0.688	0.757	0.796	0.815
Output/Labor		1.000	1.000	1.010	1.034	1.066
K stock (N=1.5)		1.000	1.150	1.322	1.515	1.720
Output		1.000	1.149	1.282	1.369	1.425
Output/Population		0.617	0.685	0.738	0.757	0.760
Output/Labor		1.000	1.000	1.010	1.034	1.065
K stock (N=2)		1.000	1.150	1.322	1.515	1.720
Output		1.000	1.149	1.282	1.369	1.445
Output/Population		0.617	0.674	0.710	0.713	0.713
Output/Labor		1.000	1.000	1.010	1.034	1.060
Comparisons	O/P	1.000	1.004	1.026	1.052	1.072
(N=1)/(N=1.5)	O/L	1.000	1.000	1.000	1.000	1.001
Comparisons	O/P	1.000	1.020	1.066	1.116	1.144
(N=1)/(N=2)	O/L	1.000	1.000	1.000	1.000	1.006

Table 12. (continued)

2005	2010	2015	2020	2025	2030	2035	2040
1053	1044	1025	1003	978	951	919	878
794	788	767	724	681	599	506	422
259	256	258	279	297	352	413	456
1.746	1.731	1.700	1.663	1.622	1.577	1.524	1.456
1.317	1.307	1.272	1.201	1.129	0.993	0.839	0.700
1155	1167	1171	1175	1178	1177	1169	1150
820	841	846	825	801	741	674	617
335	326	325	350	377	436	495	533
1.915	1.935	1.942	1.949	1.954	1.952	1.939	1.907
1.360	1.395	1.403	1.368	1.328	1.229	1.118	1.023
1272	1310	1346	1388	1431	1469	1498	1518
859	906	936	939	941	913	881	863
413	404	410	449	490	556	617	655
2.109	2.172	2.232	2.302	2.373	2.436	2.484	2.517
1.425	1.502	1.552	1.557	1.561	1.514	1.461	1.431
1.933	2.150	2.372	2.595	2.814	3.027	3.223	3.400
1.449	1.480	1.486	1.456	1.419	1.312	1.175	1.039
0.830	0.855	0.874	0.875	0.875	0.832	0.771	0.714
1.101	1.133	1.169	1.213	1.256	1.321	1.400	1.485
1.934	2.157	2.390	2.630	2.872	3.113	3.346	3.567
1.485	1.555	1.603	1.611	1.611	1.550	1.470	1.398
0.775	0.804	0.825	0.827	0.825	0.794	0.758	0.733
1.092	1.115	1.142	1.178	1.213	1.262	1.315	1.366
1.937	2.167	2.414	2.674	2.942	3.216	3.490	3.763
1.538	1.647	1.734	1.783	1.829	1.828	1.816	1.822
0.729	0.758	0.777	0.774	0.771	0.750	0.731	0.724
1.080	1.096	1.117	1.145	1.172	1.207	1.243	1.273
1.071	1.064	1.060	1.059	1.061	1.048	1.016	0.973
1.008	1.016	1.023	1.030	1.036	1.047	1.064	1.087
1.138	1.128	1.126	1.130	1.135	1.109	1.054	0.986
1.019	1.033	1.046	1.059	1.072	1.094	1.126	1.166

Table 12. (continued)

2045	2050	2055	2060	2065	2070	2075	2080
825	771	701	613	523	457	407	370
368	329	300	262	224	192	167	149
457	442	401	351	299	265	240	221
1.368	1.279	1.163	1.017	0.867	0.758	0.675	0.614
0.610	0.546	0.498	0.434	0.371	0.318	0.277	0.247
1119	1087	1039	972	901	853	819	781
589	569	541	501	461	429	407	387
530	518	498	471	440	424	412	394
1.856	1.803	1.723	1.612	1.494	1.415	1.358	1.295
0.977	0.944	0.897	0.831	0.765	0.711	0.675	0.642
1529	1542	1540	1517	1491	1488	1492	1483
872	876	865	841	822	813	812	806
657	666	675	676	669	675	680	677
2.536	2.557	2.554	2.516	2.473	2.468	2.474	2.459
1.446	1.453	1.434	1.395	1.363	1.348	1.347	1.337
3.555	3.698	3.830	3.954	4.067	4.169	4.259	4.342
0.948	0.880	0.829	0.755	0.676	0.606	0.548	0.506
0.693	0.689	0.713	0.742	0.779	0.799	0.813	0.824
1.554	1.613	1.666	1.737	1.819	1.902	1.980	2.047
3.776	3.982	4.185	4.382	4.571	4.751	4.922	5.088
1.370	1.352	1.318	1.259	1.195	1.144	1.109	1.077
0.738	0.750	0.765	0.781	0.800	0.808	0.817	0.831
1.402	1.433	1.470	1.515	1.564	1.608	1.643	1.678
4.036	4.317	4.603	4.891	5.177	5.462	5.749	6.040
1.869	1.907	1.920	1.909	1.903	1.913	1.936	1.949
0.737	0.746	0.752	0.759	0.770	0.775	0.782	0.792
1.293	1.313	1.338	1.368	1.396	1.419	1.437	1.458
0.939	0.918	0.932	0.950	0.974	0.989	0.995	0.992
1.108	1.126	1.133	1.146	1.163	1.183	1.205	1.220
0.940	0.923	0.948	0.979	1.012	1.031	1.039	1.040
1.202	1.229	1.245	1.269	1.303	1.341	1.378	1.404

APPENDIX 2. MATHEMATICAL NOTES[47]

The population growth process in an area (a state, a county, a province, a country, or even the world) can be formally modeled. Assume the quantity of population change in the area is a function of time and age distribution; we now introduce a function with two continuous variables, P(a, t), where a is age and t is time. P(a, t) represents the total population under the age of a at time t. This function P(a, t) is population function. Based on definition, P(a, t) is always greater than or equal to zero. That is, for any a and t, $P(a, t) \geq 0$. Furthermore, for any fixed t, that is, at any given time t, if $a_1 \leq a_2$, it must be true that $P(a_1, t) \leq P(a_2, t)$. This tells us that P(a, t) is an increasing function of a. Assume z is the maximum life expectancy, according to above characteristics, we have:

$$P(0, t) = 0 \qquad (1)$$

$$P(z, t) = P(t) \qquad (2)$$

Strictly speaking, the population function P(a, t) is the step function of the two independent variables. But if the population base is very large, and if a and t are continuous, we can treat P(a, t) as being continuous in every variable. We assume furthermore that the first partial derivatives of P(a, t),

$$P_a(a, t) = \partial P / \partial a$$

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47. The model was established by the work of Song Jian, Tian Xueyuan and other Chinese scientists and first introduced in Population Projection and Population Control, Song Jian, Tian Xueyuan, Beijing: 1982, (in Chinese).

and

$P_t(a, t) = \partial P / \partial t$ are also continuous functions.

Assume $p(a, t) = \partial P / \partial a$. Here $p(a, t)$ is population age distribution density function, or simply population density function. According to the increasing characteristics of the population function $P(a, t)$ and properties (1) and (2), we have:

$$p(a, t) \geq 0 \text{ and } p(z, t) = 0 \qquad (3)$$

If Δa is a very small age interval, and $\Delta a > 0$, then total population within age interval $[a, a + \Delta a]$ at time t is $p\{a, t\}$.

Since $p\{a, t\} = \partial P / \partial a$ and $P\{0, t\} = 0$, we have:

$$P\{a, t\} = \int_0^a p\{a, t\}da, \qquad (4)$$

$$P(a_{max}, t) = \int_0^z p\{a, t\}da = \int_0^{\infty} p\{a, t\}da = P\{t\}. \qquad (5)$$

For any small value a, the total population aged between a_1 and $a_2 (a_2 > a_1)$ at time t is:

$$P\{a_2, t\} - P\{a_1, t\} = \int_{a_1}^{a_2} p\{a, t\}da. \qquad (6)$$

A very important parameter in the population growth function is death rate function, which can be used to describe the death factor in population growth process. Assume that the number of people within age interval $[a, a+\Delta a]$ died at time t is $D\{a, t\}\Delta a$, and that those who survived and entered the next age group is $p\{a, t\}$ a. The death ratio function is defined as:

$$d\{a, t\} = \lim [\, D(a, t)\, a \,/\, p(a, t)\, a \,]. \qquad (7)$$

The main sources of a country's population gain are

immigrants and new-borne children. Since immigration has very small impact upon China's population growth, our major concern is to study the trend and policy related to new borne children. There are four main determinants of the quantity of new borne population in a year: (1) Number of people in birth age and their age distribution, (2) Percentage of women in the above population, (3) Individual fertility model, that is, the number of children per woman and (4) Aggregate social average fertility model. In this paper we discuss the impact of the last factor.

We use B(t) to denote the number of new borne children in year t, s(a, t) to denote the percentage of women among total population in fertility age (which is a function of age a and time t), and [a1, a2] to denote women's fertility interval (that is, if the minimum marriage age is 18 and the maximum age that a woman still has the ability to give birth is 50, the fertility interval will be [18, 50]).

Let p(a, t) denote the population at time t and age a(let a = 1), and the number of women at that age is s(a, t)p(a, t). The average number of children who were given birth by s(a, t)*p(a, t) women at time t is B(a, t). Letting R(a, t) be a ratio function, we have:

$$R(a, t) = B(a, t) / \{ s(a, t) * p(a, t) \}, \qquad (8)$$

and

$$B(a, t) = s(a, t) * R(a, t) * p(a, t). \qquad (9)$$

The number of children produced by the total number of women in their fertility age at given time interval is:

$$B(t) = \int_{18}^{50} s(a, t) * R(a, t) * p(a, t)da. \qquad (10)$$

The ratio function R(a, t) depends on two factors. One is average number of children per woman during her whole life and two, birth age and interval. We call the latter fertility model. In order to analyze the two separately, we standardize the ratio function as:

$$R(a, t) = N(t) * h(a, t), \qquad (11)$$

and

$$\int_{18}^{50} h(a, t)dt = 1. \qquad (12)$$

In equation (11), N(a, t) is the number of births each woman in fertility age gives in a given time interval, or simply the number of children each woman has in her whole fertility age. Equation (10) can now be written as:

$$B(a, t) = N(t) \int_{18}^{50} s(a, t)*h(a, t)*p(a, t)da. \qquad (13)$$

The chapter gives population forecasts for five different values of N.

CHAPTER SIX
SOME POLICY IMPLICATIONS

In this chapter, some policy implications are discussed, and alternative policies are suggested. First, parents' opportunity cost for children plays important role in making child-bearing decision. Opportunity cost of having children is negatively related to the number of children a couple is willing to have. Secondly, in present China, the majority of aged people are taken care of by their descendants in the family. Under the current population policy, without a well-established social security system, the increase of one-child families will cause frustration and social problems, and will also hinder productivity. The population aging problem associated with tight population control will also bring severe negative social and economic consequences. An efficient non-family-based social security system should be built up in order to ensure elderly for their life. Thirdly, our study indicates that the geographic distribution of the Chinese population is very uneven. Although many geographic localities are harsh for certain types of economic activities, internal migration is possible given proper economic incentives, so that population pressure high densities can be relieved and a smooth and slow population growth rate can be accepted. In order to achieve these objectives and to encourage voluntary and non-abortion population planning, the government should promote a more open and liberal market-oriented economy. Under current situation, one policy option is to continue to encourage one child per family, while legally allowing each couple to have up

to two children.

1. MORE OPEN AND LIBERAL ECONOMIC POLICY

In a closed economy, the growth in population is determined by birth and death rates. In more developed countries, birth rates are largely determined by economic factors rather than by cultural factors. Since children provide pleasure to their parents, and parents make outlays and investments on their children, economists tend to analyze family formation in terms of the framework provided by consumption theory. In this view, disposable income, individual preference, and the opportunity cost of children each play an important role in family planning.

The productivity of a person and his or her education level are positively related. As peoples' education level increases, their opportunity of economic activity increases, and when their economic opportunity increases, the opportunity cost of their time will also increase. Therefore, we can expect that as the education level increases, the preference for children will decrease. Economic opportunity is of course also affected by economic policy. Despite the fact that it is difficult to get relevant data to make detailed computation and prediction about the relationship between the level of education and fertility, we still can observe that there is negative relationship between them in China. Table 13 confirms this relationship.

Table 13. Correlation Between Education and Fertility

Education Level	(1)	(2)	(3)	(4)
National Average	17.96	9.64	4.38	3.94
University	1.23	0.82	0.17	0.24
Senior High	3.41	2.50	0.55	0.36
Junior High	9.15	5.69	1.95	1.51
Primary School	26.75	13.74	6.76	6.25
Illiterate	40.19	17.54	9.86	12.79

Note: (1) Proportion of women with more than two children.
(2) Proportion of women with three children.
(3) Proportion of women with four children.
(4) Proportion of women with more than four children.

Source: China Statistical Year Book, 1984, The State Statistical Bureau. p. 101, (in Chinese).

This suggests that education is an important factor which will affect fertility rate. It is not unreasonable to predict that as their overall educational level increases, people will more readily cooperate with government family planning program.

Although it is inappropriate to put price tag on children in real life, in economic analysis we can treat children as special commodities. If we hold preferences and prices, defined here as the prices of goods and services for children, constant, then an increase of disposable income of parents would increase both the number of children parents would have and the amount of investment the parents would make in their children, unless some viewed children as inferior goods. Experience in many developed countries shows that as income increases, the impact on the quality side is larger than on the quantity side. This means that increases in income will make family size increase at a

decreasing rate, and the investments in children increase at an increasing rate.[48] In developed countries, and in the upper classes of developing countries, parents tend to make substantial expenditures on the education and other measures which increase the quality of children. Some empirical observations also confirm the expected negative relation between family size and the opportunity cost of children. Housing, food, education, and the opportunity cost of parents' time are obviously cheaper in developing countries, including China, compared to more developed countries, and cheaper in rural than in urban areas. This shows that the substitution effect is larger than income effect.

One important factor contributing to parents' preference for more children in China, particularly in rural areas, is the current low level of economic activity. The opportunity cost of having more children is so low that some parents feel that to have one more child in the family simply costs another pair of chopsticks at the dinner table. When a nice family planning official was trying to explain to a housewife in the countryside the disadvantage of having more children, the housewife said that looking after children is just like her husband looking after his sheep; he would not mind adding another sheep to his flock. Only when his earning capacity increases will he change his preference

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48. We assume that both the amount of investment parents would like to make on their children(I) and the number of children they want to have(N) are functions of income(i), that is, $I = I(i)$ and $N = N(i)$. The first derivatives of I and N with respect to i are both positive. The second derivative of I with respect to i is positive, but the second derivative of N with respect to i is negative.

for children. This explains why urban families as a whole usually have relatively fewer children. Recently, since the Chinese government adopted a more liberal economic policy in agricultural sectors, farmers in many areas have shifted their attention from land to some other activities. As their income levels increase, and also when housewives become involved in more productive activities, their time becomes more valuable and thus the opportunity cost of time rises. Many of those new farmers find they no long have the time to take care of many children. As they get the chance to see more of the outside world, they change their expectation for their children: they want their children to get education and to live better lives. They start to hire baby-sitters and family tutors to help their children. In some interviews conducted by the media, many farmers expressed their new preference for a small family. Also with the more liberal economic policy, those previously poor farmers will not only increase their own standard of living, but also make investment and thus create many employment opportunities. Many newly improved farmers expressed their intention to reinvest their gain, but are fearful of ever-changing policies. To encourage people to voluntarily accept family planning and to cooperate with the government's effort, the essential and ultimate point is to provide them with more opportunities, and let them realize that there are more valuable things they can do.

It should be pointed out that the current economic policy is contradictory to population policy. Under the current economic

policy, the larger the family size, the larger the labor force, the greater the degree of role specialization by sex and generation, the greater the ability to accumulate tangible resources, and the larger the social network for obtaining capital, labor, technology and market information. The incentive to have more children is reinforced. This also needs to be overcome.

2. IMPROVE SOCIAL WELFARE SYSTEM

Taking care of the old people in the family is an important feature in China and it provides a buffer to the aging problem. This type of family life style has long been appreciated by people in China and by other countries of the world. The Chinese government expects to preserve the family system of social security and encourages young couples to take care of old people, in order to meet the needs of the growing number of aged population. Unfortunately such a system is challenged by the increasing number of families with only one child that disrupt the family support system for elderly. The government is facing a serious dilemma between the macro-demographic impacts of population policy on total population size and population aging on the one hand, and the micro-demographic effects on the family's ability to support the elderly and its economic capacity on the other hand. As the proportion of one-child families increases, in about 20 to 30 years each couple will have to take

care of over four old people.[49] This will cause frustration and conflict in families and affect family relationships, and reduce old people's welfare and sense of security, and reduce the productivity of the young people. The negative impact has already become reality and has attracted nationwide concern.

The most important thing for the old is security, but the existing pension system applies only to State- and collective-owned enterprises and institutions. Farmers and other individual laborers depend on their descendants. Moreover, the majority of China's old population is in rural areas, and they rely upon their families to assume the major responsibilities for the care of them. The rationality and the reason for this situation are not the objectives of this paper, but this reality is a challenge to the current population policy and social security system. The overall trend of population aging is: urban areas prior to rural areas, coastal provinces prior to inland provinces, and inland provinces prior to remote provinces. Such a sophisticated trend and differentiation gives the government a more sophisticated and challenging issue in building up its security system to face the aging population. To attain both population control and old age support, non-family based options for elderly support need to be explored. Some meaningful linkages between family and government elderly support need to be established. A critical policy issue

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49. Lei Jeqiong, "Change of Urban Family and Old Life", People's Daily, (Overseas Edition), August 16, 1986, (in Chinese).

in China is what the optimal combination of both types of support system should be.

As an alternative to the above problem, some people suggest that China develop old folks' homes and apartments. However, at the moment, there are only 20,000 old folks' homes across the nation, a far from sufficient number.

My speculation is that instead of monopolizing all the economic activities, the government may give individuals more freedom and space to make their own decisions based on market supply and demand. It is impossible for the central government to put every aspect of the economic and social activities into a perfect plan, nor can the government find sufficient funds to finance all it needs and wants to do. The law of supply and demand will teach people how to fulfill their needs quickly and efficiently, if the government can stand at the right position to support and adjust the process. Instead of treating services for old people as a non-profit activity which has to be offered by the government, it may not be a bad idea to make it a new business.

Chinese scientists and government leaders have accepted the fact that it is inevitable and irreversible that China will reach an aging population period in 1990s and that this trend will accelerate in early next century.[50] The current one-child

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50. Yang Taoyuan, "China is Facing the Challenge of Aging Population", Outlook Weekly, (Overseas Edition), No. 30, July 28, 1986, (in Chinese).

policy is the main cause of the aging population.[51] According to another official prediction, in the year of 2000, China will have 130 million old people over 60 years.[52] However, mistakes of the past give us a buffer period. From now to the end of this century, those born during the baby boom in 1960s will enter into labor force. Such a huge base can slow down the aging population process. Therefore, this period can be considered to be the "golden period" in which age composition is favorable to economic development because the ratio of young and old dependents combined to the working age population is rather low. If we can take this opportunity to expand production and improve social security and welfare system, we can set a material base and will be in better shape when we face the challenge of accelerating aging population. This again depends upon a more open and liberal economic environment. The government must manage to expand the present economic and political reform toward a more market-oriented economy.

Another problem the government should solve in order to effectively encourage voluntary birth control is to assure the availability of non-abortion contraceptive tools. Currently, many couples find it hard to believe that contraceptives are so hard to find when they hear that birth-control products are

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51. Wang Wei, Director of the State Family Planning Commission, "China's Population Control Policy and Aging Population", Outlook Weekly, (Overseas Edition), Vol. 30, July 28, 1986, (in Chinese).

52. According to journalists' report, People's Daily, (Overseas Edition), October 31, 1987, (in Chinese).

piling up in factory warehouses. This problem is caused by the disequilibrium between production and distribution. An official of the State Family Planning Commission said "China is not short of family planning products. In fact, supply exceeds demand."[53] Take condoms for example. The country had 600 million in stock by the end of 1985. However distribution is poor and a condom factory in Dalian, Liaoning province, was facing bankruptcy as supplies pile up in their warehouse. The problem of "shortage" of contraceptives does not lie in production but in distribution and the service sector. In China, contraceptives are distributed free to the public through two channels: chemist shops run by pharmaceutical companies or neighborhood family planning committees and those in workplaces. Since the contract responsibility system was introduced in drug stores in some areas, many of the goods that do not earn profits have been taken off the shelves and put in some inconspicuous place. People who are too shy to ask cannot find them. Formerly most chemists displayed contraceptives openly so that people could help themselves. Effort needs to be made to make contraceptives readily available to those who are willing to use family planning.

3. DOMESTIC IMMIGRATION

Rational consideration of population policy in China must

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53. "Contraceptives in Abundance-But Where?", China Daily, Vol. 5, No. 1051, May 17, 1986.

consider the spatial distribution of the population. In China, as in other nonindustrial countries, population settlement originally followed arable land, and the topography and climate so limit the area on which different crops can be grown that only a small proportion of the total territory is at present cultivated. As the result, about ninety-five percent of total population live on less than forty percent of the land. The most densely populated areas cover most of the Yangtze delta region and the Northern China plain. From table 14 we can see that the least densely populated provinces--Tibet, Qinghai, Xinjiang and Inner Mongolia--contains almost half of the total area of the country but only about four percent of the total population, while in some of those most densely populated provinces such as Jiangsu and Shandong the distribution density is close to that of a metropolitan city. Table 14 presents the overall provincial densities. In order to show the uneven regional population distribution, we employ the technique of Lorenz Curve in figure 10. The computation procedure is shown in notes to table 14.

The Lorenz Curve in the figure shows a substantial uneven distribution of China's population over the total area of China.

The geographical distribution of a population depends on both natural factors (climate and landforms) and cultural factors.[54]

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54. Adopted from The Determinants and Consequences of Population Trends, United Nations, Series A, Population Studies, No. 17. 1953, p. 163-180, with some additions and other changes.

Table 14. Computation of Concentration Ratio of Regional Population Distribution in 1983

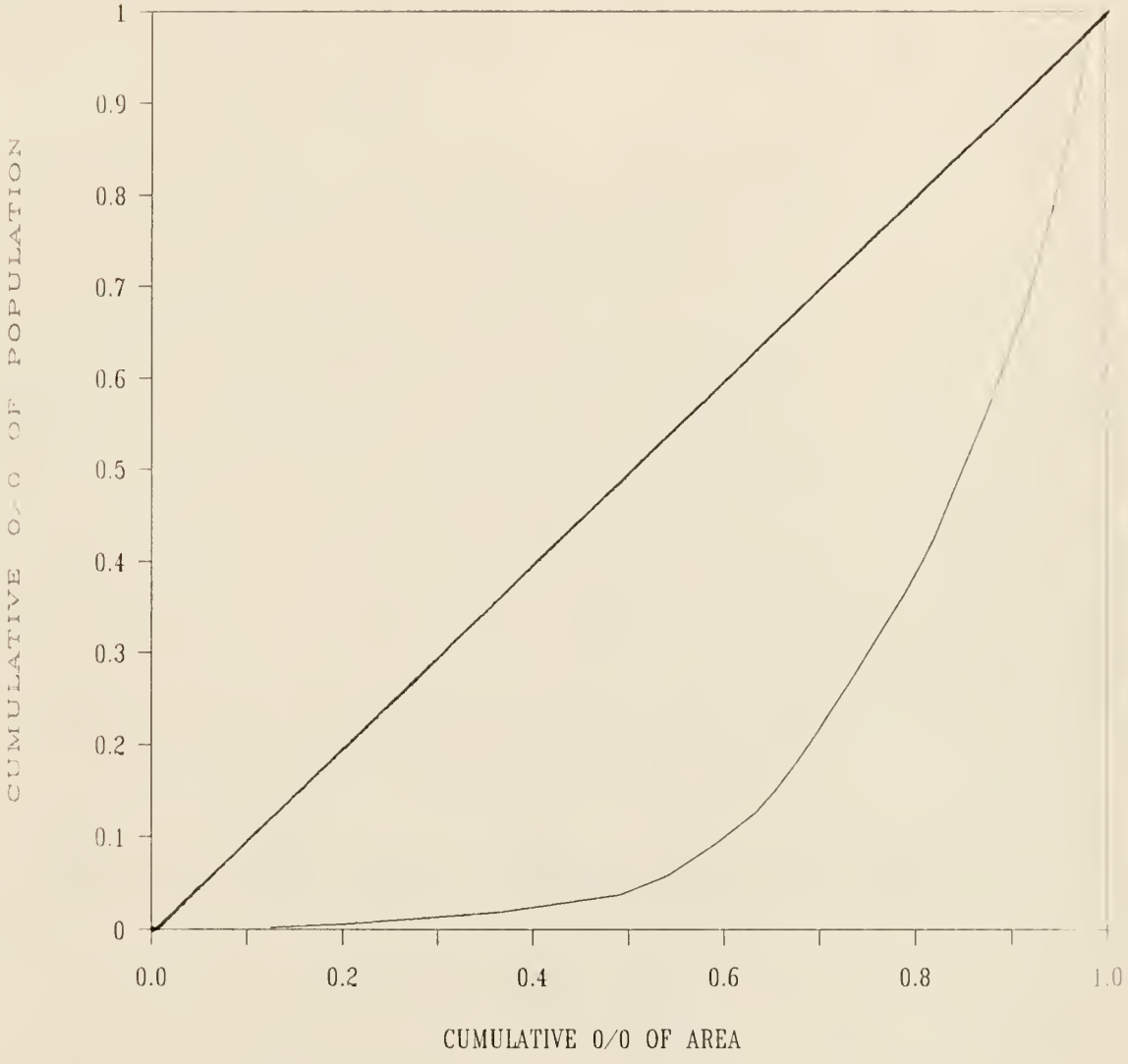
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Nation	102,495	9,600	107	1	1	-	-
Tibet	193	1,200	1.6	0.002	0.125	.002	0.13
Qinghai	393	720	5.4	0.004	0.075	0.01	0.20
Xinjiang	1,318	1,600	8.2	0.013	0.167	0.02	0.37
Inner Mongolia	1,955	1,200	17	0.019	0.125	0.04	0.49
Gansu	1,988	450	44	0.019	0.047	0.06	0.54
Ningxia	398	60	60	0.004	0.006	0.06	0.54
Heilong-jiang	3,306	460	70	0.032	0.048	0.09	0.59
Yunnan	3,319	390	84	0.032	0.041	0.13	0.63
Jilin	2,270	180	121	0.022	0.019	0.15	0.65
Shannxi	2,931	200	143	0.029	0.021	0.18	0.67
Guangxi	3,733	230	162	0.036	0.024	0.21	0.70
Shanxi	2,572	156	165	0.025	0.016	0.24	0.71
Guizhou	2,901	170	165	0.028	0.018	0.27	0.73
Sichuan	10,076	560	178	0.098	0.058	0.36	0.79
Jiangxi	3,384	160	203	0.033	0.017	0.40	0.81
Fujian	2,640	120	218	0.026	0.013	0.42	0.82
Liaoning	3,629	140	249	0.035	0.015	0.46	0.83
Hubei	4,835	180	258	0.047	0.019	0.51	0.85
Hunan	5,509	210	262	0.054	0.022	0.56	0.87
Guangdong	6,075	210	287	0.059	0.022	0.62	0.90
Hebei	5,420	180	289	0.053	0.019	0.67	0.91
Anhui	5,056	130	363	0.049	0.014	0.72	0.93
Zhejiang	3,963	100	389	0.039	0.010	0.76	0.94
Henan	7,591	167	455	0.074	0.017	0.83	0.96
Shandong	7,564	150	494	0.074	0.016	0.91	0.97
Beijing	934	16.8	556	0.009	0.002	0.92	0.97
Jiangsu	6,135	100	598	0.060	0.010	0.98	0.98
Tianjin	789	11.3	697	0.008	0.001	0.98	0.98
Shanghai	1,194	6.2	1,926	0.012	0.001	1.00	0.99

Notes:
(1): Units at the Provincial Level.
(2): Total Population (times 10^4).
(3): Area(1,000 sq.km).
(4): Population Density(persons / sq.km).
(5): Proportion of Areas to the Total Area.
(6): Proportion of Populations to the Total Population.
(7): Cumulative Proportions of Areas to the Total Area.
(8): Cumulative Proportions of Population to the Total Population.

Source: China Statistical Year Book, 1984, The State Statistical Bureau, (in Chinese)

#10. POPULATION REGIONAL DISTRIBUTION

(1983)



The cultural factors modify the effects of the natural and the physical factors, and all of them operate through the demographic factors. Many parts of China are hilly and mountainous, or consist of generally flat to rolling desert plains. The climate is highly diverse, ranging from tropical and subtropical in the Southern provinces such as Guangdong, to subarctic in the extreme Northeastern provinces such as Heilongjiang, thus giving some parts intense summer heat and others long winters with only relatively short growing seasons. Some provinces in the Northwest are quite arid and not favorable for agriculture.

In addition to topography and climate, the cultural and social structure and tradition have worked against extensive long distance migration. The economic factors are also important for people when they make migration decision. Only an unusual attraction or a severe crisis can induce such a decision.

The Chinese government has realized the necessity of population redistribution and has tried several policies. From 1960 to 1966 and continuing during the ten-year Cultural Revolution period (1966-1976), millions of persons, particularly youths, were sent to countryside under the propaganda slogan of "concentrate forces on strengthening the agricultural front" and "it is necessary for educated young people to go to the countryside and be re-educated by the poor and low-middle class farmers". Although the intentions of Chairman Mao Zedong, the Party and the government, and the effort and contribution of

those who were sent to countryside should be appreciated, generally speaking the policy as a whole failed, and the remaining problems left many families and the government with trouble. The reason is that those population redistribution movements were supported only by political and spiritual beliefs. Although these beliefs are sometimes beautiful, some are against human nature, and will not last long and will eventually fail. For most of those who were forced to migrate to the countryside by political and official pressure instead of spiritual belief, crisis was implied at the very beginning. Experience proved that without economic incentive, and without the hope of prosperity for their own sake in the short run, people will not be willing to take the risk and give up their current opportunity in cities or more developed areas. In the long run, everything could be beautiful, but because in order to reach the beautiful long run goal, people have to make painful sacrifice in the short run, or even in several generations, it is very unlikely that they will take it. Only short-run incentives have significant impact on people's decision-making.

Recently, since the Party and the government took new economic policy in agricultural sectors, many former farmers have left their homelands and have shifted from traditional agricultural activities to business activities. Some of them even started their businesses in those provinces where few people were willing to go, such as Gansu, Qinghai, and Tibet. The problem is that these people are suspicious of the new policy and

are not sure how long the policy will last. They are scared because of past policy changes, and the discrimination against private ownership. The reward for their risk-taking is not legally protected. Therefore they are reluctant to invest the gain they have received in the poor areas to set up permanent businesses which will create employment opportunities in those areas and attract more migrants, and they are certainly not going to get the whole family to settle in the new area permanently. And since land is legally owned by the country, no farmers have the incentive to cultivate new land. Thus no large scale voluntary migration can take place.

As for professional manpower, there is less economic incentive to attract them to the less developed regions. The whole salary system is under the state planning, and salaries of different persons at the same rank are almost the same with only a very insignificant regional compensation. Because the government and the Party encourage people to plant their roots in the countryside, in boundary areas, and in poor and less developed areas, once professionals have left their urban life style, it is very difficult for them to go back to their homeland and to get back their former jobs[55]. Thus professional workers have no voluntary will to go to those areas.

In order to solve this problem, it is essential to promote

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55. In China people are not allowed to move and settle in another place without official permission and registration. Job assignment for professional and educated people are also made by the government.

more open and liberal economic policy, as discussed above, and to legally protect private ownership. Risk-taking should be encouraged and rewarded. High compensation will encourage professionals to give up their urban life and jobs in more developed areas, so local government, institutions, and businesses should be given more authority to offer higher compensation and better living condition in order to attract skilled workers and professionals. Those willing to contribute to the less developed areas for short time but not willing to settle permanently should be given the freedom and convenience to go and return.[56] To promote migration to Tibet and other less developed provinces in order to reduce population pressure and to help economic development in these areas, more economic incentives are needed. These incentives could include government support program and improvements to schools, hospitals, transportation systems and others public facilities.[57]

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[56]. It should be mentioned that recently many people worldwide have expressed concerns about China's internal migration to some less developed regions, including Tibet. Their concerns include the fear that such migrations will exploit resources in these areas, interrupt the natural progress of social and economic structure, and will have harmful effect on the economic development in these regions. The situation is not that those people go to Tibet to take advantage of that area. Instead, they are either assigned by the government to serve there temporarily, or are voluntarily willing to contribute to the people there. The numbers are so small that it has not reduced the population pressure in other areas.

[57]. The Chinese government's efforts and projects aiming to promote economic transformation and development in Tibet and other less developed provinces were quite successful in the past and were appreciated by the residents in those areas, though there are still many improvements to be made in order to achieve more efficient result.

4. SHORT-TERM POPULATION POLICY

In 1986, the World Bank published its population projection[58]. The projection of China's population indicates that Chinese population will reach the stationary level in about 2010, represented by Net Reproduction Rate(NRR)[59] equal to 1, and fertility, or Gross Reproduction Rate(GRR), equal to 2.1. This result almost coincides with the 100-year projection with N=2, reported earlier. Combining the World Bank projection and the results of the 100-year projection discussed in chapter 5, and considering factors such as total labor force and dependency ratio and their impact upon economic development, we may conclude that the optimal control target of the crucial variable N should be set between 1.5 and 2.0. Our target is to adjust the population policy and control the total population into the region bounded by the two curves representing the population growth trends with N=1.5 and N=2.0, respectively. We can assume another approach, that is, to set our control range as $1.0<N<1.5$. These two assumptions are illustrated in figure 11.[60] As we

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58. "World Population Projections, 1985. Short- and Long-Term Estimates by Age and Sex with Related Demographic Statistics". From the data files of The Word Bank. The Johns Hopkins University Press, Baltimore and London, p. 272-273.

59. The NRR measures the extent to which women reproduce themselves under given fertility and mortality conditions. A NRR=1 means that women simply reproduce themselves. In other words, each woman during her reproductive years produces one female child. A stationary population is represented by NRR=1. In this paper, the N can be seen as gross reproduction rate(GRR). The assumption of N=GRR=1 can be translated as equal to NRR=0.5.

60. Figure 11 is constructed with data from table 6, 7, and 8.

discussed in chapter 4 and chapter 5, this approach will meet challenge in practice in the short-run and face problem in reaching sustained development in the long-run, therefore is not realistic. From figure 3, we have already seen the negative effect of the radical population policy.[61]

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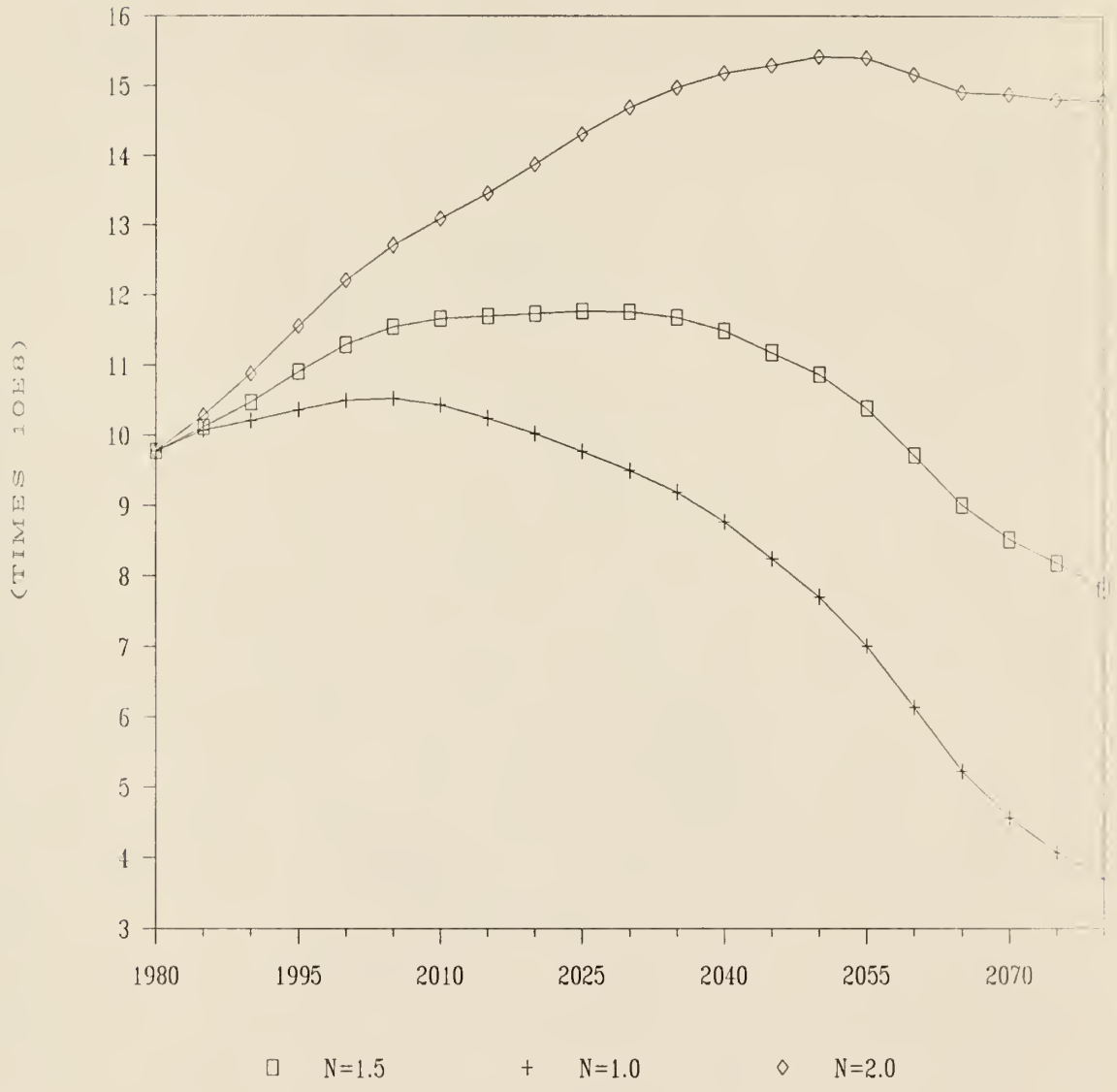
61. Although many factors can affect infant mortality, if we review the political, economic and social conditions, we have sufficient reason to believe that the main reason is the population policy.

#11. POPULATION CONTROL TARGET



A main challenge to this conclusion could be summarized as follows: the larger the population size, the lower the income per capita, holding other factors constant. This is the effect on consumption side. This proposition can also be supported by the law of diminishing returns, which is the effect on production side. I imagine that the Chinese policy makers designed the one-child-per-family policy based on the above propositions. However, readers might realize also that this challenge relies entirely upon the assumption of ceteris paribus. What is being held constant here includes capital and total output. We may think about what China would have been like if its population had never exceeded the population size of 2 million in Shang Dynasty in 1000 B.C.. We may also realize the fact that some countries with the highest population density on the earth are among the most developed countries. Adding more people to a population while holding the pie fixed directly reduces everyone's share, and indirectly affects consumption through the effect on production per worker. Under the current one-child-per-family policy and based on the projection of dependency ratio reported earlier, if the total population declines sharply, total production may go down, and it is not quite sure that GNP per capita can be higher under the high dependency ratio, or high enough to compensate the lost social welfare. As we saw in chapter five, in one of our projections (the N=1 assumption), the increase of output per worker is about the same proportion as the decrease in output per dependent, when dependency ratio is 1.483.

Our projections of output per capita indicated that the current population policy will give not only a much smaller total output, but also a lower per capita output in the long-run. The fertility assumption N=1.5 gives the highest per capita output among all assumptions.

Income per capita depends upon the amount of capital available for each worker, though not entirely. Given a constant capital stock, a decrease of population and thereafter labor force will increase proportionally the amount of capital available per worker. But the assumption that income and capital are fixed, instead of variable in response to the number of people, is very unrealistic. People with more children tend to forego some current consumption in order to save for their children's future needs, such as education and marriage.[62] Thus, "Population growth is likely to have a positive effect on this sort of saving, and hence upon the community's stock of capital."[63] Our projections in chapter five prove that under strict one-child-per-family policy, total capital will decline substantially.

We have discussed that Chinese economy is generally speaking represented by labor-intensive technology. We need to keep sufficient labor force to operate this labor intensive economy.

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62. This does not lead to the proposition that more children necessarily means more saving, just like a reduction of children does not necessarily mean an increase of saving.

63. Julian L. Simon, The Economics of Population Growth, Princeton University Press: Princeton, New Jersey, 1977. p. 34.

Thus we cannot afford a sharp decrease of population. This does not mean that China should keep this labor intensive structure and bring this backwardness of the past to the future. This is not the preference. Instead, this is a painful reality China has to face. Before the structural transformation of technology has naturally occurred, a sharp decline of population and labor force, and increase of dependency ratio, will lead the economy to a hard situation, as reported in chapter 5.

Even if we assume that a one-child-per-family policy can successfully increase GNP per capita, we need to recognize that social welfare is the function of many factors, not only disposable income per head, but also family life, love to and from children, personal integrity, etc.. We cannot measure the net gain or loss of welfare of a policy quantitatively, but if most people are not happy about the effect of the policy, we have reason to challenge it. Population policy is the type of policy which has impact upon almost every family, even those who choose to have one or no child. If this policy cannot lead to optimal social welfare, we cannot consider it as the best alternative.

Finally, the one-child-per-family policy itself has already been proved to be unpractical by past experience. If China has unlimited resource, then there is no need for a family planning program. People can have as many children as they want. On the other hand, if the one-child-per-family policy can successfully achieve sustained economic development, increase aggregate social welfare and be implemented without so many difficulty, resistance

and human misery, there is no argument either. But when sustained economic development, increased level of material wellbeing, optimal social welfare, and human rights are all desired, a tough trade-off has to be made.

With respect to the population policy, we may suggest that the government legally allow each couple to have two and only two children. Those who decide to have one or no child should be encouraged with high compensation, because with the given contribution they make to the society, they take a smaller share from the society, and the society should let the parents share the external welfare the parents contributed to the society. The opposite is also true. Since in China, many public services and social security benefits are available to the public free or at low charge,[64] those who choose to have more than two children will take larger share at the expense of others' relative low share, and they should be charged with substantially high economic penalty.[65] In this way, the society can shift the external cost of additional child to the internal cost of parents who choose to have more than two children. As we discussed in

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64. Actually nothing is "free". Since China's income distribution system is based on Marxist distribution theory, deductions are made by the central government "for workers' interest" before employees get their share, therefore employees and their families are entitled to public services with good quality.

65. It is not unreasonable to assume that after a couple have the second child, the marginal utility of the third child is lower than the first and even lower than the second, and the elasticity of demand should be also fairly high. Thus the economic penalty should be high enough to show the government's principle and policy, and to compensate the society.

the first section of this chapter, when the level of education and standard of living increase, the opportunity cost for parents to have children will be higher and many may not want to have two children. It is my belief that both the current population pressure and the state of human right, people's overall welfare should be taken into account, given my standpoint that population control is very important and necessary.

It should also be pointed out that the current one-child-per-family policy may not be favorable for children's sake. In 1986 there were 35,000,000 one-child families. The "only-child problem" has drawn national concern. These children have obvious weaknesses in personality, characteristics, social attitude behavior, and interpersonal relationship. These children tend to have a higher possibility of having psychological problems than children from non-one-child family. Parents, teachers and social workers are deeply concerned about this problem. Many wonder if these children can become psychologically healthy citizens and the type of people the parents and the society expect and need.[66]

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66. According to journalists' report, **People's Daily**, (Overseas Edition), May 26, 1986, (in Chinese).

CHAPTER SEVEN

SUMMARY AND CONCLUSION

The introduction of the one-child-per-family policy in China in 1979 gave rise to a good deal of controversy. Although the net natural growth of population has been declining, and the achievements are appreciated, there have been frequent violation of human rights and associated human misery. These violations are hurting China's international image.

The negative impact of rapid population growth is clear. Without population control, China will stay at the subsistence level of income forever. However, a sharp decline in total population, which is the end result of a one-child policy, will also hamper China's economic development. The disadvantages of the one-child-per-family policy can be summarized as follows:

1) With the one-child-per-family policy, China may face the danger of shortage of labor force when China is seeking sustained economic development. If the one-child policy can be successfully implemented, China's total population in 2080 will be less than 370 million, with 55 percent old dependents. This will put the national economy in a hard situation. The result of this projection looks unrealistic; that is because the policy itself is not realistic and not practical.

2) The current policy will accelerate the process of aging population. A high dependency ratio will put pressure on

the society. Even more, if old people mainly contribute to the high dependency ratio, it will cause some economic pressure and social conflict. Until China has built up a more complete social security system, most people still need to have more than one child to assure security. Based on our projection assuming each couple has only one child, the dependency ratio in the year 2080 will be 1.48, with 203 million old dependents and 18 million young dependents, provided for by only 149 million people of working age. Even if Chinese government loosens the restriction some time later, the first round effect will only increase the dependency ratio, since the people added to the population as the result of a higher fertility level are children, if we assume there is no increase of old people mortality. This will increase the economic pressure on the working population.

3) The strict one-child policy will not only decrease total output, but will also slow down capital stock accumulation and per capita output growth in the long-run, compared to the policy effects under more moderate population growth. Instead of achieving sustained economic development, the result of this policy is harmful to Chinese economic development.

3) The strict enforcement of the one-child-per-family policy will cause human misery. The reappearance of female infanticide is the direct result of the new policy. Without a policy change, this trend will cause sex ratio to lose balance.

4) The policy will have a negative impact on children. The one-child families are facing educational problems and

frustration to parents, grandparents, children and society.

In sum, the most uncertain consequences of Chinese population policies lie in the political, economic and social sphere. If the social security system is not well instituted, or if the economic incentive fails to materialize, serious disillusionment could pervade Chinese society, complicating any successful struggles or economic crises that may occur. The changes in the family resulting from the sudden imposition of the one-child-per-family limit on a society with traditional values and with economic needs to have more than one child could cause changes in socialization and in attitudes toward government and the party. By the time these consequences are visible, there may be little that can be done to overcome them.

To solve the Chinese population problem, we need to take into account both economic development target and human right, which will also affect the aggregate social welfare. In order to promote voluntary, non-abortion family planning, several steps should be taken:

1) Increase educational level of the whole population. Our table 13 indicates that there is clear correlation between education and fertility, and the number of children per couple is negatively related to the parents' education level. This suggests that education is an important factor in child-bearing decision, since education can affect parents' opportunity cost for children.

2) Increase productivity and build a solid material

base. We showed that one important factor contributing to parents' preference in China, particularly in rural areas, is the relatively low level of economic activity. The opportunity cost of having children is negatively related to the number of children parents are willing to have. As people become more productive, and their economic opportunities increase, their opportunity cost to have children will increase, and they will voluntarily accept family planning.

3) Improve social welfare and security system, and make efficient use of these public facilities. At present in China the majority of old people are taken care of by their family members. A well-developed non-family social security system will assure security through society, rather than mainly through the family security system, and will thus reduce the need for more children, thereby reducing the problem of female infanticide.

4) Our study shows that the current Chinese population demographic distribution is fairly uneven. To relieve the current and potential population pressure, the government should encourage voluntary internal migration with government support and economic incentive. Given proper incentives, such internal migrations are possible, and this will make a smooth and slow population growth in the short-run acceptable.

5) In order to solve the population problem ultimately and to fulfill the above steps, the government should introduce and assure a more open and liberal economic policy, and promote a market-oriented economy. As economic development occurs,

demographic transition will occur. One important factor affecting parents' preference for children is the opportunity cost of their time. Economic policy will indirectly induce parents to voluntarily have fewer children.

As a temporary compromise, the short-term population policy should allow the maximum of two children, while encourage one-child family. In order to keep population from growing fast, the government should promote voluntary family planning program, assure the availability of contraceptive devices, compensate one-child families, and put economic penalty on parents who choose to have more than two children. Overall, a smooth and slow population growth is preferable to a sharp decline.

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CHINA'S POPULATION POLICY AND ITS IMPACT ON ECONOMIC DEVELOPMENT

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AN ABSTRACT OF MASTER'S THESIS

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A B S T R A C T

Since 1979, China has made significant achievement in population control program. The net natural growth rate has successfully gone down. However, with the introduction of mandatory one-child-per-family policy, violation of human right, coercion, and most important, forced abortion and female infanticide reappeared. This has also drawn worldwide concern.

People's preference for more children and for son should be viewed as the result of particular culture and economic condition. Without a well-developed social security system, people have to have more children to ensure the security of the family.

The current Chinese population has a young structure. A radical policy will cause shortage of labor in the near future. It will also speed up the process of aging population, which will put pressure on the society. The resistance to the policy causes people to practice abortion and female infanticide. This brings many psychological and social problems and is causing imbalance of sex ratio. In addition, the one-child-per-family policy has many disadvantages in children's development.

The population projection and output per capita projection based on different fertility assumptions indicate that one-child policy will not lead to optimal outcome. The study also indicates that one-child policy cannot optimize aggregate social welfare.

In order to promote voluntary family planning program, we

should increase the overall education level, adopt more open and liberal economic policy. As people become more productive, their preference for children will decline. We also need to improve the social security system. In order to release the current and potential population pressure, we should encourage voluntary internal migration. In addition to economic incentive, the government should provide infrastructure support and most important, legal protection of their reward.

At present, a more practical alternative policy is to allow each couple to have two children, while encourage one-child family. High compensation should be offered to those who choose to have one or no child, and high penalty to those who have more than two children, in order to assure social justice.