Demographic Transition and Social Security in Taiwan

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The population of Taiwan is aging at a more rapid rate than is the case in Western industrialized countries. The share of the population aged 65 and older, which was 7.8 percent in 1996, is projected by the Council for Economic Planning and Development to increase to 9.9 percent by 2010 and to 21.0 percent by 2035 (Council for Economic Planning and Development 1999: Table 3). The share of the population aged 80 and older is projected to rise from 1.5 percent in 1996 to 2.3 percent by 2010 and to 4.9 percent by 2035. Figure 1 illustrates projected changes in Taiwan’s age structure between 2000 and 2035.

The elderly dependency ratio, defined here as the ratio of the population aged 65 and older to the population aged 25-64, is projected to rise from 15.3 percent in 1996 to 17.4 percent in 2010, then jump to 42.0 percent in 2035. By that time, every 2.3 workers will have to support one elderly person (Council for Economic Planning and Development 1996: 83).

Taiwan’s extremely rapid population aging is the result of a fall in both the birth rate and the death rate. The crude birth rate, which was 15.5 per thousand population in 1995, is projected to fall to 14.5 by 2010, and further to 11.7 in 2035. The crude death rate, at 5.6 per thousand in 1995, is projected to rise to 7.0 in 2010 and to 10.5 by 2035 (Council for Economic Planning and Development 1999: Table 1-2).

In a traditional society the family is responsible for taking care of its elderly members. This practice worked well in Taiwan when agriculture dominated the economy and the elderly population was small. However, the resources that the elderly can count on for support will decline as the population ages. Lin (1987: Table 1) projects that the number of children per elderly person aged 75-79 will fall from 5.8 in 1985 to 3.6 in 2010 and
FIGURE 1  Projected population of Taiwan, ages 25–79, by single-year age groups, both sexes, as percent of the population aged 25 and older, 2000, 2010, and 2035


to 1.6 in 2035. Likewise, Lin (1987: Table 2) projects that the number of employed children per person aged 75–79 will decline from 4.0 in 1985 to 2.4 by 2010 and to 1.0 in 2035. The sharp rise in the number of dual-career couples further aggravates the problems the country faces in caring for its elderly. According to a survey conducted by the Executive Yuan’s Directorate General of Budget, Accounting and Statistics (1997: Table 44), 65.8 percent of Taiwan’s elderly (those 65 and older) were supported by their children in 1986; but the figure fell to 52.3 percent by 1993 and to 48 percent by 1996.

Population aging per se does not necessarily pose a problem for the economy if working-age people prepare for a longer life span by increasing their saving or postponing retirement, or if the rate of productivity rises, creating additional output for the retired population. Cutler et al. (1990) argue that the anticipated population aging in the United States will im-
prove that country's standard of living in the near future but lower it slightly over the very long run. Hu (1999) shows that within the framework of an endogenous growth model, an extension of the average length of life may increase the long-run growth of an economy because it promotes human-capital accumulation by lengthening the period in which the investment in human capital can be rewarded. Human capital is the main engine of economic growth, according to Lucas (1988).

It is ironic that just when the population is aging and life expectancy is lengthening, both labor force participation and saving rates have been declining in Taiwan. The overall labor force participation rate fell from a peak of 60.4 percent in 1986 to 58.0 percent in 1998. The household saving rate also fell, from 29.3 percent in 1986 to 18.4 percent in 1993 and again to 17.0 percent in 1998 (Figure 2). Several explanations have been suggested for the decline in the propensity to save. First, the financial liberalization that the country has undertaken since the early 1980s has led to a relaxation of credit constraints on consumption. Second, a sharp rise in housing prices in 1988-89 provided homeowners with windfall profits for increased consumption. Finally, the rise in welfare expenditures and the establishment of the National Health Program in 1994 have reduced

FIGURE 2. Household saving rate (from household disposable income): Taiwan, 1968–98

the need for precautionary saving. Whatever the reasons are, the declining propensity to save implies that a segment of the population may not be inclined to save for their retirement and that many elderly will have few financial resources available for retirement consumption.

To prepare the economy for an aging population and a changing family structure, the Taiwan government decided to establish an economy-wide social security system by 2001. The objectives of the system are to ensure old-age income security and relieve the burden on the working-age population of caring for elderly parents. The objectives are to be achieved partly through forced saving and partly through intergenerational transfers. In other words, the government adopted a partially funded system rather than a pure pay-as-you-go system of funding social security (Council for Economic Planning and Development 1995).

Just as Taiwan is launching the National Pension Program, social security programs in the United States and other developed countries are encountering difficulties. The main reason is that their programs are financed mostly by a pay-as-you-go system, achieving old-age income security through intergenerational transfers. Such a system works well in an economy where the population growth rate is high and the ratio of the elderly to the total population is low. When the population ages, however, the system imposes a heavy burden on the working population and thereby distorts decisions about saving and labor force participation. Some countries have recently enacted social security reforms to extend the normal retirement age, reduce retirement benefits, or increase the payroll tax rate, whereas others have attempted to partially or fully fund their social security programs in an effort to maintain the financial soundness of those programs (Holzmann 1997).

In Taiwan there is likewise concern about whether the National Pension Program will adversely affect aggregate savings and thereby dampen economic performance. As we have mentioned, although Taiwan’s saving rate is still high, it is declining. Too much saving is not necessarily a good thing (Aaron 1966). However, Krugman (1994) and Lau (1998) argue that economic growth in East Asia’s newly industrialized economies is due primarily to increases in inputs rather than to technical progress. Acceptance of this argument implies that Taiwan needs a high saving rate to continue economic growth.

Another reason for Taiwan to have a high saving rate is that it needs a large foreign-exchange reserve because it faces the possibility of a military conflict with mainland China, is politically isolated from the international community, and is excluded from such international organizations as the International Monetary Fund and the World Bank. Taiwan has no "contingent credit lines" to draw upon in an emergency. At the end of 1998 it had foreign-exchange reserves totaling US$90.3 billion, or 10.5
months' worth of imports, more than three times the amount recommended by the International Monetary Fund. Its huge foreign-exchange reserves and the prevalence of resilient small and medium-size firms in the economy are the main reasons Taiwan has been able to cope with the recent Asian financial crisis, suffering minimal harm.

This chapter examines how the proposed National Pension Program will interact with projected demographic changes to affect aggregate savings. The analytical framework employed here is the life cycle or permanent-income model, but it allows for the possibility that a segment of the population may be myopic in the sense that its behavior is better described by Keynes's current-income hypothesis than by the life cycle or permanent-income hypothesis of consumption (Hu 1996). In the following section we describe Taiwan's pre-existing social security programs and the new program. Next we discuss the effect of social security on aggregate savings, then follow the discussion with simulations. The final section summarizes our findings and their policy implications. The Appendix provides the technical details of the simulations.

Pre-existing old-age insurance programs and the National Pension Program

Taiwan's National Pension Program will not start from scratch. Two-thirds of the population have been covered by one of two public insurance programs that provide retirement benefits. The Public Employees Insurance Program covers government employees, and the Labor Insurance Program covers other workers. In March 1995 the National Health Insurance Program became effective.

The Public Employees Insurance Program, established in 1958, provides retirement, survivors, and disability insurance to regular government employees, who in 1994 accounted for about 5.1 percent of the population aged 25 and older. An insured person is eligible for retirement benefits if he or she has worked for 25 years or has reached age 60 and has worked for at least five years. Each eligible government retiree is paid a lump-sum retirement benefit up to 36 times the last working month's salary. The premium (contribution) is currently 9 percent of covered payroll, of which 35 percent is paid by the employee and 65 percent by the government.

The Labor Insurance Program, established in 1960, also provides retirement, survivors, and disability insurance to insured persons. It covers workers in enterprises that employ at least five persons, professionals, and temporary government workers, accounting for 59.3 percent of Taiwanese aged 25 and older in 1994. An insured person is eligible for retirement benefits upon reaching age 60 (55 if female), or upon reaching age 55 (50 if female) if the worker has been insured for at least ten years. The insured
person is paid additional benefits equal to one month’s salary per additional year of coverage. The maximum amount of benefits is 45 times the last working month’s salary. The premium is 6.5 percent of covered wage income, of which 20 percent is borne by the worker, 70 percent by the employer, and 10 percent by the government.

Initially, health insurance was included in both the Public Employees and the Labor Insurance programs. In March 1995 the National Health Insurance Program took over this part of insurance and expanded it to cover all persons who had resided in the country for at least four months, including aliens with residence permits. The program’s coverage reached 96.3 percent of the population by the end of 1997. Under this program, medical care (including preventive and prenatal care, inpatient and outpatient hospital treatment, surgery, and prescription drugs) is provided directly by public and private clinics and hospitals under contract with the National Health Insurance Bureau. The co-insurance rates are 20 percent for scheduled fees; 30–50 percent for hospital visits; from 10 percent for the first 30 days of inpatient care for short-term illness to 30 percent for the 61st day and thereafter; and from 5 percent for the first 30 days of inpatient care for long-term illness to 30 percent for the 181st day and thereafter. The premium is 4.25 percent of the covered payroll, of which 30 percent is borne by the employee, 60 percent by the employer, and 10 percent by the government.

Both the Public Employees Insurance Program and the Labor Insurance Program are financed on a pay-as-you-go basis, partly by premiums and partly by general revenue through government subsidies. They have accumulated large implicit debts. For example, in 1997 the Public Employees Insurance Program had an annual deficit of NT$6.9 billion (US$211 million at the exchange rate of US$1 = NT$32.7 in April 1999), or 42 percent of receipts. Its implicit debt ranges from about NT$80 billion to NT$100 billion. The Labor Insurance Program had a surplus of NT$22.0 billion, or 16.3 percent of revenue, and about NT$287 billion of assets in 1997 (Council for Economic Planning and Development 1998b: Table 16.9). But it also had an implicit debt three times as large as its assets.

In contrast, social security systems in other Asian countries are either partially or fully funded. For example, Singapore fully funds its old-age pensions through individual saving accounts managed by its Provident Fund. Every worker who earns a monthly wage of more than S$200 (US$117.6 at the exchange rate of US$1 = S$1.7 in April 1999) and his or her employer are each required to contribute 20 percent of the worker’s earnings to the Provident Fund. Upon reaching age 65, the worker is paid a lump sum equal to the total employer and employee contributions, plus at least 2.5 percent compound interest, less an amount (S$15,000, or US$8,824) that is set aside for medical emergencies (US Social Security Administration 1997).
Governments in such countries as Japan and South Korea partially fund their social security systems. Japan has a two-tier system. The first tier is the National Pension Program, which provides mandatory coverage to all citizens aged 20–59 and voluntary coverage to citizens aged 60–64. The second tier is the earning-related Employees Pension Insurance, which covers employees in industry and commerce. (Employees in other private industries, public employees, and teachers are covered by other special insurance programs.) Workers' contributions to the National Pension Program are included in their contributions to Employees Pension Insurance, which amount to 8.675 percent of earnings. Other workers pay a flat amount each month of 12,800 yen (approximately US$100 at the exchange rate of US$1.00 = 119 yen in April 1999). If fully insured—that is, after having made contributions for 480 months—an insured person is entitled to a flat annual benefit of 785,500 yen, equivalent to US$6,600 (US Social Security Administration 1997: 194). In contrast, the Korean system is based entirely on earnings. It covers workers in firms employing at least five persons and farmers, fishermen, and rural self-employed persons aged 18–59. The premium is 3 percent of payroll for employed persons and 6 percent for their employers. The monthly benefits are 2.4 times the sum of average monthly earnings of all insured persons for the preceding year and average monthly earnings of retired persons over their entire contribution period (US Social Security Administration 1997: 207–208).

If Taiwanese workers were all paid salaries or wages, the Labor Insurance Program would be an economy-wide social security program. However, Taiwan's economy is dominated by small and medium-size enterprises. In 1999, 51.0 percent of workers were employed by enterprises having fewer than ten persons, while only 4.0 percent of workers were employed by enterprises having more than 500 employees (Directorate-General of Budget, Accounting and Statistics 1999: Table 15). Many workers in small enterprises are self-employed, and their earnings are difficult to determine. The Labor Insurance Program, which covers workers in enterprises employing at least five workers, thus excludes a large number of workers from insurance. As a result nearly one-third of the population is not covered by either the Labor Insurance Program or the Public Employees Program. The need to provide this segment of the population with some form of old-age income security has become an important political issue in recent elections.

An easy way to establish a new social security system is of course to extend the coverage of the two existing programs. Their implicit debts must first be settled, however. Moreover, those who are not currently covered by one of the two programs, most of whom are self-employed workers, workers in small businesses, farmers, and housewives, either do not have reported earnings or their earnings contain some elements of capital in-
come and therefore are not entirely wage earnings. As a result the pro-
posed social security system retains and revises the existing Public Employ-
ees and Labor Pension programs while creating a National Pension Pro-
gram to cover those who are not yet insured by either of the existing
programs. Each of the three programs will be managed by its own govern-
ning board. In other words, the proposed program will be essentially a two-
tier system similar to Japan’s system. The main difference between the two
countries is that in Taiwan all new entrants into the labor market in both
private and public sectors will be required to join the new pension pro-
gram instead of the existing ones. Thus the two pre-existing programs will
be eventually phased out, although it may take 40 years or longer to com-
plete the process.

The new program has the following features (Council for Economic
Planning and Development 1998a). First, it is a defined-benefit program.
All individuals will receive an identical flat monthly benefit that provides
only basic living expenses. Specifically, the full benefit level at program
inception (in 2000) is set equal to 65 percent of the average consumption
expenditures in the preceding two years, or around NT$9,100 ($278) per
month. The minimum guaranteed benefit level is NT$2000 ($61) per month.
The benefits are indexed for subsequent years on the basis of consumer
prices and labor productivity (real wages). All insured persons pay a flat
monthly premium equal to 10 percent of the basic benefits level, or NT$910
($27.80).

Second, upon reaching age 65, insured persons who are aged 25–39
at program inception will receive a benefit equal to the full benefit, di-
vided by the number of years between 65 and their age at program incep-
tion, for each year in which they have paid premiums, provided that they
have paid premiums for at least ten years. Thus they will be eligible to
receive full benefits when reaching age 65 if they have paid premiums dur-
ing all their working years. Those who are 40 and older at program incep-
tion will be entitled to one-twenty-fifth of full benefits for each year in
which they have paid premiums if they have paid premiums for at least
ten years or for 65 – A years (where A is their age at program inception),
whichever is smaller.

Third, all those who are 65 and older at program inception are eli-
gible for the retirement subsidy of NT$2,000 per month mentioned above
without having to pay any premium.

Fourth, the benefits provided by the Public Employees and Labor In-
surance programs will be divided into a basic and a supplemental part. The
basic benefits are unified across the board and set equal to the full benefit
level of the National Pension Program. The supplemental benefits, that is,
the portions of benefits provided by the two existing programs that are in
excess of the basic level, can vary between the two programs.
To be true to its stated purpose of being a forced saving program, the National Pension Program should be fully funded. However, the premium for a fully funded program would be too high, and there is a political need to maintain a premium not too different from the premiums paid to the other two programs. Therefore the premium has been set equal to 10 percent of the full-benefit level so as to gradually fund the system. It will result in an accumulation of reserves to the level that maintains financial soundness of the program for at least 25 years. In other words, Taiwan’s new system is in reality a partially funded system, with the funding ratio increasing over time.

Figure 3, which projects the net lifetime benefits, or social security wealth, that each age cohort will receive from the National Pension Program, shows that the program will have differential effects. (See the Appendix for an explanation and derivation of social security wealth.) Persons aged 45 at program inception among the working population and retirees aged 65 are the biggest winners under the proposed program.

FIGURE 3 Projected social security wealth per capita (present value of benefits less present value of premiums) from the National Pension Program at inception, by age: Taiwan

SOURCE: Calculations by the authors.
The estimated saving effect of the National Pension Program

We now focus on how the National Pension Program interacts with projected demographic changes to affect aggregate saving. The literature has shown that the saving effect of social security depends critically on the method by which it is funded, whether as a fully funded system or as a pay-as-you-go system.

In a fully funded system the government collects social security contributions from workers and invests their contributions in securities to earn interest. When a worker retires, the government returns the principal plus compound interest to him in the form of a lump-sum payment or an annuity. A rational person who saves for his retirement will simply reduce his private saving by the amount of social security contributions, leaving his consumption unchanged. But because the social security account is maintained fully funded, the sum of his private and social security savings will remain unchanged. The fully funded social security system does not affect aggregate saving regardless of changes in the population’s age structure and longevity due to demographic transition. Of course, as life expectancy is extended and the length of retirement increases, people must save more for retirement. Likewise, if the retirement benefit per annum remains unchanged, the premium paid under the fully funded system must increase, as must social security assets.

A pay-as-you-go system, on the other hand, is an intergenerational-transfer system. The government directly transfers the contributions from workers to retirees in the form of benefits rather than depositing the contributions in the workers’ retirement accounts. Thus the social security account for each worker is actually unfunded. The effect of a pay-as-you-go system is to crowd out aggregate savings, at least in part, unless retirees save their entire pension benefits for bequest purposes (Barro 1974).

The pay-as-you-go system also distorts saving decisions because the rate of return depends greatly on the demographic structure of the economy and is not necessarily equal to the market rate of return. The average premium paid by workers per dollar of benefit is determined by the dependency ratio (the ratio of the elderly population to the working population). The premium rises and the rate of return on social security falls when the dependency ratio rises. For example, the number of working-age persons aged 25–64 supporting each elderly person in Taiwan was 6.5 in 1996, but will fall to 5.7 by 2010 and to 2.4 by 2035 (Council for Economic Planning and Development 1999: Table 3). By then the premium required by a pay-as-you-go system will be three times as high as it was at program inception.

The empirical evidence concerning the effect of social security can be found in Feldstein (1974 and 1996) and in Bailliu and Relsten (1997).
Feldstein (1974) studied the US time-series data for the period from 1930 to 1972. He concluded that the US pay-as-you-go system resulted in a decline in personal savings of 50 percent. His study has been challenged, especially by Leimer and Lesnoy (1982), who found that social security had only an insignificant effect on US aggregate savings. Recently Feldstein (1996) replicated his 1974 study with additional data from the 1973–92 period. His findings indicate that unfunded social security in the United States has resulted in an even greater fall in personal saving, by nearly 60 percent. Bailliu and Relsten (1997), studying panel data from 11 countries for the period from 1982 to 1993, found that the pension reserve per worker contributed to an increase in aggregate saving. This result was stronger in developing countries than in industrialized countries.

One way to quantify the saving effect of Taiwan’s new social security system is to perform a regression analysis of the effects of the two pre-existing programs on aggregate savings and from that infer the effect of the new program. This approach, however, is subject to the criticism that a policy change affects economic behavior and causes structural changes in the economy. We have therefore decided to provide a simulation analysis of the saving effect of social security using the structural parameters of the economy.

The structural model for our analysis is the augmented permanent-income or life cycle hypothesis. We first assume that individuals are rational or foresighted in the sense that they save for retirement, and therefore their behavior can be described by the hypothesis. Their consumption each year depends on their lifetime resources. Thus a social security system affects their consumption by causing a change in their lifetime resources. Following Feldstein (1974), we define the change in lifetime resources of an individual aged \( a \) that is brought about by social security as “social security wealth,” denoted by \( W(a) \) and illustrated in Figure 3. This is simply the present value of benefits minus the present value of premiums paid by the insured. It represents the net transfers from future generations and is denoted by Barro (1974) as national debt, although it is a component of individual wealth. The change in consumption of an individual aged \( a \) induced by social security equals the individual’s social security wealth multiplied by \( \Gamma(a) \), where \( \Gamma(a) \) is the marginal propensity to consume out of wealth. As shown in the Appendix, \( \Gamma(a) \) depends on the interest rate, the rate of time preference, and the degree (coefficient) of aversion to relative risk.

There are some individuals, however, who display myopic behavior because they either do not have information to plan their futures, or find such information too expensive, or are unable to commit to their lifetime planning. We assume that the behavior of myopic individuals can be described by Keynes’s current-income hypothesis (see Hu 1996). For these individuals, social security contributions decrease their consumption by
reducing their current disposable income, whereas social security benefits increase their consumption by augmenting it. The total consumption effect of social security on the myopic population equals $\gamma \Delta Y_d$, where $\Delta Y_d$ is the change in total current disposable income. $\Delta Y_d$ can be explicitly written as

$$\Delta Y_d = \sum_{a=R}^{T} N(a)b(a) - \sum_{a=A}^{R-1} N(a)x(a),$$

(1)

where $b(a)$ represents the retirement benefits receivable at age $a$ ($a = R \ldots T$), $x(a)$ is the contribution paid at age $a$ ($a = A \ldots R-1$), $N(a)$ is the size of the age cohort $a$, and $\gamma$ is the marginal propensity to consume (out of current income).

To summarize, the change in aggregate savings due to social security is as follows:

$$\Delta S = -m[(1 - \phi)\sum_{a=A}^{R-1} N(a)\Gamma(a)W(a) + \phi \gamma \Delta Y_d],$$

(2)

where $\phi$ is the fraction (income weighted) of the population aged $a$ that is myopic and $m$ is the fraction of the population that is covered by the National Pension Program. The first term inside the brackets is the change in consumption of the rational population, whereas the second term is the change in the total consumption of the myopic population.

A study by Deaton and Paxson (1994) of the Taiwan Household Expenditure Survey data suggests that, on average, young people are foresighted and do know how to prepare for the likelihood that they will have few children to provide for their retirement consumption. Even so, the life cycle or permanent-income hypothesis is not the perfect, although it is the best, model to describe Taiwanese consumer behavior. A study by Chan and Hu (1997) suggests that it describes the behavior of 70 percent of the population, and the current-income hypothesis explains the remaining 30 percent ($\phi$).

**Simulation results**

The first step in our simulation analysis is to calculate social security wealth for each age cohort on the basis of the government’s plan (Council for Economic Planning and Development 1998a), described in the preceding section. As we have already mentioned, the full benefit level is equal to 65 percent of individual consumption expenditures for the previous two years, which amounts to NT$9,100 per month, or NT$109,200 in the first year of National Pension Program. The benefit, however, is indexed to consumer prices and labor productivity (the real wage rate). Consumer prices are assumed to rise at an annual rate of 1.5 percent. The growth rates of gross domestic product (GDP) per capita and labor productivity (the real wage
rate) are both assumed to be 3 percent per annum. Partial benefits are then calculated according to the stipulations explained earlier. The projected premium is set equal to 10 percent of the full benefit level, or NT$910 per month in the first year of the program. We find (see Figure 3) that the social security wealth so calculated is positive for all age cohorts. In the first year it is the largest for the cohort of age 47, NT$285,251 ($8,723) per capita, and is only relatively insignificant, at NT$57,473 ($1,756) per capita, for the cohort of age 25. Thus the new program is both a forced-saving and an intergenerational-transfer program. When it matures, however, the forced-saving component will dominate the transfer component.

The population of each age cohort $a$, $N(a)$, is based on the demographic tables constructed by the Council for Economic Planning and Development (1999) for 1995–2035. The council provides three population projections based on different assumptions about birth rates. Our simulations are based on the medium series, although in Tables 1, 3, and 5, panels 4 and 5, we also provide simulated results based on the high and low series.

As mentioned earlier, the Public Employees and Labor Insurance programs cover 73 percent of the population. Thus the National Pension Program will affect only 27 percent of the population (income-weighted). This ratio ($m$) is taken to be unchanged throughout our simulations. Following Chan and Hu (1997), we assume that the myopic population accounts for $\phi = 30$ percent of the total population in the benchmark case. The relative risk-aversion coefficient is 1 (see the Appendix) for foresighted individuals, and the marginal propensity to consume is $\gamma = 1$ for myopic individuals. (Chan and Hu 1997 are able to show only that $\phi = 0.3$.)

Tables 1 through 6 show the simulated effects of the National Pension Program on aggregate savings on the basis of the stipulations described above. The values within parentheses indicate the change in savings as a percentage of GDP (on the assumption that GDP grows at the rate of 3 percent per annum). Tables 1 and 2 assume that the fraction of the myopic population is $\phi = 30$ percent. Tables 3 and 4 assume that the insurance benefits are as stipulated in Tables 1 and 2 but that the premium levels are set so that the system is maintained at a fully funded level and is actuarially fair. Tables 5 and 6 assume that there is no myopic population, so that the economy can be described entirely by the life cycle or permanent-income hypothesis. The difference between Tables 1, 3, and 5 on the one hand and 2, 4, and 6 on the other is that the first group assumes that the demographic transition is as projected by the Council for Economic Planning and Development (1996), whereas the second group assumes that the age distribution of the population from 2000 through 2035 remains the same as in 2000. In each table we perform sensitivity analysis by allowing the risk-aversion coefficient to change from $\rho = 1$ to $\rho = 0.6$ (second row of panels 1 and 2), the real interest rate to change from $r = 6$
percent to \( r = 8 \) percent (third panel) and, for Tables 1, 3, and 5 only, the demographic scenario to change from the medium estimates to high estimates (fourth row) or low estimates (fifth row).

We see from the first row of Table 1 that the government's proposed plan for partially funding the National Pension Program would result in a fall in aggregate savings by NT$25 billion in the first year, or 0.25 percentage points in the saving rate. The decline in the saving rate would increase to 0.69 percentage points by 2010 and further to 3.04 percentage points by 2035. That the program lowers aggregate savings indicates that it is both a forced-saving and an intergenerational-transfer program. Whereas it forces myopic individuals to save, its transfers component actually encourages consumption by foresighted individuals that exceeds forced saving. The fall in aggregate savings is not as small as it appears to be. The reason is that the program affects only 27 percent of the population. A full-scale program would result in a fall in the saving rate by 11.26 percentage points, or equivalently more than 60 percent in aggregate savings, by 2035. This result is consistent with the findings of Feldstein (1996). Although Feldstein does not explicitly consider whether part of the population is myopic, the coefficients of disposable income in his regression equations implicitly take myopia into account.

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<th>2035</th>
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**NOTES:** In panels 1–3, birth rates are assumed to equal medium rates projected by the Council for Economic Planning and Development (1999). In panels 4 and 5, they are assumed to equal projected high and low rates, respectively.

\( r = \) real interest rate.
\( \rho = \) risk-aversion coefficient.
Table 2 demonstrates what would happen if there were no demographic changes. The first panel shows that the decline in aggregate savings due to the National Pension Program would be 0.25 percentage points of GDP for 2000, 0.47 percentage points for 2010, and 0.94 percentage points for 2035. A comparison of the first panel of Tables 1 and 2 shows that population aging aggravates the adverse saving effect of national pensions only slightly for the first ten years but to an increasingly large extent afterward. By 2035 it exacerbates the adverse saving effect by as much as threefold (3.04 versus 0.94 percentage points). The main reason is that between 2000 and 2010 the demographic transition will affect primarily the age distribution of the working population but will not substantially increase the ratio of the retired population to the working population. This is seen in Figure 1 by the fact that the upper parts of the age distributions for 2000 and 2010 almost coincide.

Tables 3 and 4 show that if fully funded (and actuarially fair), the National Pension Program itself does not cause any significant change in saving, regardless of whether there are demographic changes. The reason is that although demographic changes affect the amount of savings needed for retirement and the premiums that must be paid per dollar of retirement benefits, they do not affect social security wealth (equal to zero) and therefore leave unchanged the saving effect of fully funded social security. With a segment of the population being myopic, the program initially will have a positive effect on aggregate saving because it forces those myopic workers to save more than they would in the absence of the program. But when those myopic workers retire, they will have more income than otherwise to consume, and thus the effect of social security on aggregate sav-

### TABLE 2  Simulated effects of the National Pension Program on aggregate saving in millions of constant NT dollars and as percentage of real GDP in the absence of demographic changes: Taiwan, 2000, 2010, and 2035

<table>
<thead>
<tr>
<th>Assumptions</th>
<th>2000</th>
<th>2010</th>
<th>2035</th>
</tr>
</thead>
<tbody>
<tr>
<td>No. 1</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>$r = 6%$</td>
<td>-24,958</td>
<td>-61,933</td>
<td>-258,645</td>
</tr>
<tr>
<td>$\rho = 1$</td>
<td>(-0.25%)</td>
<td>(-0.47%)</td>
<td>(-0.94%)</td>
</tr>
<tr>
<td>No. 2</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>$r = 6%$</td>
<td>-13,561</td>
<td>-46,863</td>
<td>-228,642</td>
</tr>
<tr>
<td>$\rho = 0.6$</td>
<td>(-0.14%)</td>
<td>(-0.36%)</td>
<td>(-0.83%)</td>
</tr>
<tr>
<td>No. 3</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>$r = 8%$</td>
<td>-12,890</td>
<td>-40,333</td>
<td>-143,675</td>
</tr>
<tr>
<td>$\rho = 1$</td>
<td>(-0.13%)</td>
<td>(-0.31%)</td>
<td>(-0.52%)</td>
</tr>
</tbody>
</table>

**NOTES:** Birth rates are assumed to equal medium rates projected by the Council for Economic Planning and Development (1999).

$r = $ real interest rate.

$\rho = $ risk-aversion coefficient.
### TABLE 3  Simulated effects of fully funded national pensions on aggregate savings in millions of constant NT dollars and as percentage of real GDP: Taiwan, 2000, 2010, 2035

<table>
<thead>
<tr>
<th>Assumptions</th>
<th>2000</th>
<th>2010</th>
<th>2035</th>
</tr>
</thead>
<tbody>
<tr>
<td>No. 1</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>$r = 6%$</td>
<td>14,402</td>
<td>18,267</td>
<td>-24,012</td>
</tr>
<tr>
<td>$\rho = 1$</td>
<td>(0.15%)</td>
<td>(0.14%)</td>
<td>(-0.09%)</td>
</tr>
<tr>
<td>No. 2</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>$r = 6%$</td>
<td>14,402</td>
<td>18,267</td>
<td>-24,012</td>
</tr>
<tr>
<td>$\rho = 0.6$</td>
<td>(0.15%)</td>
<td>(0.14%)</td>
<td>(-0.09%)</td>
</tr>
<tr>
<td>No. 3</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>$r = 8%$</td>
<td>14,402</td>
<td>18,014</td>
<td>-53,795</td>
</tr>
<tr>
<td>$\rho = 1$</td>
<td>(0.15%)</td>
<td>(0.14%)</td>
<td>(-0.19%)</td>
</tr>
<tr>
<td>No. 4</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>$r = 6%$</td>
<td>14,406</td>
<td>18,337</td>
<td>-23,593</td>
</tr>
<tr>
<td>$\rho = 1$</td>
<td>(0.15%)</td>
<td>(0.14%)</td>
<td>(-0.09%)</td>
</tr>
<tr>
<td>No. 5</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>$r = 6%$</td>
<td>14,402</td>
<td>18,267</td>
<td>-25,687</td>
</tr>
<tr>
<td>$\rho = 1$</td>
<td>(0.15%)</td>
<td>(0.14%)</td>
<td>(-0.09%)</td>
</tr>
</tbody>
</table>

**NOTES:** In panels 1–3, birth rates are assumed to equal medium rates projected by the Council for Economic Planning and Development (1999). In panels 4 and 5, they are assumed to equal projected high and low rates, respectively.  
$r$ = real interest rate.  
$\rho$ = risk-aversion coefficient.

### TABLE 4  Simulated effects of fully funded national pensions on aggregate savings in the absence of demographic changes in millions of constant NT dollars and as percentage of real GDP: Taiwan, 2000, 2010, 2035

<table>
<thead>
<tr>
<th>Assumptions</th>
<th>2000</th>
<th>2010</th>
<th>2035</th>
</tr>
</thead>
<tbody>
<tr>
<td>No. 1</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>$r = 6%$</td>
<td>14,402</td>
<td>15,704</td>
<td>5,361</td>
</tr>
<tr>
<td>$\rho = 1$</td>
<td>(0.15%)</td>
<td>(0.12%)</td>
<td>(0.02%)</td>
</tr>
<tr>
<td>No. 2</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>$r = 6%$</td>
<td>14,402</td>
<td>15,704</td>
<td>5,361</td>
</tr>
<tr>
<td>$\rho = 0.6$</td>
<td>(0.15%)</td>
<td>(0.12%)</td>
<td>(0.02%)</td>
</tr>
<tr>
<td>No. 3</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>$r = 8%$</td>
<td>14,402</td>
<td>15,471</td>
<td>-6,132</td>
</tr>
<tr>
<td>$\rho = 1$</td>
<td>(0.15%)</td>
<td>(0.12%)</td>
<td>(-0.02%)</td>
</tr>
</tbody>
</table>

**NOTES:** Birth rates are assumed to equal medium rates projected by the Council for Economic Planning and Development (1999).  
$r$ = real interest rate.  
$\rho$ = risk-aversion coefficient.
ing could become negative. Positive or negative, however, the saving effect of fully funded national pensions is small.

Our calculations in Tables 1 and 2 assume that individuals do not have bequest motives. Barro (1974) argues that individuals have bequest motives and take into account the tax burden of social security on their heirs. Should they do so, social security wealth would be equal to zero. Thus Tables 3 and 4 also represent the saving effect of social security under the assumption that foresighted individuals have full bequest motives. In this case the consumption of foresighted individuals is not affected, but myopic individuals are forced to save. The negative saving effect of social security is minimal in this case.

Tables 5 and 6 assume that there is no myopic population. We see that the negative saving effect of partially funded social security is greater than when part of the population is myopic (as in Tables 1 and 2). In the presence of population aging especially, the decline in aggregate saving due to national pensions increases from 0.46 percentage points of GDP in 2000 to 4.05 percentage points by 2035. Thus, according to the standard literature, if social security were entirely pay-as-you-go, the negative saving effect would be larger. The case for increased funding for social security is stronger and is further enhanced by population aging.

**TABLE 5** Simulated effects of the National Pension Program on aggregate savings in millions of constant NT dollars and as percentage of real GDP in the absence of myopia: Taiwan, 2000, 2010, and 2035

<table>
<thead>
<tr>
<th>Assumptions</th>
<th>2000</th>
<th>2010</th>
<th>2035</th>
</tr>
</thead>
<tbody>
<tr>
<td>No. 1</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>$r = 6%$</td>
<td>$-45,119$</td>
<td>$-141,244$</td>
<td>$-1,116,126$</td>
</tr>
<tr>
<td>$\rho = 1$</td>
<td>$(-0.46%)$</td>
<td>$(-1.07%)$</td>
<td>$(-4.05%)$</td>
</tr>
<tr>
<td>No. 2</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>$r = 6%$</td>
<td>$-28,838$</td>
<td>$-114,117$</td>
<td>$-1,051,821$</td>
</tr>
<tr>
<td>$\rho = 0.6$</td>
<td>$(-0.29%)$</td>
<td>$(-0.87%)$</td>
<td>$(-3.81%)$</td>
</tr>
<tr>
<td>No. 3</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>$r = 6%$</td>
<td>$-27,879$</td>
<td>$-106,957$</td>
<td>$-797,974$</td>
</tr>
<tr>
<td>$\rho = 1$</td>
<td>$(-0.28%)$</td>
<td>$(-0.81%)$</td>
<td>$(-2.89%)$</td>
</tr>
<tr>
<td>No. 4</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>$r = 6%$</td>
<td>$-45,132$</td>
<td>$-141,539$</td>
<td>$-1,124,443$</td>
</tr>
<tr>
<td>$\rho = 1$</td>
<td>$(-0.46%)$</td>
<td>$(-1.07%)$</td>
<td>$(-4.08%)$</td>
</tr>
<tr>
<td>No. 5</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>$r = 6%$</td>
<td>$-45,120$</td>
<td>$-141,244$</td>
<td>$-1,111,597$</td>
</tr>
<tr>
<td>$\rho = 1$</td>
<td>$(-0.46%)$</td>
<td>$(-1.07%)$</td>
<td>$(-4.03%)$</td>
</tr>
</tbody>
</table>

**NOTES:** In panels 1–3, birth rates are assumed to equal medium rates projected by the Council for Economic Planning and Development (1999). In panels 4 and 5, they are assumed to equal projected high and low rates, respectively.

$r =$ real interest rate.

$\rho =$ risk-aversion coefficient.
TABLE 6  Simulated effects of the National Pension Program on aggregate savings in millions of constant NT dollars and as percentage of real GDP in the absence of myopia and demographic changes: Taiwan, 2000, 2010, and 2035

<table>
<thead>
<tr>
<th>Assumptions</th>
<th>2000</th>
<th>2010</th>
<th>2035</th>
</tr>
</thead>
<tbody>
<tr>
<td>No. 1</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>r = 6%</td>
<td>-45,119</td>
<td>-98,951</td>
<td>-353,874</td>
</tr>
<tr>
<td>p = 1</td>
<td>(-0.46%)</td>
<td>(-0.75%)</td>
<td>(-1.28%)</td>
</tr>
<tr>
<td>No. 2</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>r = 6%</td>
<td>-28,838</td>
<td>-77,422</td>
<td>-311,216</td>
</tr>
<tr>
<td>p = 0.6</td>
<td>(-0.29%)</td>
<td>(-0.59%)</td>
<td>(-1.13%)</td>
</tr>
<tr>
<td>No. 3</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>r = 8%</td>
<td>-27,879</td>
<td>-68,092</td>
<td>-188,897</td>
</tr>
<tr>
<td>p = 1</td>
<td>(-0.28%)</td>
<td>(-0.52%)</td>
<td>(-0.68%)</td>
</tr>
</tbody>
</table>

NOTES: Birth rates are assumed to equal medium rates projected by the Council for Economic Planning and Development (1999). r = real interest rate. p = risk-aversion coefficient.

We have also conducted sensitivity analysis and shown that the results are robust with respect to parameter specification. In general the higher the interest rate, or the higher the intertemporal elasticity of substitution, the smaller is the saving effect of the National Pension Program. The use of the high series or the low series of demographic projections does not significantly change the saving effect of the program.

Conclusion

As Taiwan embarks on its new National Pension Program, it must choose between a pay-as-you-go and a fully funded system. A pay-as-you-go system is not viable in the long run because of the rapid aging of the population. A fully funded system will avoid a negative effect on aggregate saving but result in the accumulation of huge social security assets. If the government controls all those assets, it will become a socialist-style financial monopoly. The Taiwan government has chosen the middle ground by adopting a partially funded system. This chapter has shown that given Taiwan’s rapid population aging, the partially funded program will have a negative effect on aggregate saving. This finding suggests that the funding ratio is on the low side.

The negative saving effect of the program will be relatively small in the first ten years but will increase afterward. To ensure that economic growth and living standards are sustained as the population ages, a possible solution is to gradually increase the funding ratio so as to achieve the
forced-saving effect. This is essentially what Japan did in its 1994 reform of social security. It raised the retirement age gradually from 60 to 65, slowed the rate at which pension benefits were indexed, and increased the pension contribution rate. Adopting these steps in Taiwan will avoid the negative impact of population aging under the pay-as-you-go system and protect the long-term financial soundness of the social security system.

As we have noted, however, the Public Employees and Labor Insurance programs are seriously underfunded and have accumulated large implicit debts. If the National Pension Program forces the other two programs to clear their implicit debts or to increase their funding ratios, its negative saving effect may be alleviated.

We have concentrated on the saving effect of the National Pension Program, but there are other components of the program that may also affect the economy. First, the literature has shown that social security affects both labor force participation and saving decisions. Since the National Pension System does not impose a retirement test, however, its effect on labor force participation is likely to be small and can even be positive. The Public Employees and Labor Insurance programs provide full retirement benefits at age 55. If workers have to reach age 65 before they are allowed to receive pension benefits, early retirement might become less common.

Appendix

This Appendix derives analytic formulas for the marginal propensity to consume out of wealth and for the change in consumption of each cohort due to social security. We assume that the instantaneous utility function displays constant relative risk aversion (\( \rho \)). We use the discrete time version of the Blanchard (1985) model. The lifetime optimization problem faced by an individual aged \( a \) is

\[
\text{Max} \sum_{t=a}^{T} \left( \frac{1}{1+\delta} \right)^{t-a} \frac{1}{1-\rho} c_{t}^{1-\rho},
\]

(A1)

subject to

\[
w_{t+1} = (1+r)[w_{t} + y_{t} - c_{t}], \quad t = a, a+1, \ldots, T,
\]

(A2)

where \( T \) is the maximum life span, \( \delta \) is the rate of time preference plus the mortality rate, \( c_{t} \) and \( y_{t} \) are respectively consumption and labor income, \( w_{t} \) is real assets, and \( r \) is the real rate of interest plus the mortality rate. The Euler equation is given by

\[
c_{t}^{-\rho} = \left( \frac{1+\delta}{1+r} \right) c_{t+1}^{-\rho}, \quad \text{or} \quad c_{t} = \left( \frac{1+r}{1+\delta} \right)^{\frac{1}{\rho}} c_{t+1}.
\]

(A3)
Substituting the above equation in equation (A2) yields consumption at age \( a \):

\[
c(a) = \Gamma(a) \left( w_a + \sum_{t=0}^{T-a} \frac{Y_t}{(1+r)^t} \right),
\]

where \( \Gamma(a) \) is the marginal propensity to consume (social security) wealth and is given by

\[
\Gamma(a) = \frac{(1-\theta)}{(1-\theta^{T-a})}, \quad \theta = \frac{(1+r)^{T-1}}{(1+\delta)^{T-1}}.
\]

We now consider how social security affects the lifetime resources, the terms inside the parentheses in (A4). Assume that the individual’s current age is \( a \), lifespan is \( T=80 \) years, normal retirement age is \( R=65 \), the age at which the individual is required to join the National Pension Program is 25. We assume that the real interest rate is \( r \). The individual’s social security wealth is

\[
W(a) = \sum_{t=a}^{T-a} \frac{b(t)}{(1+r)^{t-a}} - \sum_{t=a}^{R-1} \frac{x(t)}{(1+r)^{t-a}},
\]

where \( x(t) \) is the premium and \( b(t) \) is benefits received at age \( t \). If social security is pay-as-you-go, then the benefit level is determined by

\[
x = \frac{\sum_{a=A}^{R} N(a) b}{\sum_{a=A}^{R} N(a)},
\]

where the denominator is the total population of age between \( A \) and \( R-1 \), and the numerator is the total population aged 65 and above. \( N(a) \) is the population of age cohort \( a \).

If the system is fully funded and actuarially fair, then the relationship between benefits and premiums is

\[
\sum_{t=a}^{T-a} \frac{b(t)}{(1+r)^{t-a}} = \sum_{t=a}^{R-1} \frac{x(t)}{(1+r)^{t-a}}.
\]

Combining the above equation with equation (A1), we find that the social security wealth is equal to zero.

The social security wealth for the entire population is

\[
W = \sum_{A=a}^{T} N(a) W(a).
\]
According to the life cycle or permanent-income hypothesis, the change in consumption brought about by social security is

\[
\Delta C_i = (1 - \phi) \sum_{a=A}^{T} \Gamma(a)N(a)W(a).
\] (A8)

The current disposable income brought about by the National Pension Program is

\[
\Delta Y_d = \left[ \sum_{a=R}^{T} N(a) \right] b - \left[ \sum_{a=R}^{T-1} N(a) \right] x. 
\] (A9)

Assume that myopic individuals’ marginal propensity to consume with respect to income is \( \gamma \). The change in consumption due to national pensions is then

\[
\Delta C_k = \phi \gamma \Delta Y_d.
\] (A10)

If the fraction of the total population not covered by social security is \( m \), the change in aggregate saving due to the introduction of the National Pension Program is

\[
\Delta S = -m(\Delta C_i + \Delta C_k).
\] (A11)

This is equation (2) in the main text, which is used in the simulations.

Notes

We thank Ling Wang of the Council for Economic Planning and Development, the Executive Yuan, for providing the updated demographic projection on Taiwan.

1 The average price of housing per square meter after adjustment for inflation rose by nearly 50 percent between 1987 and 1989 (Lin, Chang, and Peng 1994).

2 Although studies of the US data suggest that the degree (coefficient) of relative risk aversion is between 2 and 4, the study by Chan and Hu (1997) seems to suggest that the relative risk-aversion coefficient is much lower. We cannot exclude the possibility that the coefficient may approach 0.

References


