
THE EFFECT OF AN EXPANSION OF THE PAY-AS-YOU-GO SOCIAL SECURITY SYSTEM IN CHINA

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Abstract

China is in the process of industrialization with a large amount of the labor force moving from the agricultural sector to industrial sectors. An expansion of the pay-as-you-go social security system benefits current urban retirees, and may solve the social security payment problem faced by many state enterprises. Also, although facing a declining population growth rate, China may not have a social security crisis under a pay-as-you-go social security system just covering the wage earners, as many industrialized countries face. However, the expansion of the pay-as-you-go social security system may have an adverse effect on capital accumulation in the long run, hurting the rural old, and either benefiting or hurting the wage earners in urban areas before the completion of industrialization, and is likely to reduce wage earners' welfare after industrialization.

Introduction

As economic reforms in other areas proceed in China, social security reform has become urgent. China has a pay-as-you-go social security system which covers only a small portion of the population. The social security reform can go different directions: expanding the existing system to cover more people, or privatizing the present system by establishing individual accounts, or a combination of the two. This paper analyzes the effect of an expansion of the current pay-as-you-go system on the Chinese economy.

Many countries in the world provide social security to their residents. Most social security systems are pay-as-you-go in nature, i.e., government collects taxes from the working generation to finance the

benefits to the retired generation. This system is also called an “unfunded system” because the benefit received and the taxes paid by an individual may not be the same. Under this system population growth will benefit each generation since there will be more young people supporting the retirees. Problems arise when the population growth rate begins to decline, i.e., each generation has to pay more and more to keep the parent generation as happy as their grandparent generation. As capital markets become well-developed, it is also possible for a person to provide old-age security for him- or herself. When working, each individual deposits a portion of his or her salaries into a fund. Over time the fund would accumulate interest, and on retirement, each individual receives the principal and accrued interest as old-age security benefits. This form of old-age security can be called “individual security,” and it is a fully-funded system because individuals receive exactly what they paid in terms of the present value.

Recent research on Chinese social security reforms have identified two major problems China's new social security system must solve. One is to reduce the social security burden of the state enterprises, and the second is to avoid a social security crisis due to the decrease in the population growth rate (Zhou and Wang, 1994; and the World Bank, 1997). To solve these problems, a mixed social security system which combines a social account (an account through which the government collects social security contributions from the young and pays social security benefits to the old) and an individual account (a mandatory savings account through which an individual saves when young and withdraw savings and interest when old) has been recommended. On one hand, this proposed system is an expansion of the current pay-as-you-go social security system since more workers are covered; on the other hand, the system is a partial privatization of the existing system since each worker has his or her own mandatory saving account. The size of the social account and the individual account is essential to determine the nature of the social security system. At present, the social account is the major part. Thus, the social security system is largely pay-as-you-go in nature.

This paper argues that a pay-as-you-go social security system can easily solve the social security payment problem in the state enterprises. China's current social security system only covers the employees of state enterprises, state institutions, and government agencies. Each state enterprise takes care of its own employees and the government pays social security benefits to the employees of state institutes and government agencies. Many state enterprises are unable to pay social security benefits due to the decline of their profitability. Most non-state employees are not

covered by the current system. Expanding the pay-as-you-go system to all wage earners will enable the government to collect enough funds to pay social security benefits to the retirees in the state enterprises.

This paper also argues that, unlike the industrialized economies China may not have a social security crisis in the near future with the pay-as-you-go system covering all wage earners. Due to decreased population growth rate, U.S. and other industrial countries will have a social security account deficit around 2030 if the current systems are not reformed (see Kotlikoff 1996). Facing the imbalance of social security accounts in the future, some countries, such as the U.S., now have adopted a partially funded system, i.e., save some of the tax revenues in order to pay the social security benefit to the future retirees. China is in the process of industrialization, and more and more rural laborers are becoming wage earners. Thus, there should be more and more young workers supporting retirees in industries, even though the growth rate of the total population has declined.

One problem prior studies on Chinese social security have disregarded is the effect of a social security system on capital accumulation. Many studies on social security have shown that social security has an adverse effect on private savings and capital accumulation (see, for example, Feldstein, 1974, 1996; Blinder, Gordon, and Wise, 1981; Diamond and Hausman, 1982; and Kotlikoff, 1979).⁽¹⁾ China is a developing country which needs a large amount of capital goods. This paper shows that a pay-as-you-go social security may reduce capital accumulation in both the short run and the long run.

Another problem which has not been addressed is the differential effects of the social security system on urban wage earners and the rural farmers. If the pay-as-you-go system is established, the young workers who just migrated to cities must have double social security burden, i.e., pay social security taxes to finance the benefits to city retirees and make transfers to support their rural parents; the rural old might be worse off since their children who migrate to cities may transfer less to them; the current urban retirees will be better off due to the increase in social security taxes while the future generations may be worse off due to lower capital stock.

This paper is organized as follows. Section 2 describes the stage of Chinese economic development and the social security system from a historical perspective. Section 3 presents an overlapping generations model. Section 4 provides comparative static analyses of the effects of a

pay-as-you-go social security system on the real interest rate, the real wage rate, and capital accumulation. Section 5 analyzes the effect of a pay-as-you-go social security system on industrial workers and rural farmers. Section 6 discusses the effect of a decrease in the population growth on the pay-as-you-go social security system. Section 7 provides concluding remarks.

The Stage of Chinese Economic Development and Current Social Security System

When discussing social security reforms in China, we must take into consideration the stage of Chinese economic development. China is a low-income developing country. The population increased from 0.55 billion in 1950 to 1.24 billion in 1997.⁽²⁾ In 1990, the life expectancy at birth was 68 for men and 71 for women. The per capita GDP in 1997 was 6,097 Chinese yuan, equivalent to \$735.5 based on the official exchange rate.⁽³⁾ In 1996, 0.86 billion people, or about 70% of the population, lived in the rural areas, while 0.37 billion people, or 30% of the population, lived in urban areas.

China is in the process of industrialization. The agricultural GDP share declined from 33.27% in 1982 to 20.24% in 1996. The growth rate of population is declining. The annual growth rate of population was 1.93% from 1952 to 1980, and dropped to 1.34% from 1980 to 1996. However, due to industrialization, the annual growth rate of population in urban areas has been rising. The annual growth rate of population in urban areas was 3.51% from 1952 to 1980, and rose to 3.94% from 1980 to 1996. In 1952, the share of rural population in total population was 87.54%. It decreased to 82.85% in 1978 and 70.63% in 1996. The annual growth rate of population in rural areas was 1.64% from 1952 to 1980, but only 0.52% from 1980 to 1996. In fact, the rural population even declined from 1991 to 1993. The decline in the population growth is not caused by a decrease in the rural birth rate, but by growth of rural-urban migration. As industrialization proceeds, the decline in agricultural population is inevitable.

Every society has its own old-age security. Like other traditional societies in which agriculture dominates, for a long time in China, several generations of a family lived together, and people raised kids to support them in the old age. This can be called "family security."⁽⁴⁾ The old-age security had a great impact on Chinese culture. People wanted to have sons to support them in their old age.⁽⁵⁾

China's social security system was established in the 1950s. In the early 1950s, China undertook a socialist reform, i.e., eliminating all private enterprises in industrial sectors, and collectivizing individual farmers. A nation-wide pay-as-you-go social security system was established for staff and workers in all state enterprises and some collective enterprises, as well as government agencies.

In 1966 China began a ten-year Cultural Revolution, resulting in severe economic crises. The government was unable to pay the committed social security benefits, and therefore, shifted to the state-owned enterprises the responsibility of paying social security benefits to their own workers, and the government pays social security to other government employees by tax revenues.

Table 1
Social Insurance and Welfare Funds in 1996
(billion yuan)

	Total	Pensions for termination	Retirement pensions	Resignation allowances	Medical care	Funeral Expenses & Pensions for Survivors	Trans- portation	Other subsidies
Total	179.768	13.776	119.927	1.710	26.561	2.660	1.416	14.000
Enterprises	127.804	6.559	87.874	1.303	18.509	1.961	0.889	10.600
1. State Units	151.778	12.847	99.248	1.196	22.974	2.28	1.253	11.981
Enterprises	101.689	5.735	68.526	0.823	15.168	1.611	0.737	9.090
Local	66.569	3.534	46.142	0.637	10.528	0.974	0.437	4.318
Institutions	34.537	3.711	22.549	0.221	5.234	0.459	0.335	2.027
Local	27.887	2.884	18.507	0.195	4.092	0.38	0.261	1.568
State Organs	15.553	3.400	8.173	0.152	2.572	0.21	0.181	0.864
Local	14.187	3.107	7.566	0.138	2.274	0.19	0.163	0.749
2. Urban Collectives Units	23.08	0.731	17.32	0.473	2.685	0.306	0.133	1.433
Enterprises	21.628	0.653	16.262	0.444	2.509	0.289	0.123	1.346
3. Other Ownership	4.901	0.198	3.359	0.0402	0.903	0.0712	0.0314	0.307
Enterprises	4.488	0.170	3.086	0.0353	0.832	0.0620	0.0290	0.273

Sources: China Labor Statistical Yearbook, 1997, pp. 456-457.

In 1978 another reform started in China, aimed at bringing market mechanisms into the economy. Although much progress has been made in the other areas, China's social security system remains largely unchanged. Table 1 shows the social insurance and welfare funds by ownership (state units, collective units, and other ownership) in 1996. The social insurance and welfare funds include pensions, medical care, funeral expenses and pensions for survivors, transportation and other subsidies. Retirement pensions are the largest item in the social insurance and welfare payments. In 1996 total social insurance and welfare funds were 179.768 billion yuan, and retirement pensions were 119.927 billion yuan. Medical care ranked second, with 26.561 billion yuan in 1996. Funeral expenses and pensions for survivors were only 2.66 billion yuan. Unlike in the U.S. where a retiree (no matter whether they worked or not before retirement) receives at least half the spouse's social security benefits, in China only the person

who worked receives social security benefits.

In 1996, the share of social insurance and welfare funds for state units was 84.4%, for urban collective units was 12.8%, and for all other enterprises was only 2.7%.⁽⁶⁾ Many non-state employees are not covered by the social security system.

The state enterprises, in addition to other problems, have been heavily burdened by the large social security payments to their retirees. The ratio of retirees to workers was 7.8% in 1980, 16.4% in 1990, and 21.7% in 1996.⁽⁷⁾ Thus, the ratio of retirees to workers is growing. Most of the private enterprises employ younger people and do not have large social security payments.

Table
2 Pensions for Retirees *
 (100 millions yuan unless specified)

Year	Total Pensions		Pensions for State Units		Pensions for Urban Collective	Pensions for Other Ownership	Average pensions (yuan)	Average pensions for State Units (yuan)
	-----	-----						
	Sub-total	-----	Paid by Civil Admin. Dept Units					
1978	17.30	16.30	14.10	2.20	1.00	0.00	551.00	574.00
1979	31.86	28.33	25.59	2.75	3.53	0.00	700.00	749.02
1980	46.62	40.15	37.10	3.05	6.48	0.00	660.50	722.48
1981	56.28	48.15	45.17	2.98	8.13	0.00	637.76	699.19
1982	64.80	55.05	52.22	2.84	9.75	0.00	628.55	686.17
1983	76.24	64.63	61.83	2.79	11.62	0.00	634.06	687.34
1984	90.14	71.88	69.33	2.55	18.01	0.25	650.81	692.44
1985	113.66	90.63	87.74	2.89	22.72	0.31	729.90	814.21
1986	124.52	101.25	98.82	2.43	22.83	0.44	723.86	820.32
1987	140.22	115.44	112.70	2.75	24.91	0.55	743.31	846.26
1988	156.46	124.84	121.02	3.82	30.75	0.87	765.49	841.34
1989	153.98	124.24	120.55	3.69	29.06	0.69	712.88	783.19
1990	187.10	150.84	147.38	3.47	35.44	0.82	831.01	899.37
1991	214.55	174.50	170.94	3.56	38.98	1.08	905.94	980.81
1992	252.49	206.79	202.71	4.09	44.18	1.51	1003.55	1087.03
1993	293.17	240.45	235.74	4.71	48.02	4.71	1090.23	1168.69
1994	331.04	277.72	272.08	5.64	46.52	6.80	1159.57	1264.67
1995	360.52	301.66	296.21	5.45	50.55	8.31	1197.14	1297.39
1996	403.81	340.23	334.91	5.32	53.15	10.43	1280.84	1384.07

Sources: China Labor Statistical Yearbook, 1997.

* Excluding funeral expenses and pensions for survivor, medical expenses and health care. Figures for 1985-1988 do not include price subsidies.

Table 2 shows the level of pensions for retirees. In 1978, total pensions were 1.73 billion yuan; while 1996 total pensions increased to 40.38 billion yuan at the 1978 constant price, 23.3 times as large as that in 1978. In 1978 the average pension for all retirees covered by the social security system was 551 yuan, and 574 yuan for retirees of state units; in 1996, the average pension for all retirees covered by the social security system was 1,280.84 yuan, and 1,384.07 yuan for retirees worked for state units at the 1978 constant price. The average pension per retiree in 1996 was 2.3 times of that in 1978. The large increase in total pensions was

caused by the large increase in the number of retirees.

In 1997, the population over age 60 in cities and towns accounted for 10.2% of the total population. Thus, China is entering the aging population period.⁽⁸⁾ Moreover, it was estimated that the ratio of the population aged 60 years or over to the total population will be 12.7% in the year 2000, and will reach 36.6% in 2040.

Recently efforts have been made to reform the system by pooling many enterprises together at the county, municipality, and province level. This pooling of responsibility is intended to help the heavily indebted state enterprises fulfill their social security obligations, although it may also spread risk. Through this reform, the government implicitly transfers the funds from new enterprises (which have smaller social security burden) to old state enterprises (which have a heavy burden of social security payments). That is, save the old state enterprises at the expense of the young private or collective enterprises. This pooling approach is an expansion of the pay-as-you-go system.

Can this reform solve the short-run social security payment problem for state enterprises and government institutes? Will the declining population growth cause social security crisis? How will the expansion of the pay-as-you-go system affect industrial workers and farmers? How will the pay-as-you-go system affect the current and future generations? We intend to discuss these issues based on an overlapping generations model.

The Model

The economy consists of two parts, cities and rural areas. There are two types of individuals in each generation, industrial workers and farmers. Farmers are in rural areas and industrial workers are in urban areas. Each individual lives for two periods. Industrial workers work, earn wages, and save in the first period, and retire in the second period. Each industrial worker is endowed with one unit of labor in the first period, which is supplied inelastically. Each farmer has a fixed amount of endowment in the first period, which is used for his own consumption and for support of his parents. Farmers are supported by their children in the second period of life. Government lives forever, collecting taxes to finance its spending and social security.

The population growth rate is h . Farmers can become industrial workers. For simplicity, assume that the portion of farmers who become

laborers in each period is q . Thus, the number of farmers in period $t + 1$, F_{t+1} , is: $F_{t+1} = (1 + h - q)F_t$, and the growth rate of farmers is: $h - q$. Assume that $h - q < 0$. (9) The number of industrial workers in period $t + 1$, L_{t+1} , is: $L_{t+1} = (1 + h)L_t + qF_t$, and the growth rate of laborers in period $t + 1$, n , is: $n_{t+1} = (L_{t+1} - L_t) / L_t = (hL_t + qF_t) / L_t = h + qF_t / L_t$. The total population in period $t + 1$, P_{t+1} is: $P_{t+1} = (1 + h)(L_t + F_t)$.

The production function in industry exhibits constant returns to scale in both capital and labor. The output, Y_t , is given by: $Y_t = F(K_t, L_t)$, where K_t is capital and L_t is labor in period t . Letting $y_t = Y_t / L_t$, the output-labor ratio, we have: $y_t = f(k_t)$, $f'(k_t) > 0$, $f''(k_t) < 0$, where $k_t = K_t / L_t$, is the capital-labor ratio. Assume that capital is fully depreciated after one period's production. Factor markets are perfectly competitive, thus the rate of return to each factor is its marginal product, i.e.,

$$1 + r_t = f'(k_t)$$

(1)

$$w_t = f(k_t) - r_t k_t$$

(2)

where $1 + r_t$ is the rate of return on physical capital in period t , and w_t is the rate of return to labor.

The optimization problem for a representative non-migrant industrial worker in industry is as follows:

$$\text{Max} \quad u = u(c_t^t, c_{t+1}^t)$$

s.t.

$$c_t^t + c_{t+1}^t / (1 + r_{t+1}) \leq (1 - p_t)w_t + z_{t+1}(1 + n_{t+1}) / (1 + r_{t+1})$$

where c_{t+j}^t is consumption in period $t + j$ of an agent born in period t (called generation t), $j = 0, 1$; p_t is the tax rate on labor income; $z_{t+1} \equiv Z_{t+1} / L_{t+1}$, is social security benefits from the government.

Migrant industrial workers care for their parents by giving them a fixed portion of their income as gifts. For simplicity, we assume that this kind of transfer yields utility to the migrant. Using a “ $\wedge$ ” to indicate the variable for a migrant worker, the optimization problem for a representative migrant industrial worker in industry is as follows:

$$\text{Max} \quad \bar{u} = u(\bar{c}_t^t, \bar{c}_{t+1}^t) + g(1 - p_t)w_t / s$$

s.t.

$$\bar{c}_t^t + \bar{c}_{t+1}^t / (1 + r_{t+1}) \leq (1 - p_t)w_t + z_{t+1}(1 + n_{t+1}) / (1 + r_{t+1})$$

where $g(1 - p_t)w_t$ is the transfer that a migrant gives to parent, and s is the altruistic coefficient.

Farmers receive gifts from their children migrating to industry, as well as gifts from their children remaining in rural areas. The optimization problem for a representative farmer is as follows:

$$\text{Max} \quad u = u(c_t^t, c_{t+1}^t) + l e_t / s$$

$$\text{s.t.} \quad c_t^t \leq e_t - l e_t$$

$$c_{t+1}^t \leq (1 + h - q)l e_{t+1} + gq(1 - p_t)w_{t+1}$$

where $e_{t+1} = (1 + w)e_t$ is the endowment in period 1 (w, h , and q are constant); $l e_{t+1} = l(1 + w)e_t$ is the gift each old aged receives for old-age security from each young; $l e_t$ stands for transfers to the parent by the young remaining in the rural area; and $gq(1 - p_t)w_{t+1}$ is the gifts received from their children migrating to urban areas. (10)

To obtain explicit solutions for savings and other endogenous variables and keep the model tractable, assume that $u(c_t^t, c_{t+1}^t) = \ln(c_t^t) + r \ln(c_{t+1}^t)$ where $r < 1$ is the (constant) pure rate of time preference.

Solving the representative non-migrant industrial worker's maximization problem yields (11)

$$s_t = \frac{r(1 - p)w_t}{1 + r} - \frac{z_{t+1}(1 + n_{t+1})}{(1 + r)(1 + r_{t+1})}$$

(3)

where s_t represents savings in period t of a non-migrant industrial worker born in period t , which is the difference between the first-period income and the first-period consumption.

Solving the representative migrant industrial worker's maximization problem yields:

$$\bar{s}_t = \frac{r(1 - g)(1 - p)w_t}{1 + r} - \frac{z_{t+1}(1 + n_{t+1})}{(1 + r)(1 + r_{t+1})}$$

(4)

where $\bar{s}_t$ represents savings in period t of a migrant industrial worker born in period t .

The government can finance its spending and social security by collecting labor income taxes. The government budget constraint is as follows:

$$G_t + Z_t = L_t p_t w_t$$

where G_t is government spending, $z_t \equiv Z_t / L_t$ where Z_t is the per capita social security payments in period t . Dividing both sides of the above equation by L_t gives:

$$g_t + z_t = p_t w_t$$

(5)

where $g_t \equiv G_t / L_t$.

A competitive equilibrium for the economy is defined as a set of sequences $\{k_{t+1}, s_t, \bar{s}_t, r_t, w_t, g_t, z_t, p_t\}$ satisfying equations (1)-(5), and

$$\begin{aligned} & \frac{(1+h)L_t s_t + qF_t \bar{s}_t}{L_t} = (1+n_{t+1})k_{t+1} \quad \text{or} \\ & \frac{[(1+h)L_t + qF_t] \left[\frac{r(1-p)w_t}{1+r} - \frac{z_{t+1}}{(1+r)(1+r_{t+1})} \right] - qF_t \frac{rg(1-p)w_t}{1+r}}{L_t} \\ & = (1+n_{t+1})k_{t+1}. \end{aligned} \quad (6)$$

Equation (6) indicates that savings in the current period must be equal to the physical capital or investment in the next period.(12)

Pay-as-You-Go Social Security and Capital Accumulation

This section examines the effect of an introduction of a pay-as-you-go social security system on the interest rate, the wage rate, and capital accumulation in the steady state equilibrium. In the long run, the growth rate of wage earners is equal to the growth rate of population, i.e., $\lim_{t \rightarrow \infty} n_{t+1} = h + \lim_{t \rightarrow \infty} qF_t / L_t = h$. Recall that $F_t = (1+h-q)^t F_0$ and $1+h-q < 1$. The steady-state version of equation (5) and (6) can be written as:

$$(7) \quad g + z = pw \quad \text{or} \quad z = (pw - g)$$

$$s = \frac{r(1-p)w}{1+r} - \frac{z(1+h)}{(1+r)(1+r)} = (1+h)k$$

(8)

Substituting $z = (pw - g)$ into equation (8) and differentiating the resulted equation yields:

$$\begin{aligned} & \frac{r(1-p)}{1+r} \frac{dw}{dr} dr + \frac{rw}{1+r} dp - \frac{w(1+h)}{(1+r)(1+r)} dp - \frac{p(1+h)}{(1+r)(1+r)} \frac{dw}{dr} dr + \frac{(pw-g)(1+h)}{(1+r)(1+r)^2} dr \\ & = (1+h) \frac{dk}{dr} dr \end{aligned}$$

Rearranging the terms in the above equation gives:

$$\frac{dr}{dp} = \frac{\Lambda}{\Pi}$$

$$\text{where } \Lambda \equiv -\frac{rw}{1+r} - \frac{w(1+h)}{(1+r)(1+r)}$$

$$\Pi \equiv (1+h) \frac{dk}{dr} - \frac{r(1-p)}{1+r} \frac{dw}{dr} + \frac{p(1+h)}{(1+r)(1+r)} \frac{dw}{dr} - \frac{(pw-g)(1+h)}{(1+r)(1+r)^2}$$

The numerator is negative and the denominator is negative by the stability condition. Thus, $dr/dp > 0$, implying that $dk/dp < 0$ and $dw/dp < 0$. (13) Thus, *in the steady-state equilibrium, an introduction of a pay-as-you-go social security financed by labor income taxation will increase the real interest rate, reduce the wage rate, and reduce capital accumulation.*

The intuition is as follows. An increase in the labor income tax rate, p , will not affect the investment [the right side of equation (8)] at the initial interest rate and unambiguously decrease savings [the left side of equation (8)]. Therefore, there will be excess quantity demanded for funds, and the real interest rate must increase to clear the market. As the real interest rate increases, the capital-labor ratio and the real wage rate will decrease.

The Impact of the Pay-as-You-Go System on Industrial Workers and Farmers

This section compares the benefits to non-migrant workers, migrant workers, and farmers, under a fully-funded social security system and the pay-as-you-go social security system.

Gains by Industrial Workers

Consider a forced savings social security system. The government forces every industrial worker to save part of their income when young, and everyone receives savings plus interest rate when old. Assume that the forced saving rate is p . The net rate of returns to savings is the interest rate. Table 3 shows the costs and benefits received by non-migrant industrial workers.

Table 3
Gains under a Fully-Funded System

<i>Generation</i>	<i>Costs and Benefits in Time Period</i>				<i>Gains</i>
	t-1	t	t+1	t+2	
t-1	$-pw_{t-1}$	$(1+r_t)pw_{t-1}$			$r_t pw_{t-1}$
t		$-pw_t$	$(1+r_{t+1})pw_t$		$r_{t+1} pw_t$
t+1			$-pw_{t+1}$	$(1+r_{t+2})pw_{t+1}$	$r_{t+2} pw_{t+1}$

The net returns to a representative industrial worker in generation $t-1$, generation t , and generation $t+1$ are $r_t pw_{t-1}$, $r_{t+1} pw_t$, and $r_{t+2} pw_{t+1}$, respectively. In China, the savings rate for time deposit for 5 years was 9% on April 21, 1991, 12.06 % on May 1, 1996, and 9% on August 23, 1996.(14) From 1978 to 1996, the annual inflation rate was about 9.41% based on GDP deflators, and was 7.384% based on general retail price indices.(15) In 1996, the inflation rate was 6.1% based on the general retail price index, and 9.6% based on the GDP deflator. Thus, the real interest rate in China was between 3%-6%.

Now consider a pay-as-you-go social security system. As shown in section 4, a pay-as-you-go social security system will lower the capital stock and the wage rate, i.e., $w_t > \tilde{w}_t$. Each young non-migrant industrial worker at time t pays a payroll tax $p\tilde{w}_t$ when young, where p is the tax rate and $\tilde{w}_t$ is the wage rate. The total amount of taxes are $L_t p\tilde{w}_t$. The tax revenue is used to finance the social security benefit for the current retirees in urban areas. The labor force is growing at the rate of n_t . Assume that the real wage rate is growing at the rate of l_t , i.e., $\tilde{w}_t = (1+l_t)\tilde{w}_{t-1}$. Table 4

illustrates the contributions and benefits of a representative industrial old in period t (generation $t-1$) contributes nothing but receives $(1+n_t)(1+l_t)p\tilde{w}_{t-1}$. Each old in generation t contributes $p\tilde{w}_{t-1}$, and receives $(1+n_{t+1})(1+l_t)p\tilde{w}_t$. Thus, the net rate of returns to generation t is $(1+n_t)(1+l_t)-1=n_t+l_t+n_t l_t$. Similarly, the net rate of returns to generation t is $(1+n_{t+i})(1+l_{t+i})-1=n_{t+i}+l_{t+i}+n_{t+i} l_{t+i}$, for $i = 1, 2, \dots$

Table 4
Gains under a Pay-as-You-Go System

Generation	Costs and Benefits in Time Period				Gains
	t-1	t	t+1	t+2	
t-1	0	$(1+n_t)(1+l_t)p\tilde{w}_{t-1}$			$(1+n_t)(1+l_t)p\tilde{w}_{t-1}$
t	$-p\tilde{w}_t$	$(1+n_{t+1})(1+l_{t+1})p\tilde{w}_t$		$(n_{t+1}+l_t+l_t n_{t+1})p\tilde{w}_t$	
t+1		$-p\tilde{w}_{t+1}$			$(n_{t+2}+l_{t+2}+l_{t+2} n_{t+2})p\tilde{w}_{t+1}$

Now let's compare the net returns under the fully-funded system and the pay-as-you-go system. Recall that under the fully-funded system, the net return for a worker of generation t is $r_{t+1}pw_t$ and the net return under the pay-as-you-go system for a worker of generation t is $(n_{t+1}+l_t+l_t n_{t+1})p\tilde{w}_t$. Thus, theoretically, whether workers will be better off or worse off under the pay-as-you-go system is unambiguous, depending on whether $(n_{t+1}+l_t+l_t n_{t+1})p\tilde{w}_t$ is greater or less than $r_{t+1}pw_t$.

Recent data indicate that industrial workers can be better off under the pay-as-you-go system in the short run. The urban population growth rate from 1978 to 1995 was about 4.081%, (16) and thus, the growth rate of wage earners, n_t , was about 4.1%. The growth rate of real wage rate is l_t . The growth rate of the real wage rate was about 5.462% from 1978 to 1996, but was 8.12% from 1991 to 1996. (17) Thus, rate of returns to each retiree was more than 13%! Recall that under the fully-funded system (the forced savings system), the rate of returns was only about 3-6%. Thus, wage earners will receive higher returns under a pay-as-you-go social security system than a forced-saving system. As industrialization proceeds,

eventually there will be less and less labor migrating from rural areas to cities. The decrease in the migration rate, together with the decrease in capital accumulation and wage rate, may reduce the urban wage earners' welfare in the long run.

Like a non-migrant industrial worker, the rate of return to a migrant industrial worker is the real interest rate. As mentioned earlier, the real interest rate in China was between 3%-6%. Migrant industrial workers must take care of their rural parents when young, i.e., transferring an amount of $g(1-p)q\tilde{w}_{t-1}$ to their rural parents. With the same wage rate, migrant industrial workers will have less income left for consumption and savings than a non-migrant worker.

It should be mentioned that, if the pay-as-you-go system is introduced in period t , then the generation $t-1$ will receive a windfall benefit without paying anything, and will be clearly better off. However, the debt will be transferred to the future generations.

Losses by Farmers

As mentioned, farmers rely on family security. Old farmers receive gifts from their children who migrated to industry, as well as gifts from their children who remain in rural areas. Table 5 shows benefits to farmers under a fully-funded system and a pay-as-you-go system for urban workers.

Table 5
Benefits to Farmers under Alternative Social Security System for Urban Workers

Generation		Costs and Benefits in Time Period				Gains
		t-1	t	t+1	t+2	
t-1	$-be_{t-1}$					$[(h-q) + w + (h-q)w]be_{t-1}$
			$+g(1-p)qw_t$			$+g(1-p)qw_t$
t			$-be_t$	$(1+h-q)(1+w)be_t$		$[(h-q) + w + (h-q)w]be_t$
				$+g(1-p)q\tilde{w}_{t+1}$		$+g(1-p)q\tilde{w}_{t+1}$
t+1			$-be_{t+1}$	$(1+h-q)(1+w)be_{t+1}$		$[(h-q) + w + (h-q)w]be_{t+1}$
				$+g(1-p)q\tilde{w}_{t+2}$		$+g(1-p)q\tilde{w}_{t+2}$

Each young farmer in period $t-1$ contributes be_{t-1} amount out of his endowment to his parent, and receives $(1+h-q)(1+w)be_{t-1}$ amount from his rural children and $gq(1-p)w_t$ amount from his migrant children when old (time period t). Recall that h is the population growth rate, q is the rate of migration from rural areas to cities, and w is the growth rate of endowment. The population growth is beneficial to farmers. Rural-urban migration may or may not be beneficial to farmers. While migration results in less young in the rural areas to support the old, it also results in more migrant workers to give their rural parents gifts.

Suppose that a pay-as-you-go social security system for the urban workers is introduced in period t . As mentioned earlier, a pay-as-you-go system may reduce capital accumulation and wage rate, i.e., under a pay-as-you-go system, the wage rate is lower than that under a fully funded system. Letting the real wage rate under the pay-as-you-go system, we have $\tilde{w}_{t+1} < w_{t+1}$ for $t > 0$.

An introduction of a pay-as-you-go social security for the urban workers will hurt the rural old. The reason is clear. The rural old partially depend on transfers from their young who migrated to urban areas. The transfer is part of the migrant worker's disposable income. When a social security system financed by labor income is introduced, the disposable income of migrant workers will decrease. Thus, they will transfer less to

their rural parents. Thus, an introduction of pay-as-you-go social security benefits the current urban retirees, while hurting the rural old.

The Impact of the Decline in Total Population Growth

Since the early 1970s, China has adopted a population control policy. The policy was more strictly carried out in cities than in rural areas. As a result, China's population growth rate has declined significantly. The annual growth rate of population was 2.02% from 1952 to 1975, and 1.33% from 1978 to 1996. From 1952 to 1975, the annual growth rate of population was 3.327% for urban areas and 1.7% for rural area. From 1978 to 1996, the annual growth rate of population was 4.1% for urban areas, and 0.50% for rural area.(18) Although there was a decrease in the growth rate of total population, the growth rate of population in urban areas has increased.

The increase in the city population was caused by the labor migration from rural areas to urban areas. In 1995, the annual natural growth rate of population was 1.06% for the nation, 0.923% for cities, and 1.109% for rural areas; meanwhile, the total city population increased by 2.55%; thus, the annual migration rate from rural areas to cities was about 1.44%.(19)

Many economists and policy makers in industrialized countries are concerned with the social security crisis resulting from the decrease in the population growth rate.(20) Their concern is justified since there will be less young people to support the old. Without raising the social security tax rate, the future retirees will have less social security benefits. Some Chinese policy makers and economists also predict that a similar social security crisis will occur in China under a pay-as-you-go system due to a decline in the population growth rate.(21) This concern might be unnecessary. If the pay-as-you-go social security system covers only wage earners (the population in cities), there will be no social security crisis as the growth rate of wage earners has been increasing.

Thus, the decrease in the growth rate of population may not cause a pay-as-you-go social security crisis in China as would happen in the industrialized countries since more and more farmers will move to urban areas and become wage earners.

Concluding Remarks

China is in the process of industrialization with a large amount of the labor force moving from the agricultural sector to industrial sectors. An expansion of the pay-as-you-go social security system benefits current urban retirees, and may solve the social security payment problem faced by many state enterprises. Also, although facing a declining population growth rate, China may not have a social security crisis under a pay-as-you-go social security system, which just covers the wage earners, that many industrialized countries face. However, the expansion of the pay-as-you-go social security system may have an adverse effect on capital accumulation in both the short run and the long run, hurting the rural old and either benefiting or hurting the wage earners in urban areas before the completion of industrialization and is likely to reduce wage earners' welfare after industrialization.

Expanding the individual account and gradually privatizing social security will increase capital accumulation and benefit Chinese economic development. The difficulty of privatizing social security lies in financing social security debt (the obligation to current retirees and workers who have made contributions under the pay-as-you-go system). Since China's social security system only covers a small portion of the population, the social security debt is not too large. International experience indicates that pension debt is about 20-30 times of the current pension payment. In 1996, pensions for retirees were 152.55 billion yuan. Thus, the social security debt should be between 3,051.2 billion and 4,576.8 billion yuan--about 44-66% of GDP (China's GDP was 6,859.38 billion yuan in 1996). In 1996, pensions for state enterprises were 128.54 billion yuan, implying that the social security debt should be between 2,570.8 billion yuan and 3,856.2 billion yuan.⁽²²⁾ The Chinese government has run budget deficits since 1985, and there is no budget surplus to be used for social security debt finance. The asset of state enterprises was about 3,452 billion yuan, which might be enough to pay the social security debt.⁽²³⁾ The government can issue bonds to finance the social security debt. It can be shown that asset finance and debt finance are equivalent, both transferring the burden to future generations. Tax finance, particularly consumption tax finance, is beneficial to capital accumulation and economic development.

China's major social security problem may occur in rural areas. The birth control policy has resulted in a decline in the birth rate, and industrialization has caused large rural-city migration. Thus, the ratio of the rural old to the rural young is increasing. The income for rural

residents is still rather low. In 1996, the average annual cash-receipt of a rural resident was 2,309.4 yuan, the cash expenditure was 2,137.4 yuan, and the surplus was only 172 yuan (about \$20 based on the official exchange rate).(24) The pay-as-you-go system does not work in rural areas since the government cannot collect enough taxes. The forced savings system also may not work since in most rural areas farmers may not have much cash left for savings. The rural young provide their old parents a lot of services which would be very costly through the market. There exist large external benefits in a rural family with the young and the old being together. The family security may have to last a long time in many rural areas. The government must raise funds to provide basic supplies for those rural old people without transfers from children.

Notes

1. However, Barro (1978) found that social security had no effects on the economy based on the time series data from 1929-1940 and 1947-1974, and Kopits and Gotur (1980) found that social security had positive effects on savings based on the data from fourteen industrial countries for the period of 1969-1971. Many economists, including Feldstein and Samwick (1996) and Kotlikoff (1996), called for privatization of the pay-as-you-go social security system. Others including Diamond (1996) suggested less radical adjustments to the current system.
2. A Statistical Survey of China, 1997.
3. The GNP per capita estimated by the World Bank based on purchasing power parity method was \$3570 in 1997.
4. The system can also be considered as a funded system in the sense that parents invest on their children first and then receive the returns from their children.
5. The views of "raising sons for old-age security" and "more sons and more happiness" were widespread in rural areas. Children were disciplined in a way to respect the old and take care of their parents. This kind of old-age security was a result of labor immobility, and it in return further restrained the labor mobility. The young were taught that, "Do not travel far away from home when father and mother are alive." The young should unconditionally respect and serve their parents. Also, parents value sons higher than daughters (zhong nan qing nu). In rural

China, when daughters get married, they normally live with the husbands' home and take care of the husbands' parents.

6. Calculated based on the data from Table 1.
7. See China Labor Statistical Yearbook, 1997, pp. 466-467. Officially, the retirement age for a man is 60 years old and for a woman is 55 years old.
8. Generally, a country's population is said to be aging if the population over age 60 accounts for more than 10% of the total population.
9. The rural population in China in 1992 and 1993 was lower than that in 1991, but started to increase slowly again (Statistical Yearbook of China, 1997; p. 69). If the birth control policy and the rural-city migration continue, the number of farmers will decline in the future.
10. There might be other reasons why the young support their parents. The first one is government laws. In countries such as China, the law requires the young to support his or her parent. The second one is social pressure. If a young person does not support his or her aged parent, he or she will be criticized by the society. The third reason is that the young wants to be an example for his or her kids, so that his or her kids will support him or her in the future.
11. A detailed derivation is available on request.
12. In the OG model, the ownership of capital changes every period. Thus, capital stock is equal to investment from an individual's perspective.
13. Differentiating the steady-state versions of equations (1) and (2) gives:

$$dk / dp = (dr / dp) / f''(k) < 0 \text{ and}$$

$$dw / dp = f'(k)(dk / dp) - r(dk / dp) - (dr / dp)k = -(dr / dp)k < 0.$$
14. See Statistical Yearbook of China, 1997, p. 625.
15. See Statistical Yearbook of China, 1997, p. 42, 267.

16. Urban population was 172.45 million persons in 1978 and 359.5 million persons in 1996. See Statistical Yearbook of China, 1997, p. 69.
17. General retail price index was used to calculate the real wage rate. See Statistical Yearbook of China, 1997, p. 123, 267.
18. See Statistical Yearbook of China, 1997, p. 69.
19. See Statistical Yearbook of China, 1996.
20. It was estimated that in the year of 2030 a deficit will appear on the social security account.
21. See The World Bank (1997) and Zhou and Wang (1994).
22. Labor Statistical Yearbook of China, 1997.
23. A Statistical Survey of China, 1997.
24. A Statistical Survey of China, 1997.

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Biographical Sketch

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