ROUTLEDGE

Understanding Japanese Saving

Does population aging matter?

Robert Dekle

Understanding Japanese Saving

Japan's savings are among the highest in the world, and these high rates have played a valuable role throughout the post-war period. The high level of saving has provided the funds needed to finance corporate investment in plant and equipment during the high-growth era of the 1950s to the early 1970s and helped meet capital shortages abroad during the post-1973 era of stable growth. However, over the next several decades, Japan's population will be aging rapidly. Will this lower Japanese savings rates?

Using up-to-date financial and demographical data, Robert Dekle finds that the answer to this question is an emphatic "yes." The aging of the population currently under way will steadily lower Japan's savings rate from 30 percent of GDP today to 19 percent of GDP in 2040, while Japan's total investment rate will decline from 28 percent of GDP today to about 22 percent of GDP in 2040. Given the more rapid decline in total saving, Japan's current account will steadily narrow from its current level and turn to deficit around 2015.

Understanding Japanese Saving holds key lessons for Western nations undergoing similar demographic transformations as well as for developing countries looking to establish public savings institutions.

Robert Dekle is Professor of Economics at the University of Southern California. He has studied the Japanese economic system for more than two decades.

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1 Introduction

Japanese saving and investment and aging

Japan's saving and investment rates are among the highest in the world, and these high rates have played a valuable role throughout the post-war period. The high saving has provided the funds needed to finance corporate investment in plant and equipment during the high-growth era of the 1950s, 1960s, and early 1970s, and helped meet capital shortages abroad during the post-1973 era of stable growth. The high investment has allowed Japan to incorporate the latest technologies into its production process, and has raised living standards through better public infrastructure, both in cities and in rural areas. However, there are some who blame Japan's high saving rate for her massive net export surpluses, leading to trade friction with her neighbors. Some also claim that Japanese firms are "overinvesting," that the returns to capital are abysmally low, and that government infrastructure investment is determined mostly by political considerations and is inefficiently allocated.

Over the next several decades, Japan's population will be aging rapidly. In 1955, only 5.5 percent of the population were 65 years or older; by 1998, 16.2 percent were elderly. Projections imply large increases in the elderly in the coming decades; by 2015, 25 percent of the population will be 65 or above. The main reason for this aging is the fall in the total fertility rate (births per family). The total fertility rate was more than 4 children per household before 1949, declining sharply to 2.1 in 1957. It has begun to fall again since 1974 and the current level of 1.4 was reached in 1997. There is still little sign that this has stabilized or returned to a higher level.

The main purpose of this book is to revisit the issue of the impact of demographic change on the Japanese saving–investment balance. There is widespread public belief that rapid aging – Japan's demographic destiny – will lead to major shifts in the Japanese saving–investment balance. I show that this belief is largely true. Using updated government demographic projections, I show that the aging of the population currently under way will steadily lower Japan's saving rate from 30 percent of the Gross Domestic Product (GDP) today to 19 percent of GDP in 2040. Japan's total investment rate will decline from 28 percent of GDP today to about 22 percent of GDP in 2040. Given the more rapid decline in total saving, Japan's current account will steadily narrow from its current level, and turn to deficit around 2015.

Overview of post-war Japanese saving and investment

It is well-known that the post-war Japanese economy is characterized by very high saving and investment rates. In fact, Japan's saving rates are among the highest in the world – only Italy, Singapore, and Taiwan have higher saving rates. However, these high Japanese saving and investment rates are primarily a post-war phenomenon – in fact, a post-1955 phenomenon. If the period of the Korean War is excluded, Japan's saving rate did not make it into the double digits until 1955, a full ten years into the post-war period. Thus, we can immediately reject the view that Japan's high saving rate is the result of cultural factors such as national character or Confucian and Buddhist teachings, because although cultural factors were stronger in the pre-war period, the saving rate was lower.

The trends and fluctuation in Japanese saving and investment closely mirror the trends and fluctuations in Japanese GDP. The broad trends in post-war Japanese private and government saving rates, investment rates, and the net export surplus – GDP ratios, are depicted in Table 1.1.[1,2]

The *private saving rate* rose steadily between 1955 and the mid 1970s, peaking (first) in 1978. Subsequently, the rate fell until the early 1990s, when it rose (again) to reach its post-war peak in 1998. There is a voluminous literature that seeks to explain the pattern and level of Japanese post-war private saving.[3] The literature suggests that the most important reason for Japan's high private saving rate is rapid economic growth. The permanent income/life-cycle hypothesis can explain the positive impact of income growth on the private saving rate if income growth is faster than expected. This hypothesis may have been valid until the early 1970s. The surge in private saving from the mid 1970s to the early 1980s is related to the two oil crises in the 1970s. The explanation given is that these crises added further fuel to the already rampant inflation and precipitated a recession, which in turn raised

Table 1.1 Japanese private and government saving, investment, and net exports (in percent of GDP)

	Private saving	*Government saving*	*Private investment*	*Public investment*	*Net export surplus*
1955–73	14	10	17	7	−2
1974–79	26	3	21	9	−1
1980–90	26	5	21	7	2
1991–95	26	5	22	8	2
1996–99	28	2	20	8	2

Note: Government saving includes net social security surplus; private investment includes plant and equipment, housing, and inventory investment.

Source: Economic and Social Research Institute, *Annual Report on the National Accounts*, 1999 and 2001 editions.

uncertainty about the future and increased the need to save for precautionary purposes. The fall in private saving from the mid 1980s to the early 1990s is because of robust consumption, stimulated by rising stock and land prices. In contrast, the mid to late 1990s rise in private saving is related to the recessionary economy, increased unemployment, uncertainty, and pessimism, all raising precautionary savings. Horioka (1991, 1992) finds that the level and growth of Japanese GDP explains about 65 percent of the variation in the private saving rate.

The literature suggests that the second most important reason for Japan's high private saving rate is the favorable age structure of the population. Until the early 1970s, the proportion of the aged (over 65) to the working-age population (20–64) – the so-called "dependency ratio" – was low in Japan. According to the life-cycle hypothesis, an increase in the dependency ratio has a significant negative effect on the private saving rate. Horioka (1991, 1992) finds that adding the dependency ratio to the equation already including the level and growth of GDP raises the proportion of private saving explained from 65 to 75 percent. Moreover, he estimates that a one percentage point increase in the dependency rate will cause the private saving rate to decline by one percentage point. These and similar estimates suggest that the 12 percentage point increase in the dependency rate between 1975 and 1998 has depressed private saving by about 12 percentage points annually.

The government saving rate rose until the mid 1960s, then gradually fell to its historical low in 1978. Subsequently, the rate rose (again) until the early 1990s, when it started to decline to (almost) its new low in 1998. The trend in Japanese government saving is also closely related to economic growth. Government saving surged until the mid 1960s, as growth rates were consistently above government projections, leading to rising tax revenues. From the mid 1960s, however, the demand for government services increased, dampening the budget surpluses. The recessionary 1970s led to counter-cyclical measures and a further drop in government saving. To halt the decline in government saving, the Japanese government in the early 1980s introduced budget freezes and reformed the tax system. These measures and strong economic growth in the mid to late 1980s led to rising budget surpluses. However, as the economy slumped in the early 1990s, falling tax revenues and the need for expansionary fiscal policy again depressed government saving rates.

The *investment rate* also rose steadily, peaking in 1973. Since then, it has fallen slightly. Compared to household and government saving rates, the investment rate has remained comparatively stable. The main determinant of Japanese investment has again been economic growth. As GDP growth surged in the 1950s and 1960s, investment was able to take advantage of newly available technologies. Since the early 1970s, the investment rate has dipped somewhat, but has remained at a high level. The surge in investment rates in the late 1980s is related to the cheap financing available to firms, owing to rising stock and land prices. Although private investment has dipped in the 1990s, rising government investment owing to expansionary public works projects in the mid to late 1990s has kept overall investment rates high.

Japanese *net exports* were in persistent deficit until the early 1970s, reflecting strong investment demand and inadequate saving. However, by the mid 1980s, the surge in saving and decline in investment pushed Japanese net export surpluses (as a percentage of GDP) into record territory. Subsequently, as a result of strong domestic consumption in the late 1980s and strong government investment in the 1990s, the net export surpluses (as a percentage of GDP) declined.

Plan of this book

So much for the overview and casual description of the determinants of Japanese saving and investment. The major objective of this book is to rigorously characterize the determinants of Japanese saving and investment. In Chapter 2, I assess the shape of the Japanese elderly's age–wealth profile. If the Japanese elderly on average are reducing their wealth, then as the population ages, household saving should fall. However, if the Japanese elderly are on average holding their wealth constant, then the rapid aging should not by itself decrease the aggregate household saving rate by much. Moreover, I investigate the bequest motive of the Japanese elderly. Only when bequests are left for altruistic reasons is the dynastic household model applicable to Japan.

In Chapter 3, I examine whether private investment is determined by economic fundamentals, such as productivity growth and demographics. Only when private investment is largely determined by fundamentals would aging affect the level of investment. However, the determination of private investment is a highly controversial topic, and other factors besides fundamentals may influence private investment rates, such as stock market "bubbles."

Chapter 4 is the crux of the book, in which I present the simulation model of Japanese saving, investment, and government budget balances, based partly on the empirical results of Chapters 2 and 3. Based on the results of Chapter 2, regarding the specification of household preferences in our simulation model, I have assumed that households are dynastic and Ricardian, and very altruistic. Based on the results of Chapter 3, regarding the specification of the investment function, I have assumed that investment is driven by fundamentals, such as profits, which are in turn determined by productivity growth and demographics. I have disregarded "bubbles" and other non-fundamental factors in influencing Japanese private investment. Using recent government demographic projections, I show that the aging of the population under way will lower Japan's total saving rate from 30 percent of GDP today to 19 percent of GDP by 2040. Japan's total investment rate will decline from 28 percent of GDP today to about 22 percent of GDP in 2040.

In Chapter 4, I also show that the aging of the population will worsen public finances. I forecast future government spending from projected demographics. Given the forecasted government spending, large tax increases will become necessary for the current government debt to be sustainable.

One way of mitigating the aging problem is to increase immigration into Japan. In Chapter 5, I compare the saving and investment balances that occur without immigration (Chapter 4), to the inflows that occur with immigration. Consistent with the United Nation's recommendations, I assume that from 2005 to 2040, Japan will allow 400,000 immigrants annually. With the larger labor force from the immigration, output in 2020 will be 22 percent higher, and 50 percent higher by 2040. I show that the decline in private saving is much milder with immigration than without immigration. Private and public investment rates gradually fall over time, but the decline in these investment rates is much less rapid with immigration. Public finances drastically improve with immigration.

In Chapter 6, I examine how land and housing prices impact residential choice, and the saving behavior of the Japanese elderly. Total wealth is the sum of financial wealth and real-estate wealth. I show in Chapter 2 that the Japanese elderly desire not to bring down their total wealth. I attribute this to the desire of the elderly to leave bequests to the next generation. However, if there are constraints to bringing down their real estate wealth, then although the elderly may prefer to lower their total wealth, they may be prevented from doing so by the existence of these constraints. In Chapter 6, I examine whether the constraints on reducing real estate wealth are binding – that is, whether the elderly desire to reduce their real estate wealth, but are prevented from doing so. If constraints on reducing real estate wealth are binding, then the removal of these constraints may result in greater consumption and dissaving by the Japanese elderly.

In the concluding Chapter 7, I draw some lessons from the Japanese saving and investment experience for current-day developing countries. In this book, I show that Japanese saving and investment are determined by fundamentals. In particular, saving in Japan is determined by growth and demographics. Thus, developing countries cannot change their saving rates with public policy. However, I show that the Japanese government has influenced how saving is allocated, from investment in the traditional sector to investment in the modern, more productive sector.

2 The saving behavior of the Japanese elderly

Introduction

The main purpose of this chapter is to estimate the shape of the average Japanese elderly's age–wealth profile, using previously unanalyzed Japanese household-level data. Specifically, the chapter examines whether the Japanese elderly are on average reducing their total wealth or keeping their total wealth intact, where total wealth is defined as the sum of financial wealth and wealth in real estate.

Why is it important to assess the shape of the Japanese elderly's age–wealth profile? The Japanese population is aging very rapidly. If the elderly on average reduce their wealth, then as the population ages, aggregate household saving should fall. However, if the Japanese elderly are on average holding their wealth intact, then the rapid population aging should not by itself decrease the aggregate household saving rate by much. An increase in the aged will also mean that the elderly cohorts will carry more weight in the future in the determination of aggregate household saving. As the elderly gain in number and in relative wealth, their saving behavior will become more important in affecting the saving rate of the overall economy.

Moreover, I investigate the bequest motive of the Japanese elderly. Do the Japanese elderly leave sizable bequests, and if they do, what motivates them to leave the bequests? Generally, there are three reasons why the elderly leave bequests. First is altruism: the elderly simply care about the welfare of the young. Second is accidental: the elderly may not be willing to bring down their wealth in the event of exceptional longevity – most households leave some wealth at death. Third is the cost of child services to the elderly: the child may be a supplier to the parent of services such as incontinence care or phone calls and visits. The price of these services charged by the child is a transfer from the parent. Only when bequests are left for altruistic reasons is the dynastic household model developed in Chapter 4 applicable to Japan. When bequests are left for other reasons, the elderly are more selfish than altruistic, and the elderly's saving behavior would adhere more closely to the life-cycle model, rather than the dynastic model.

The principal finding of this chapter is that the average Japanese elderly's age–wealth profile is flat; the elderly are not dissaving. Part of the reason for the lack of dissaving appears to be bequests driven by altruism, if it can be assumed that the intensity of the bequest motive (altruism) is stronger if one has more surviving children. Thus, dynastic household models may apply well to Japanese households.

The shape of the Japanese elderly's age–wealth profile and the strength of the elderly's bequest motive have been examined by a large earlier literature. Two useful summaries of the earlier literature are Hayashi (1997; chapter 10) and Horioka (2002). In general, the earlier literature has found that the aged save until they get very old (about age 80–85), and then dissave very little. A substantial fraction of wealth held by the aged is eventually transferred to their children mainly through bequests. However, there is controversy in the earlier literature surrounding whether these bequests reflect altruism of the elderly towards their children. Using different data sets and methodologies from this chapter, the earlier literature, on the whole, found more support for the view that the elderly are leaving bequests as payment for services rendered by the young (reason three above). I believe that the discrepancies between the results of this chapter and those of earlier work arises because data used in the earlier literature included more of the poor elderly, who need more support from the young. My data, the *Survey on the Living Behavior of the Aged*, includes more of the affluent elderly, whose altruism may be stronger. Since the overall economy's saving rate is more influenced by the saving behavior of the affluent, I believe my results are more relevant in understanding how the elderly's altruistic preferences affect the saving rate in the economy.

This chapter is organized as follows. The next section develops the empirical model, specifies the elderly's age–wealth and living-arrangement choice equations that are to be jointly estimated, and proposes a test to explore the nature of the bequests of the Japanese elderly. The results are presented and analyzed in the section after next.

Specification of estimation equations

Specification of the Japanese elderly's age–wealth equation

Following much of the earlier literature, I estimate a linearized version of the elderly's age–wealth profile. To test whether the elderly reduce their total wealth, it is sufficient to see whether total wealth declines as the elderly household head moves into progressively higher age brackets, other factors suitably held constant. The equation to be estimated is the following:

$$\frac{W_t}{LTW} = a_1 + b_1 AGE1 + c_1 AGE2 + d_1 \frac{SSW_t}{LTW} + e_1 LC + f_1 MC + g_1 SE + u_1 \tag{2.1}$$

where:

- W_t: total tangible wealth of the elderly couple when the head is age t, the sum of financial assets and real estate assets
- SSW_t: social security wealth of the couple, the present value of social security benefits discounted to the present age of the head
- LTW: lifetime wealth, the present value of the couple's inheritance, after-tax earnings, and social security benefits discounted to age 20 of the head
- $AGE1$: dummy variable that takes on a value of 1 if the head is aged 65–69 and otherwise zero
- $AGE2$: dummy variable that takes on a value of 1 if the head is aged 70–74 and otherwise zero
- LC, MC: dummy variables that take on values of 1 if the elderly couple lives in a large or medium-sized city
- SE: a dummy variable that is 1 if the head is self-employed.

In addition a_1, b_1, c_1, d_1, e_1, f_1, g_1, are parameters to be estimated, u_1 is a normally distributed random variable with mean 0 and variance δ^2. The excluded category for the age dummy variables is when the head is aged 60–64. The excluded category for the city-size dummies is when the elderly couple lives in a rural area. If social security wealth is perfectly substitutable for total wealth, then d_1 should equal -1 (Feldstein, 1974). It is assumed that the disturbance term, u_1 arises out of omitted variables and approximation error uncorrelated with the regressors.

The estimation of Eq. (2.1) should be interpreted as performing an analysis of covariance with three (age) categories without interactions. The null hypothesis is that as the age cohort of the head increases, there is no dissaving from total wealth. That is,

$$H(0): b_1 = c_1 = 0,$$

and the alternative hypothesis is that dissaving occurs,

$$H(1): b_1 < 0 \text{ or } c_1 \leqslant 0.$$

The specification of Eq. (2.1) helps solve the "cohort bias" arising from using cross-section age–wealth profiles to approximate longitudinal age–wealth profiles. To test for the hypothesis of no old age dissaving, we need to observe longitudinal changes in a person's wealth. Saving is $W(t) - W(t-1)$, where both $W(t)$ and $W(t-1)$ refer to the wealth holdings of the same individual. Observing people of different ages in a cross-section is not the same as following an individual over time. On average, because of technical progress and capital accumulation, the older members of a cross-section will have worked during periods of lower real wages. Hence, everything else including education being equal, the older persons can be expected to hold less wealth. For cross-section profiles to approximate longitudinal profiles, some adjustment for interpersonal differences in lifetime wealth is needed. Equation (2.1) performs this adjustment by dividing the elderly couple's $W(t)$ and $SSW(t)$ by the couple's lifetime wealth.

The city-size dummies, $LCITY$, $MCITY$, are included to capture cost of living differences among the regions. In regions where the cost of living is high, the elderly would need to hold more wealth to finance their old age consumption. The dummy *SELF* is added to distinguish the self-employed elderly from the elderly who are employed or retired.

Specification of the elderly living arrangement equation

In Japan there are two types of elderly households: the intergenerational and the independent. For the elderly who choose to form an intergenerational household, the age–wealth profile observed in the data may not reflect their "true" saving behavior. When Japanese parents join a younger family, the parents bring their assets with them. According to Japanese social convention, once the parents join, they will bequeath almost their entire net assets to the child or to another younger generation member who takes care of them.[1]

When the parents live with the younger household, they will often impose substantial costs on the younger family, costs such as increased food spending, expenses for gas, electricity, medicine, and nursing care. Also, children may provide attention otherwise unavailable to parents. These imposed costs should be counted as part of the parents' consumption, decreasing the parents' wealth holdings. If these imposed costs are not added to the consumption of the elderly living in intergenerational households, the resulting "net wealth measurement bias" will mean that there is less of a chance that the null hypothesis of no dissaving will be rejected. Restricting the sample to the independent elderly, however, will lead to sample-selection bias, if the independent elderly are not a random sample of the entire elderly population. The coefficients of the wealth equation estimated from only the sample of the independent elderly may then not be applicable to the entire population of the elderly.

The standard procedure to correct for this form of selection bias would be to posit a self-selection equation and estimate the self-selection equation and Eq. (2.1) jointly by maximum likelihood (Heckman, 1979; Maddala, 1983). The result will give us unbiased estimates of the coefficients and of their standard errors.

The self-selection equation is:

$$V(\text{ind}) - V(\text{dep}) = a_2 + b_2 LTW + c_2 PDVO + d_2 SSK + e_2 SELF + f_2 LCITY + g_2 MCITY + h_2 OCHIL + k_2 \text{MCHIL} - u_2. \tag{2.2}$$

$NINTER = 1$ if and only if $V(\text{ind}) - V(\text{dep})$ is greater than zero, and a_2, b_2, c_2, d_2, e_2, f_2, g_2, h_2, k_2 are parameters to be estimated. For theoretical tractability, it is assumed that all parents join the younger household when the head reaches the age of 60, if they are ever to join. Thus, V(ind) and V(dep) are latent variables describing the rest-of-life indirect utilities at age 60 of living independently and living in an intergenerational household. *NINTER* is a dummy indicator variable that takes the value 1 if V(ind) is greater than V(dep), and u_2, the error term, includes the unobservables. That is, *NINTER* takes the value 1 only if the elderly couple is independent.

The difference in indirect utilities between living alone and living in an intergenerational household is assumed to depend on the following explanatory variables: lifetime wealth of the couple (*LTW*); post-mandatory retirement (post-age 60) after-tax earnings (*PDVO*); the present discounted value of social security benefits from when the head is aged 60 to when his spouse dies (*SSK*); dummy variables representing the size of the city in which the elderly couple resides (*LCITY*, *MCITY*), and dummy variables that take values of 1 if the elderly head is self-employed (*SELF*), if the elderly couple has exactly one child (*OCHIL*), and if the elderly couple has more than one child (*MCHIL*). The rationale for the inclusion of these variables is given below.

Swartz, Danzinger, and Smolensky (1984) suggest that, unconstrained by income, the elderly will prefer to be independent. The state of "living in an intergenerational family" is an inferior good. A rise in earnings, social security benefits, and wealth would imply that the elderly are more likely to realize their goal of maintaining independent households. In my model, the elderly make the decision to join at age 60. The elderly couple's economic position when the head is aged 60 is summarized by the sum of their total tangible wealth, the present value of their future earnings, and the present value of their social security receipts, i.e. $A(60) + PDVO + SSK$. For the elderly currently over 60, total tangible wealth when they were actually aged 60 is unobservable. It is plausible to assume, however, that holding *PDVO* and *SSK* constant, a change in $W(60)$ will be proportional to a change in *LTW*. *LTW* is therefore included as an instrument for $W(60)$. If living alone is preferable to joining, then a rise in *PDVO*, *SSK*, or *LTW* should raise the probability of maintaining an independent household, and the coefficients of these variables in Eq. (2.2) should be positive.

The locational variables, *LCITY* and *MCITY*, are included because they may affect how the younger family treats the parents once the parents decide to live with the younger family. We would expect that in isolated rural areas where traditional social mores persist, the parents will be offered a better deal upon joining. In Japanese rural areas, there are often heavy pressures imposed on the younger family to take care of the parents.[2]

The dummy variable *SELF* is included since the self-employed may have additional reasons for living with the younger generation. The coefficient on *SELF* should be negative, since it is not unusual for children or nieces and nephews who live with the self-employed elderly to assist in the operation of the family farm or the family business without remuneration. Such assistance, of great value to the self-employed elderly, is usually not available to those who are company employees or who are retired.

It is possible that even in the absence of surviving children, the elderly may live with a member of the younger generation. The elderly, however, may be more reluctant to live with nieces and nephews than with their own children. If *OCHIL* decreases the probability that the elderly will be independent, then the Japanese aged are more likely to form an intergenerational household with their children than with other younger relatives.

Finally, Bernheim, Shleiffer, and Summers (1985) have argued that parents have more leverage over a given child if the parents have more than one child. If the parents have only one child, then the only child can almost be certain that no matter how poorly he treats his parents, he will be able to receive his parents' bequest. His parents have only one credible beneficiary, the only child. However, if the parents have several children, the children will compete with each other for the favor of the parents in order to receive the bulk of the estate. An implication of the above hypothesis is that *MCHIL* should have a stronger negative impact than *OCHIL* on the elderly's choice of independence.

In my estimation, $NINTER = 0$ only if the parents are living with a married child or with another younger family. To include those living with unmarried children may create a problem because unmarried children are usually still dependents. In my working sample of 335 elderly, 115 live with married children and 97 live with unmarried children. The elderly are counted as living with a younger household only if the head of the younger household is reported as being the head of the entire intergenerational family.

The unobservable variables may include subjective elderly couple-specific variables such as the psychological compatibility between the elderly couple and the younger families. Since some of the unobservables in Eq. (2.1) and Eq. (2.2) are likely to be the same, u_1 and u_2 are possibly correlated. Unless corrected, this correlation will lead to biased coefficient estimates of Eq. (2.1) if the equation is estimated on only the sub-sample of the independent elderly. By estimating Eq. (2.1) jointly with Eq. (2.2) via maximum likelihood methods, we can obtain consistent and efficient estimates of the coefficients and of the coefficient standard errors. It is assumed that u_1 and u_2 are bivariately normally distributed. The algorithm used to obtain the maximum of the likelihood function is that of Davidson–Fletcher–Powell.

Specification for a test of the bequest motive

The shape of the age–wealth profile may not be informative about the strength of the motive. As noted by Davies (1981), Hubbard (1986), and Hurd (1987), the elderly may not reduce their wealth if they fear unexpected emergencies or living an unexpectedly long life. The precautionary motive for saving against medical emergencies seems prevalent among the Japanese aged. A 1983 Bank of Japan household survey reported that 82 percent of people over the age of 60 reply that they save as a precaution against high future medical expenses.

It is reasonable to assume that the intensity of bequests is some positive function of the number of children. An increase in the number of children should increase wealth held at each age, other things equal. Of course, children are not costless. Child-rearing imposes resource costs on parents that may be substantial, including expenses such as education. While these resource costs of children will tend to lower parent wealth holdings, the bequest effect will tend to raise wealth.

To explore the nature of the bequest motive, the number of children who are still alive, *NCHIL*, is added to Eq. (2.1). If the bequest effect dominates the resource cost effect, then we would expect the coefficient on *NCHIL* to be positive and statistically significant for the *independent* elderly. As mentioned, for the *intergenerational* elderly, the bulk of the bequest will go to the younger family who takes care of the elderly couple. For the intergenerational elderly, total bequests should not be a monotonically increasing function of the number of children. If *NCHIL* increases wealth holdings for the independent elderly population, then the bequest motive exists.

Results

The household survey I use is called the *Survey on the Living Behavior of the Aged* (Rojin Ishiki Chosa, LBC data for short) and was conducted in October 1983 by Tokyo University's Sociology Department on behalf of the Japanese Ministry of Posts and Telecommunications. To my knowledge, this survey has never been previously used in analyzing Japanese household saving.

Since my objective is to study the wealth-accumulation behavior of the elderly, the sample is restricted to those over the age of 60. Of the 737 people aged between 60 and 74, 507 reported both their financial and real wealth holdings. I assume that non-reporting is randomly distributed in the population.

The 507 observations are further sub-divided by deleting 37 corporate executives, 115 widows, 18 couples with the wife older than the husband or with the husband more than 11 years older than the wife, and two households in which the head earns over 15 million yen and is "retired" or self-employed. With the above criteria to define the working sample, I am left with 335 couples with the head aged between 60 and 74. Details on how the variables used in the estimation are constructed are given in Dekle (1987).

Table 2.1 summarizes and defines the variables that are used in my estimation. The cohort means of some of the variables are classified by age and education in Table 2.2. Table 2.2 shows that average total wealth rises as the age group of the household head increases. Can we conclude from Table 2.2 that the Japanese elderly are not dissaving? Such a conclusion is still premature, since there is a bias caused by the large number of the elderly living with the younger generation. However, estimates of the selectivity-corrected Eq. (2.1) show that even when this "net wealth measurement bias" is controlled, there is still no evidence that the Japanese elderly dissave from their total wealth.

Table 2.3 reports the least-squares estimates of Eq. (2.1) and Eq. (2.1) with *NCHIL* added as an additional exogenous variable. The equations

Table 2.1 Definition of variables and sample statistics

Variable		*Mean*	*Standard deviation*
$W(t)/LTW$:	Total tangible wealth divided by lifetime wealth	0.855	1.14
LTW:	Lifetime wealth of the couple	4551	905
$AGE1$:	Age of the head is between 65–69	0.355	0.479
$AGE2$:	Age of the head is between 70–74 (excluded variable is head between 60–64)	0.152	0.360
$SSW(t)/LTW$:	Present value of future social security benefits divided by lifetime wealth	0.464	0.238
$PDVO$:	Present value of after-tax future earnings from the time the head is aged M (age 60) to age T	1169	669
SSK:	Present value of future social security benefits from the time the head is aged M (age 60) to age T	4539	2669
$NINTER$:	Proportion of sample not living in an intergenerational household	0.657	0.475
$SELF$:	Household head is self-employed	0.301	0.459
$NCHIL$:	Number of living children	2.603	1.524
$LCITY$:	Couple lives in a city of over 100,000 people	0.585	0.493
$MCITY$:	Couple lives in a city of between 10,000 and 100,000 people (excluded variable is couple lives in rural area)	0.182	0.386
$MCHIL$:	Proportion of sample with more than one child	0.818	0.386
$OCHIL$:	Proportion of sample with exactly one child	0.105	0.306

are estimated on the complete sample of the elderly, including the elderly living in intergenerational households. Both equations were first estimated by ordinary least-squares. Because of the high values of the Breusch and Pagan (1979) chi-squared statistic, the estimates presented in Table 2.1 are corrected for arbitrary heteroskedasticity by a method proposed by White (1980).

For the first column, we can see that as the age group rises, $W(t)/LTW$ shows no tendency to decline. The Japanese elderly do not seem to be dissaving. Also, a greater number of children raises wealth holdings as a share of lifetime wealth, suggesting the presence of a bequest motive.

Table 2.2 Cohort means of selected variables by age group and education (in tens of thousands of 1983 yen)

		Age group		
		60–64	*65–69*	*70–74*
Number of observations	Average	165	119	51
	Below High	78	65	29
	High school	59	32	17
	College	28	22	5
Total wealth	Average	3641	3904	4242
	Below High	3525	3549	5352
	High school	3103	3473	2858
	College	5096	5577	2504
Financial wealth	Average	934	924	1100
	Below High	750	664	910
	High school	946	848	712
	College	1329	1545	604
Real estate wealth	Average	2722	3027	3427
	Below High	2776	2885	4441
	High school	2156	2625	2147
	College	3768	4032	1900
Lifetime wealth	Average	4901	4341	3904
	Below High	4365	3891	3527
	High school	4954	4465	4290
	College	6283	5490	4778
Present value of social security benefit from age t to age T	Average	2466	2083	1801
	Below High	2236	1847	1463
	High school	2688	2258	2341
	College	2641	2526	1924
Present value of social security benefit from age 60 to age T	Average	4899	4199	4164
	Below High	4453	3706	3559
	High school	5355	4695	5250
	College	5180	4937	3977
Present value of earnings from age 60 to age T	Average	1273	1143	889
	Below High	1185	1057	839
	High school	1132	1209	947
	College	1816	1301	987

These conclusions are still tentative, however, since Eq. (2.1) is misspecified when it is applied to the entire sample of the elderly. The elderly who live with a younger family do not have to reduce their assets in order to finance their old-age consumption. “Net wealth measurement bias” is present since the younger family will support the elderly in return for receiving the bequest.

Table 2.3 Dependent variable: total wealth/lifetime wealth

	(1)	*(2)*
Constant	0.581 (2.94)	0.214 (1.17)
Head, 65–69	0.164 (1.47)	0.148 (1.31)
Head 70–84	0.438 (1.49)	0.369 (1.43)
Social security wealth/ lifetime wealth	0.0117 (0.05)	0.0477 (0.22)
Large city	0.0319 (0.18)	0.0822 (0.58)
Medium city	−0.419 (−0.22)	0.0132 (−0.07)
Self-employed	0.440 (2.88)	0.386 (2.44)
Number of living children	–	0.132 (1.97)
R-squared:	0.044	0.074
Breusch–Pagan:	180.27	329.48
Sample:	335	335

Asymptotic *t*-statistics in parentheses.
Standard-errors are corrected for heteroskedasticity.

To provide for the correct specification, Eq. (2.1) is estimated on only the sample of the independent elderly. Since the independent elderly finance their own consumption from their own wealth, the independent elderly's observed wealth level is their true wealth level. However, because the sample of only the independent elderly is a self-selected sample, bias in the coefficient estimates may result unless this self-selection is accounted for in the estimation.

Table 2.4 depicts the results from the joint maximum-likelihood estimation of Eq. (2.1) with Eq. (2.2), the self-selection equation. The first column shows the estimates of the self-selection equation. An increase in earnings after age 60 raises the probability of independence. Both lifetime wealth and social security wealth after age 60 are insignificant, casting some doubt on the notion that living alone is a superior good for the aged in Japan. Kurz (1985) has argued that the decline in the number of three-generation families in the United States since the Second World War was caused by the growth of the social security system. An increase in social security benefits meant that the elderly

Table 2.4 Maximum likelihood estimate of the elderly's choice of independence and their age–wealth profile if independent

	Elderly couple remains independent	*Age–wealth profile for independent couples*	
		Selec. corr.	*Hetero. corr.*
	(1)	*(2)*	*(3)*
Constant	−0.242 (−0.40)	0.261 (0.51)	0.561 (1.68)
Head, 65–69	–	0.565 (0.19)	0.0822 (0.95)
Head, 70–74	–	0.506 (1.36)	0.561 (1.17)
Present value of earnings after 60 (10,000)	0.516 (2.19)	–	–
Present value of social security after 60 (10,000)	−0.182 (−0.40)	–	–
Social security wealth/ lifetime wealth	–	−0.00617 (−0.011)	−0.0320 (−0.107)
Lifetime wealth (1,000)	0.170 (1.20)	–	–
Large city	0.567 (2.90)	0.107 (0.24)	−0.0206 (−0.070)
Medium city	0.297 (1.24)	−0.210 (−0.38)	−0.254 (−0.84)
Self-employed	−0.978 (−2.89)	0.422 (2.56)	0.489 (2.23)
One child	−1.024 (−2.52)	–	–
More than one child	−0.728 (−2.05)	–	–
R-squared:			0.07
Breusch–Pagan:			471.23
Sample		220/335	

Asymptotic *t*-statistics in parentheses.

no longer had to rely on their children for support. Since living with children is assumed to be less desirable than living alone, more elderly people could afford to make the preferred choice. My evidence for Japan does not support Kurz's hypothesis. The further development of the social security system should not by itself cause the break-up of the Japanese three-generation family.

Table 2.4 shows that in large cities, the elderly are more likely to be independent. The tradition of taking care of parents may be weaker in urban areas. The high negative significance of the *OCHIL* variable suggests that the elderly are more likely to form an intergenerational household with children than with other younger relatives. In addition, the estimates do not support the presence of bargaining between the parents and children. The coefficient on *OCHIL* has larger negative value than the coefficient on *MCHIL*. Given that the parents have at least one child, further increases in the number of children do not raise the probability of joining a younger family.

The second column of Table 2.4 depicts the selectivity-corrected estimates of the wealth–age relation. The coefficients on both age dummies are positive, but insignificant. A Wald test of the hypothesis that $b_1 = c_1$ has a chi-squared value of 1.18, significant at only the 27 percent level, implying that among the different age classes, there are no significant difference in the total wealth levels. Also, in contradiction to the work of Kotlikoff (1979) and Hubbard (1986), who find substantial displacement of private wealth by social security wealth in US cross-section data, the results in Table 2.4 suggest that social security wealth does not displace private tangible wealth in Japan; the coefficient on social security wealth is insignificant.

That social security wealth does not displace private tangible wealth is further evidence of strong altruistic motives in Japan. A rise in social security benefits means that future social security payroll contributions will have to rise, given the Japanese pay-as-you-go social security system. When parents have altruistic bequest motives, they will raise their bequests to the young. That is, the young will need increased resources to pay for the higher payroll taxes. Thus, the parents will have to maintain a higher wealth level, in order to leave the higher bequests.

The last row between the first and second columns gives *RHO*, the estimate of the correlation coefficient between the error terms in the selection equation and the age–wealth relation. The estimate of *RHO* is insignificant. We cannot reject the hypothesis that there will be no selection bias when Eq. (2.1) is estimated on only the sample of the independent elderly. The least-squares estimates of Eq. (2.1) on only the sample of the independent elderly are therefore consistent estimates of the population parameters of the age–wealth relation.

The third column of Table 2.4 reports the results for the least-squares without the need for selection correction. Heteroskedasticity, however, is present as shown by the Breusch–Pagan statistic of 471.23, and White's (1978) constant covariance estimator is used. The pattern of the

Table 2.5 Maximum likelihood estimates of the elderly's choice of independence and the effect of the number of children if independent

	Elderly couple remains independent	*Age–wealth profile for independent couples*	
	(1)	*Selec. corr.* *(2)*	*Hetero. corr.* *(3)*
Constant	−0.242 (−0.40)	0.112 (0.16)	0.126 (0.55)
Head, 65–69	–	0.0627 (0.23)	0.0640 (0.70)
Head, 70–74	–	0.479 (1.38)	0.481 (1.16)
Present value of earnings after 60 (10,000)	−0.117 (−0.26)	–	–
Present value of social security after 60 (10,000)	−0.117 (−0.26)	–	–
Social security wealth/ lifetime wealth	–	−0.0351 (−0.066)	−0.0365 (−0.13)
Lifetime wealth (1,000)	0.166 (1.17)	–	–
Large city	0.567 (2.97)	0.0656 (0.15)	0.0591 (0.25)
Medium city	0.298 (1.29)	−0.206 (−0.39)	−0.208 (−0.80)
Self-employed	−0.979 (−2.89)	0.459 (1.62)	0.462 (2.15)
One child	−1.024 (−2.49)	–	–
More than one child	−1.728 (−2.05)	–	–
R-squared:			0.118
Breusch–Pagan:			685.12
Sample		220/335	

Asymptotic *t*-statistics in parentheses.

coefficient estimates in the third column is close to that in the second column. There is again no evidence of dissaving with advanced age.[3]

As mentioned earlier, the lack of dissaving by the elderly does not by itself prove the existence of the bequest motive. The elderly may be holding their wealth intact as a precaution against unanticipated medical expenses or living an unexpectedly long life. To test for the bequest motive, Eq. (2.1) is re-estimated on the sample of the independent elderly with *NCHIL* added as an additional regressor, and the results are depicted in Table 2.5. The estimates in the second column of Table 2.5 are selectivity-corrected. We can see from Table 2.5 that the coefficient on *NCHIL* is highly significant. An increase in the number of children increases the total wealth–lifetime wealth ratio by 0.166. Multiplying the average lifetime wealth level of 4551 by 0.166 gives 755. An increase of one child raises average wealth holdings of the independent elderly by 7.55 million yen.

The effect of children on wealth holdings seems to differ between the United States and Japan. Blinder, Gordon, and Wise (1983) find that a greater number of children increases wealth holdings by only a small amount. The mean increase in wealth due to the bequest motive is calculated to be 1.25 times the annual consumption of the average household. Hurd (1987) using US longitudinal data also shows that the presence of children does not increase the elderly's wealth holdings. For the Japanese elderly, the mean increase in wealth holdings is six years of annual household consumption. The bequest motive seems to be more important for the Japanese elderly. While the lack of dissaving for the US elderly may be largely attributable to other motives, such as the precautionary motive, the lack of dissaving for the Japanese elderly is at least partly attributable to the desire to leave bequests.

Conclusion

The main conclusion of this chapter is that the Japanese elderly are keeping their wealth intact. The elderly are not reducing their total wealth. Why are the elderly not dissaving? I find that the desire to leave bequests keeps wealth holdings high, and that altruism towards one's children can account for the high level of bequests. The bequest motive increases the average Japanese elderly's wealth holdings by approximately six times the annual consumption of the average household.

3 Private investment and fundamentals

Introduction

Aging affects private investment by lowering the required amount of the capital stock. An economy invests to equip each worker with a given amount of capital equipment. In an aging population the number of workers decline, so inevitably the amount of capital that is required declines. Thus, as the population ages, there should be less need for physical investment – the investment rate will decline.

For the above scenario to be true, private investment must be determined by long- or short-term *fundamentals*, both economic, such as productivity growth, and demographic, such as population growth and the ratio of the aged to the total population. However, the determinants of private investment is a highly controversial topic, and other factors besides fundamentals may influence private investment rates, such as stock market "bubbles."

A vast empirical literature has arisen that tries to understand the determinants of private investment (see Chirinko, 1993; Hubbard, 1998, for recent reviews). Broadly, this literature has identified three variables as important determinants of private investment: *stock market q* (stock market value), long-term *fundamentals q* (discounted future profits), and *current cash flow*. The use of stock market *q* and long-term fundamentals *q* are motivated by Tobin's *q*-theory. Since current cash flows are driven by short-term fundamentals, if investment is related to current profits, then investment rates are related to short-term fundamentals. The use of current profits is motivated by theories focused on information asymmetries between borrowers and lenders.

In general, the empirical literature has found that stock market *q* (stock market value of capital/replacement cost of capital) performs poorly in explaining investment (Hayashi, 1982; Hayashi and Inoue, 1991). In turn, long-term fundamentals *q* performs better (Abel and

Blanchard, 1986; Blanchard, Rhee, and Summers, 1993). However, the more recent literature has found that fluctuations in investment can be best explained by current profits (Fazzari, Hubbard, and Peterson, 1988; Whited, 1992; Hubbard, 1998).

In this chapter, we examine the reponsiveness of Japanese investment to three variables: stock market *q* (*SMq*); long-term fundamentals *q* (*LTFq*); and current profits (*CP*). We find considerable support for the importance of *CP*, but only moderate and very weak support for *LTFq* and *SMq*, respectively. Despite sharp fluctuations in *SMq*, Japanese investment has moved relatively little. Although Japanese investment – like *LTFq* – has also secularly declined, *LTFq* explains very little of the short-run variations in Japanese investment. *CP* explains investment well throughout the post-war period. That *CP* explains investment better than *LTFq* implies that there is a component of *CP* that is uncorrelated with *LTFq* but is still useful in forecasting investment. Moreover, as cash flow theory predicts, we find that the impact of *CP* is stronger in the 1958–71 period.

The behavior of Japanese aggregate investment has recently been examined by several prominent researchers. Kiyotaki and West (1996) find that Japanese private plant and equipment investment between 1961 and 1994 can be well explained by the "flexible accelerator" model. They regress the investment rate on *SMq* and find little association. The authors use an unadjusted measure of *SMq* that is almost always negative in their sample. It is not clear whether a more plausible measure of *SMq* would affect their results. Ogawa *et al.* (1994) examine the behavior of investment for 13 two-digit non-financial industries between 1970 and 1992. They find that on average, investment is poorly explained by *SMq*, but well explained by *LTFq*. In most industries, *CP* tends to explain investment better than *LTFq*. Ogawa *et al.*, however, do not examine the period before 1970. Also, the authors' results could be subject to simultaneity bias, since their explanatory variables are not instrumented. Chirinko and Schaller (1996) are more supportive of the hypothesis that *SMq* has influenced Japanese investment. Using aggregate data from the mid 1960s to 1991, they claim that during the "bubble" period (1985–89), firms used part of the proceeds from floating equity for fixed investment.

Investment theory

In this section, we briefly review the two investment theories that are used to specify the Japanese investment equations.

q-*theory*

First, we will review the q-theory of investment, emphasizing its implications for the relationship between the investment rate and marginal q or q_M. In addition, in this exposition we assume that the ratio of the price of capital to the price of output is equal to one, that the real interest rate is constant, and that tax rates and the depreciation rate are zero.

The firm's problem is to maximize the expected present discounted value of the "surplus" (essentially, profits):

$$\max V_t = E_t \sum_{j=t}^{\infty} K_j * s(i_j, \epsilon_f, \omega_f) * \rho^{j-t}$$

where ρ is the constant discount factor, K_j is the capital stock, and $s(i_f, \epsilon_f, \omega_f)$ is the surplus rate, the ratio of the surplus to the capital stock.

The surplus is defined as revenue minus the sum of labor costs and total investment costs. The surplus is determined by fundamentals, such as productivity and population growth, and the state of the economy. As the population ages, wages are expected to rise, raising labor costs and lowering the surplus.

The solution to the above problem (see Dekle, Henderson, and Thomas, 1999) imply:

$$i_t = -a + b * q_{M,t} - \epsilon_t,$$

where under conventional assumptions (Hayashi, 1982), $q_{M,t}$ is equal to the ratio of the expected present value of the current and discounted future surplus to the capital stock at the beginning of period t, which we refer to as long-term $q_{M,t}$ (*LTFq*). Since aging lowers the surplus, long-term q (*LTFq*) declines when the population ages.

If the asset market accurately reflects fundamentals, that is, if the asset market value of claims on capital is equal to the expected present value of the current and expected future surplus, fundamentals q is equal to the ratio of the stock market value of claims on capital to the value of capital at the beginning of period t, which we refer to as stock market q (*SMq*). That is,

$$q_{A,t} = q_{F,t}.$$

Of course, we know from the Japanese experience that asset market values can deviate significantly from fundamental values, because of "bubbles" or market manias. In the late 1980s, there was a phenomenal increase in stock market values. Since stock market values fell drastically from the late 1980s, the rise was widely attributed to a stock market "bubble" or a deviation of asset market values from fundamental values.

Cash flow theory

Cash flow theory predicts a positive relationship between the investment rate and current cash flow (surplus minus net interest payments plus gross investment divided by the value of capital). Firms limit their investment to the amount that can be financed out of their current profits (*CP*), because external financing is either considerably more costly or unavailable. The aging of the population will also lower *CP*, since workers will be scarce and more expensive, and there will be fewer consumers.

Plots of the data

Charts 3.1–3.3 contain plots of the variables for the period 1957–1994. Note the rapid increases in the investment rate and market *q* (*SMq*) in the early 1960s and late 1980s, corresponding to the boom in stock prices in the 1960s and the asset market "bubble" in the late 1980s. Graphically, the relationship between the investment rate and *SMq* appears weak, especially since the early 1970s (Chart 3.1). While

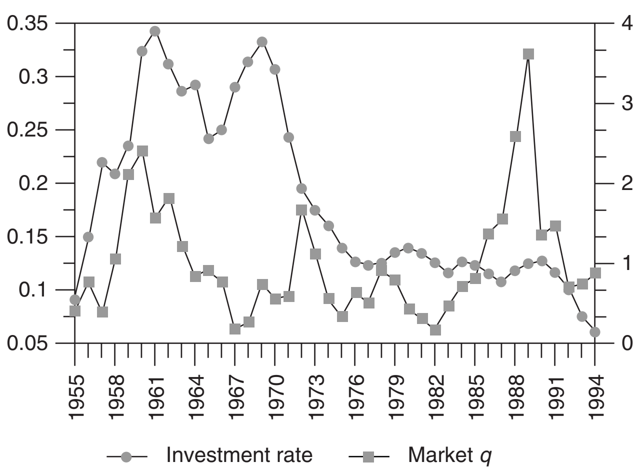

Chart 3.1 Investment rate and market *q*

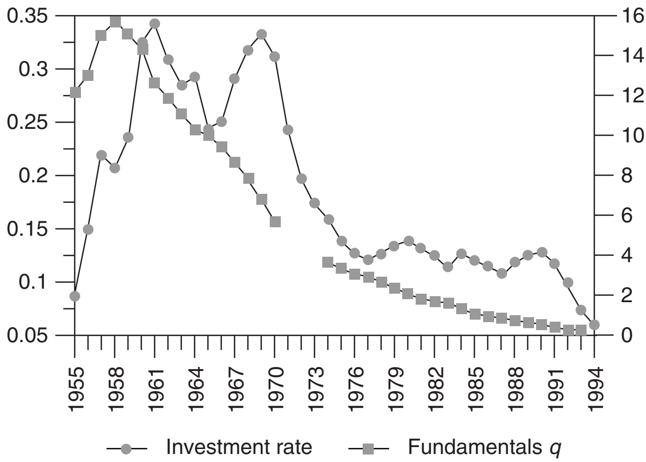

Chart 3.2 Investment rate and fundamentals *q*

SMq fluctuated greatly from 1985 to 1994, the "bubble" and post-"bubble" years, the changes in the investment rate were much more modest.

Fundamentals *q* (*LTFq*) fell steadily from its peak in the late 1950s, reflecting the declining marginal productivity of capital (Chart 3.2). The downward trend in *LTFq* corresponded to the downward trend in the investment rate. However, *LTFq* does not appear to closely "track" the short-run movements in the investment rate.

The performance of current profits (*CP*) in tracking the investment rate is very good (Chart 3.3). As the Japanese economy expanded, *CP* and the investment rate soared until 1970. Subsequently, *CP* and the investment rate declined sharply until the mid to late 1970s. The two variables have remained at that lowered level until the late 1980s, when they jointly increased again. The decline in *CP* since the early 1990s has corresponded with a sharp decrease in investment rates.

Empirical results

Are the relationships among investment and other variables the same in the period 1974–1994 as in the period 1957–1971? If so, the two periods could be considered as a single period. In attempting to explain

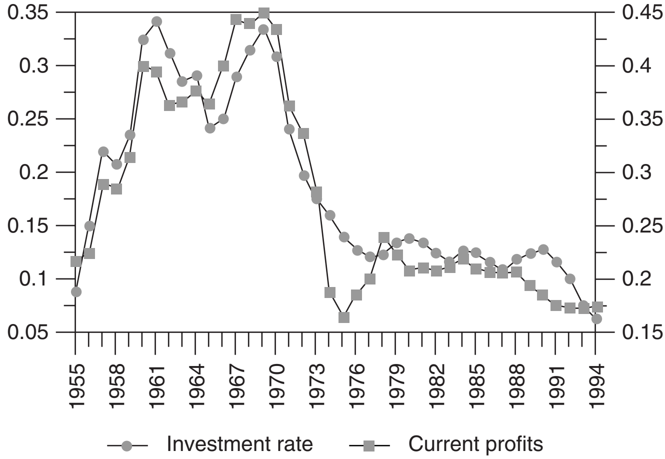

Chart 3.3 Investment rate and current profits

the time-series pattern of Japanese investment, it would be possible to exploit whatever advantages are associated with having data for a single period that is as long as possible. If not, the two periods should be considered separately.

Charts 3.1–3.3 show that the relationship between the investment rate and other variables changed distinctly in the early 1970s, as Japan shifted from the high to the low growth period. More formal tests presented in Dekle, Henderson, and Thomas (2000) also show that the relationship among investment and other variables changed drastically between 1971 and 1974.

Given that the coefficients of the investment equation most likely changed in the early 1970s, for the remainder of this chapter, we focus on the two periods separately.

Results for the two periods considered separately

We run "horse-races" to determine which variable – *SMq*, *LTFq*, *CP* – best explains Japanese investment behavior. We find that *CP* wins the "horse-races." Current profits appears to strongly impact the investment rate, especially during the 1958–71 period. This result is consistent with the view that liquidity constraints were more severe for Japanese

Table 3.1 Dependent variable: investment rate

	The present sample is 1958 to 1971								*The present sample is 1975 to 1994*							
	(1)	*(2)*	*(3)*	*(4)*	*(5)*	*(6)*	*(7)*	*(8)*	*(1)*	*(2)*	*(3)*	*(4)*	*(5)*	*(6)*	*(7)*	*(8)*
CP	0.652	0.503	0.918	0.870	0.595	0.969	0.666	0.826	0.046	0.234	−0.054	0.201	−0.170	0.058	−0.351	−0.342
	(3.78)	(2.93)	(4.74)	(8.34)	(2.24)	(4.86)	(4.53)	(5.64)	(0.35)	(2.27)	(−0.52)	(1.16)	(−0.98)	(0.47)	(−3.01)	(−1.39)
CP_1					0.029	−0.788	0.729	0.151					0.280	0.254	0.420	0.416
					(0.12)	(−3.00)	(3.88)	(0.46)					(1.57)	(2.18)	(3.57)	(2.85)
invr_1		0.320		0.515		0.894		0.428		0.726		0.649		0.708		0.017
		(1.71)		(5.34)		(3.81)		(2.01)		(4.17)		(1.74)		(4.46)		(0.04)
Constant	0.034	0.000	−0.017	−0.120	0.044	−0.042	−0.132	−0.126	0.115	−0.016	0.170	0.005	0.102	−0.029	0.152	0.148
	(0.50)	(0.00)	(−0.27)	(−3.13)	(0.64)	(−0.84)	(−2.56)	(−2.93)	(4.32)	(−0.42)	(6.71)	(0.06)	(3.63)	(−0.85)	(7.40)	(1.48)
Trend			−0.005	−0.007			−0.011	−0.008			−0.001	0.000			−0.001	−0.001
			(−2.26)	(−5.80)			(−5.10)	(−3.48)			(−3.33)	(−0.24)			(−4.96)	(−1.89)
Specification	10.80	10.60	11.20	2.99	11.50	9.60	5.59	2.62	13.70	12.00	12.30	11.90	13.90	9.50	4.98	5.01
Error autocorrelation	11.6*	35.5*	9.44*	0.58	15.8*	3.44	0.45	0.31	2.37	0.40	1.47	0.65	5.38	0.10	0.50	0.50

Note:
Each of the columns (1) to (8) contains coefficients from instrumental variables of an investment equation including some or all of the variables in the leftmost column.
The Specification row contains statistics for the Sargan (1958) specification test for the validity of instruments.
The Autocorrelation row contains statistics for the Lagrange Multiplier test of the null or no serial correlation against the alternative of up to second-order serial correlation.
The superscript * indicate rejections of the null at the 5% level.
t-statistics in parentheses.

firms in the 1950s and 1960s. However, *LTFq* also appears to have high explanatory power.

Regressions relating the investment rate with *CP* are depicted in Table 3.1. For the 1958–71 period, *CP* or lagged *CP* are always statistically significant, although for several specifications, the autocorrelation in the error may overstate the level of significance. During the 1975–94 period, contemporaneous *CP* has weak explanatory power, but lagged *CP* usually is statistically significant.

Table 3.2 depicts the relationship between *SMq* and the investment rate. Between 1958 and 1971, *SMq* retains its significance in several specifications. However, during the latter period, *SMq* completely loses its significance. That is, the large fluctuations in stock prices in the late-1980s and early 1990s have not affected physical investment. As Charts 3.1 and 3.2 show, *SMq* tracks *LTFq* more closely in the first period. The relatively strong explanatory power of *SMq* during the first period may be related to the fact that stock prices are more closely reflected with economic fundamentals during the first period. As shown in Table 3.3, the performance of *LTFq* is good during both periods. *LTFq* appears to affect investment with a one-year lag.

Conclusion

Our empirical results using post-war Japanese data provide support for the cash flow theory of investment that claims that investment is constrained by internal funds. Unlike previous work that has used Japanese data, I show that the relationship between investment and its determinants completely changed in the mid-1970s.

Stock market *q* and fundamentals *q* are associated with investment to some extent in the period 1960–71, but the association between stock market *q* and investment is much weaker in the period, 1974–94. Fundamentals *q* has some explanatory power during both periods. Our results provide much stronger support for the cash flow theory in explaining Japanese investment. I find that cash flow – contemporaneous and lagged – is clearly associated with the investment rate both in the period 1960–71 and the period 1974–94. The impact of cash flow on investment, however, is stronger in the period 1960–71, when Japanese firms were no doubt more liquidity constrained than in the later period.

What do our results mean for the relationship between aging and private investment? As aging proceeds, profits will decline as workers become more expensive. Fundamentals *q*, which is the present discounted value of profits, will decline. Cash-flow, which is essentially

Table 3.2 Dependent variable: investment rate

	The present sample is 1958 to 1971								*The present sample is 1975 to 1994*							
	(1)	*(2)*	*(3)*	*(4)*	*(5)*	*(6)*	*(7)*	*(8)*	*(1)*	*(2)*	*(3)*	*(4)*	*(5)*	*(6)*	*(7)*	*(8)*
SM_q	0.027	0.023	0.054	0.045	0.035	0.050	0.064	0.059	−0.004	−0.001	0.005	0.004	−0.007	−0.001	0.001	0.002
	(1.57)	(1.54)	(2.82)	(1.88)	(1.25)	(2.06)	(2.25)	(2.05)	(−1.34)	(−0.41)	(1.36)	(1.20)	(−1.37)	(−0.20)	(0.29)	(0.42)
SM_{q_1}					−0.010	−0.003	−0.013	−0.028					0.003	0.000	0.004	0.003
					(−0.34)	(−1.42)	(−0.53)	(−1.00)					(0.77)	(−0.04)	(1.37)	(0.81)
invr_1		0.492		0.210		0.637		0.420		0.495		0.255		0.499		0.150
		(2.21)		(0.64)		(2.56)		(1.04)		(2.50)		(1.28)		(2.22)		(0.62)
Constant	0.256	0.121	0.156	0.126	0.258	0.089	0.157	0.099	0.128	0.062	0.168	0.124	0.128	0.062	0.168	0.142
	(12.07)	(1.90)	(3.36)	(1.91)	(11.16)	(1.29)	(3.15)	(1.33)	(32.76)	(2.34)	(14.01)	(3.46)	(30.30)	(2.06)	(14.10)	(3.29)
Trend			0.007	0.005			0.007	0.003			−0.002	−0.001			−0.002	−0.001
			(2.36)	(1.19)			(2.23)	(0.71)			(−3.40)	(−2.21)			(−3.49)	(−2.30)
Specification	8.80	8.29	6.45	6.55	9.64	5.92	5.76	5.07	11.5*	10.70	10.70	9.89	10.10	10.80	9.23	9.14
Error autocorrelation	3.82	2.72	1.57	1.77	3.62	1.26	0.80	2.87	1.56	1.66	0.30	0.69	3.59	1.72	2.85	4.38

Note:
Each of the columns (1) to (8) contains coefficients from instrumental variables of an investment equation including some or all of the variables in the leftmost column.
The Specification row contains statistics for the Sargan (1958) specification test for the validity of instruments.
The Autocorrelation row contains statistics for the Lagrange Multiplier test of the null or no serial correlation against the alternative of up to second-order serial correlation.
The superscript * indicate rejections of the null at the 5% level.
t-statistics in parentheses.

Table 3.3 Dependent variable: investment rate

	The present sample is 1958 to 1971								*The present sample is 1975 to 1994*							
	(1)	*(2)*	*(3)*	*(4)*	*(5)*	*(6)*	*(7)*	*(8)*	*(1)*	*(2)*	*(3)*	*(4)*	*(5)*	*(6)*	*(7)*	*(8)*
LTF_q	−0.001 (−0.72)	0.001 (0.52)	0.001 (0.17)	0.006 (1.02)	−0.015 (−3.12)	−0.013 (−1.64)	−0.011 (−1.91)	−0.008 (−0.92)	0.015 (3.01)	0.012 (2.15)	0.017 (0.90)	0.028 (1.37)	−0.041 (−1.60)	−0.039 (−1.51)	−0.054 (−1.49)	−0.039 (−0.91)
LTF_{q_1}					0.015 (3.01)	0.013 (1.73)	0.017 (3.41)	0.014 (2.00)					0.063 (2.21)	0.059 (2.00)	0.068 (2.20)	0.058 (1.71)
invr_1		0.167 (2.20)		0.687 (2.35)		0.158 (0.42)		0.194 (0.54)		0.299 (1.11)		0.437 (1.35)		0.214 (0.87)		0.216 (0.67)
Constant	0.304 (10.40)	0.096 (0.97)	0.203 (0.58)	−0.212 (−0.62)	0.257 (9.28)	0.211 (1.87)	−0.106 (−0.40)	−0.173 (−0.58)	0.102 (14.28)	0.069 (2.20)	0.095 (1.44)	−0.007 (−0.07)	0.090 (10.47)	0.067 (2.36)	0.120 (2.04)	0.066 (0.66)
Trend			0.005 (0.29)	0.014 (0.94)			0.018 (1.37)	0.018 (1.37)			0.000 (0.12)	0.001 (0.81)			−0.001 (−0.51)	0.000 (0.01)
Specification	12.4*	11.70	12.4*	11.40	10.80	10.80	10.00	10.30	7.56	9.55	10.00	9.05	8.04	7.51	7.86	7.51
Error autocorrelation	2.12	1.26	2.23	0.62	0.68	1.39	0.00	0.11	1.12	3.92	1.07	1.93	0.51	0.67	0.26	0.62

Note:
Each of the columns (1) to (8) contains coefficients from instrumental variables of an investment equation including some or all of the variables in the leftmost column.
The Specification row contains statistics for the Sargan (1958) specification test for the validity of instruments.
The Autocorrelation row contains statistics for the Lagrange Multiplier test of the null or no serial correlation against the alternative of up to second-order serial correlation.
The superscript * indicate rejections of the null at the 5% level.
t-statistics in parentheses.

current profits, will also decline. The role of "bubbles" and other non-fundamental factors in influencing private investment is minimal. Thus, by worsening economic fundamentals, the future aging of the population should decrease the private investment rate.

4 Simulating the impact of aging on future saving, investment, and budget deficits

Introduction

The main purpose of this chapter is to simulate the impact of demographic change on Japanese saving, investment, and government budget deficits. There is widespread belief that rapid aging will lead to major shifts in the Japanese saving and investment balance, and severely worsen Japan's fiscal situation. Using recent government demographic projections, I show that the aging of the population under way will steadily lower Japan's total saving rate from 30 percent of GDP today to 19 percent of GDP in 2040. Japan's total investment rate will decline from 28 percent of GDP today to about 22 percent of GDP in 2040. Given the more rapid decline in total saving, Japan's current account will steadily narrow from its present level, and turn to deficit around 2015.

In the specification of the simulation equations, I have used the results in Chapters 2 and 3. Regarding the specification of household preferences, I assume that households are dynastic and Ricardian, and are very altruistic. The results of Chapter 2 suggest that part of the reason for the lack of dissaving by elderly households appears to be bequests driven by altruism. Thus, the empirical evidence of Chapter 2 suggests that the dynastic, Ricardian model applies well to Japanese households.

Moreover, the model of investment in this chapter assumes that investment is driven by fundamentals, such as profits. I have shown in Chapter 3 that the role of "bubbles" and other non-fundamental factors in influencing Japanese private investment is minimal. Thus, by worsening economic fundamentals, the future aging of the population should decrease the private investment rate.

I also show that the aging of the population will worsen government finances, as healthcare and social security spending soar. Unless government fiscal balances improve from the current minus 7 percent of GDP to almost plus 5 percent of GDP over the next decade or so, the current government debt is not sustainable. I forecast future government spending from projected demographics. Given the forecasted government spending, large tax increases will become necessary for the current government debt to be sustainable. In fact, I show that taxes as a percentage of GDP will need to be raised from the current 28 percent to almost 50 percent by 2040.

Most of the earlier literature projecting the impact of demographic change on the Japanese saving–investment balance and government deficits dates back almost a decade. The data are correspondingly almost a decade old. The earlier literature assumed future population growth rates that are constant, and the economic projections relied on *ad hoc* behavioral assumptions. I allow future population growth rates and support ratios (the ratio of the labor force to the population) to change every five years, and my projections are grounded in well-accepted microeconomic foundations.

This chapter is organized as follows. In the second section, I review the deteriorating Japanese government fiscal position in the 1990s. In the third section, I summarize the demographic changes undergoing in Japan, and present the Japanese government's latest demographic projections. In the fourth section, I simulate the impact of demographic change on the future Japanese saving and investment rates, government deficits, and the current account. In my simulations, I adopt the standard small-country, open-capital-market, Ramsey-optimal growth model. Specifically, I closely follow Cutler, Poterba, Sheiner, and Summers' (1990) modifications to the Ramsey model, in examining the impact of changing demographics on savings and government deficits.

The Japanese fiscal position in the 1990s

Government saving declined and public investment rose in the 1990s (Table 1.1, see Chapter 1). These trends in government saving and investment in the 1990s were caused by the recession, and also by structural changes. The recession and the decline in the rate of economic growth lowered tax revenues. Structural changes worsening government saving include tax reforms, which lowered tax elasticities and tax revenues, and the aging of the population, which raised social security and healthcare expenditures. The deterioration of government finances led to sharp increases in outstanding government bonds, raising concerns about fiscal sustainability and calls for fiscal reform.

Government saving in the 1990s

Tax revenues declined because of the recessionary environment of the 1990s. In addition, government consumption increased. Owing to the low cyclical variability of Japanese unemployment and social welfare benefits, however, government consumption increases during the recession were capped. Government saving can be divided into the "full-employment" and "cyclical" components. I estimate that during the period 1996–99, Japan's full-employment government saving was about 2.6 percent, slightly higher than actual government saving of 2.0 percent, leaving the cyclical component of government saving at −0.6 percent.[1] Thus, much of the decline in Japanese government saving in the late 1990s was not because of "automatic stabilizers," but because of structural factors, such as tax reductions. This low cyclical variability of government saving is corroborated in a recent International Monetary Fund (IMF) study showing that a one percentage point increase in the output gap translates into an increase of the cyclical deficit by about a third of one percent of GDP, which is about half of the deficit response in other OECD countries (Muhleisen, 2000).

Government saving declined from the early to mid 1990s, with tax reductions supporting aggregate demand in the face of an unprecedented economic downturn. Particularly in 1998, when the economy slipped into recession, the government passed tax-cut measures that led to a substantial decline in government saving in the following year. Marginal income and capital gains tax rates and health insurance premia were cut, exemptions for gift taxes were raised, and tax deductions for home mortgage holders were introduced. The government also lowered corporate tax rates from 50 percent to 40 percent.

Government saving can be broken down into the social security surplus, the surplus in other categories, and healthcare expenditures (Chart 4.1). The social security surplus (benefits minus contributions) fell from about 2 percent of GDP in the early 1990s to about 0.5 percent of GDP in 1999, owing to the recession (lowering contributions) and increase in the elderly (raising benefits). Government healthcare expenditures rose from about 3.6 percent of GDP in the early 1990s to about 4.2 percent of GDP in 1999, mainly owing to increase in the elderly, who use most of the hospital services. However, the healthcare expenditure–GDP ratio in Japan is smaller than in the US (6.6 percent of GDP), or Germany (7.7 percent of GDP). The remaining category of government saving includes usual spending such as education, defense, and policing and firefighting. Saving in this category declined sharply from 9.5 percent of GDP in

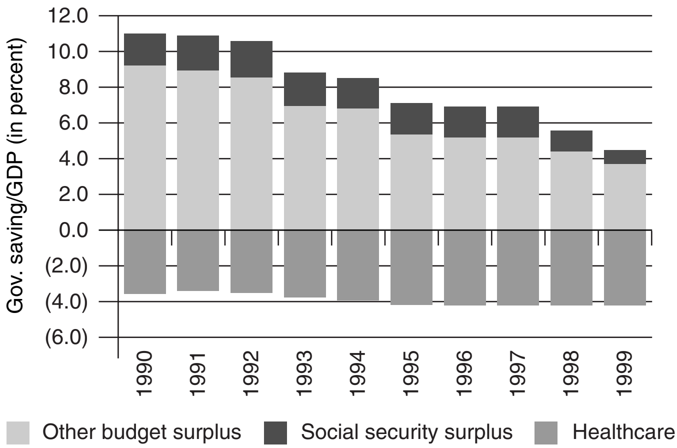

Chart 4.1 Government saving (surplus)/GDP

1990 to 4 percent of GDP in 1999, owing to the fall in (income and consumption) tax revenues.

Public investment in the 1990s

Between 1990 and 1999, the Japanese government passed ten stimulus packages, in an attempt to jump-start the stalling economy. The most important component of the government stimulus packages were public works, which are included in public investment. However, as shown in Table 1.1, the actual increases in public investment in the late 1990s were rather moderate, compared to the prominent – and headline grabbing – role of public works in the stimulus packages.

There are two reasons why actual public works fell short of the levels announced in stimulus packages. First, during the 1990s, the central government assigned roughly two-thirds of the increased public works spending to local governments (without providing a commensurate increase in funding). However, the capacity of local governments to expand public investment was affected by their poor financial situation, and the continued rise in public investment has increasingly been financed through local bond issues. The amount of outstanding local government bonds increased from 12 percent of GDP in 1990 to 22 percent of GDP in 1997. Many local governments surpassed the legally allowed threshold of bonds-outstanding, and were put under bond issuance restrictions by the central government. Second, some of the public investment funds provided by the stimulus packages remained unused, because of poor project implementation. Ishii and Wada (1998) calculated that only 60–70 percent of the stimulus packages' public works has translated into additional demand during the mid to late 1990s.

Government debt and liabilities in the 1990s

The late 1990s decline in government saving and rise in public investment led to sharp increases in government debt. Table 4.1 depicts the fiscal balance–GDP ratio, and several debt to GDP ratios. The fiscal balance–GDP ratio is lower than the difference between the government saving–GDP ratio and the public investment–GDP ratio by about 2 percent, mainly because of the inclusion of net government land purchases in the fiscal balance. During the 1990s, the government bought significant amounts of land from the private sector to prop up land prices. The fiscal surplus declined continuously in the 1990s, reaching about minus 10 percent in 1998. Correspondingly, the ratio of debt to GDP has risen sharply. By international standards, Japan's *gross* debt–GDP ratio in 1999 was the highest among the G-7 countries: Italy's was 115 percent, and the US's was 62 percent.

Because of the partly funded nature of the Japanese pension system, as well as the government's major role in financial intermediation, the Japanese government holds significant assets, keeping the *net* debt–GDP ratio at a moderate level, and lower than in other G-7 countries. However, since the assets of the social security system are more than offset by future pension obligations, they should be excluded when assessing Japan's debt situation. As a result, Japan's *net* debt *excluding social security net assets*, at 85 percent, is significantly higher than in the US, 60 percent, and in Germany, 53 percent.

The government's true net obligations may be substantially higher than the net debt figures, because of unfunded liabilities. There are three main sources of unfunded liabilities. The first source is the future costs of government social security and health schemes. Estimates of future unfunded social security costs depend on demographic, economic growth, and interest rate assumptions and range widely. In Japan, there are several social security schemes, but the main scheme – the Employees' Pension Scheme – derives one-third of its (benefit) payouts from government subsidies and two-thirds of its payouts from payroll taxes (contributions). Given current government subsidy and payroll tax rates, Chand and Jaeger (1996) estimate the present (2000) value

Table 4.1 Fiscal balances and government debt (in percent of GDP)

	1990	*1991*	*1992*	*1993*	*1994*	*1995*	*1996*	*1997*	*1998*	*1999*
Fiscal balance GDP*	2	2	1	−2	−3	−4	−5	−4	−11	−7
Gross debt/GDP	65	65	68	73	78	85	92	97	109	121
Net debt/GDP	7	6	12	10	12	17	22	28	38	44
Net debt/GDP, excluding social security	35	35	43	43	47	53	58	65	76	85

Note: *Gross Public Investment minus Gross Government Saving plus Net Land Purchases and Net Gift and Inheritance Taxes.

Source: Economic and Social Research Institute, *Annual Report on the National Accounts*, 2001 edition.

of Japan's unfunded social security liabilities at 110 percent of GDP. Muhleisen (2000) estimate the present value of net unfunded liabilities at 60 percent of GDP. With regards to government health benefits, on average, government subsidies cover about one-third of total public health insurance benefits (2 percent of GDP), with the rest covered by health insurance contributions and co-payments. Given that the elderly are exempt from health insurance contributions, and pay only small co-payments, the future aging of the population is expected to significantly raise the proportion of health benefits covered by government subsidies.

The second source of unfunded liabilities is potential losses on government assets. A portion of the government's assets represent soft loans that may not be repaid. Many large public or joint public–private infrastructure projects financed from the Fiscal Investment and Loan Program (FILP) loans generate less revenue than budgeted, which may imply significant contingent liabilities of the government. For example, much of the substantial debt – 3 percent of GDP – of the now privatized Japan National Railways is owed to FILP. Since most of this debt will never be repaid, the debt will eventually have to be covered from the government budget. Other public corporations with large accumulated FILP debt include the Japan Highway (4 percent of GDP) and Housing and Urban Development Corporations (2.5 percent of GDP).

The third source of unfunded liabilities is the explicit and implicit government guarantees of private sector lending. Explicit guarantees are extended by FILP and other government entities to encourage lending by private financial institutions. Examples are guarantees of bank deposits by the Deposit Insurance Corporation, and guarantees of lending by credit cooperatives to small- and medium-sized enterprises. Although these guarantees do not entail fresh government lending, should the guaranteed loans not be repaid, the government must cover the loans from the budget. The total amount of outstanding government-guaranteed bonds and loans amounted to about 10 percent of GDP in 2000. Although historically only about 1 percent of government-guaranteed loans are never repaid, if the Japanese economy worsens the percentage of unpaid loans could soar (Bayoumi, 1998).

In addition to the explicitly guaranteed government loans and bonds, there are the *implicitly* guaranteed government loans. Historically, the Japanese government has shown willingness to cover the irrecoverable problem-loans of private financial institutions. For example, in 1998, the government authorized 60 trillion yen (12 percent of GDP) in public funding to cover the irrecoverable loans of private banks.[2] This willingness represents implicit guarantees, and these guarantees are contingent liabilities of the government. In 2000, outstanding loans minus the capital and liquid assets of financial institutions was about 200 percent of GDP. If, as some bank analysts estimate, 10 percent of the loans are irrecoverable, then the cost to the government of these implicit guarantees could be as high as 20 percent of GDP.

Fiscal sustainability and intergenerational wealth distribution

The sharp increase in Japanese government debt in the 1990s has raised questions about the sustainability of this debt, and much policy work has been done in this area. Clearly, at current Japanese government fiscal deficit levels, the government debt will keep on growing. For given growth and interest rate assumptions, the fiscal surplus *exclusive of net debt interest payments*, or the *primary* fiscal surplus, necessary to stabilize the debt–GDP ratio is:

$$b = \frac{(r - gr)*d}{(1 + gr)},$$

where b is the primary surplus–GDP ratio, r is the long-run real interest rate, gr is the long-run real growth rate of GDP, and d is the debt–GDP ratio. For example, assume that r and gr are 0.06 and 0.012. To stabilize the debt–GDP ratio at the current net debt–GDP ratio of 0.85, the government will have to run a primary fiscal *surplus*–GDP ratio of almost 5 percent. Given the current cyclically adjusted primary fiscal deficit–GDP ratio of about 4 percent, to keep the debt–GDP ratio at the current level, the required increase in the primary balance would be 9 percent of GDP. This required adjustment in the primary balance is somewhat higher (because of the higher long-run real interest rate assumption) than, but otherwise within, the range (3–9 percent) reported in IMF (2000), and Jinno and Kaneko (2002).

It would be very difficult for the government to achieve this adjustment in the primary balance through fiscal reform in the near future. Thus, some analysts have argued that the government may attempt to lower the real value of the debt through inflation (Jinno and Kaneko, 2000; Miyao, 2001). Since Japanese government bonds pay a nominal coupon rate, inflation will lower the real return on bonds, and the real interest rate. From the equation above, we can see that the fall in the real interest rate will lower the required adjustment in the primary deficit.

In addition to debt-sustainability, many analysts have focused on the distributional effects of government debt (Sakurai, 1998; Jinno and Kaneko, 2000; Miyao, 2001). The benefits of current government spending largely fall on current generations, while the cost, in higher taxes or inflation, is borne by future generations. Thus, debt-financed government spending entails a redistribution of resources from future generations to the current generation. These redistributional effects are particularly high for social security and healthcare expenditures, where the benefits fall almost entirely on the elderly and the costs are borne by the young. Government spending that raises the future productive capacity of the economy – such as in education and physical infrastructure – will bestow benefits, as well as costs, on the young, and the redistributional effects are smaller.

Takayama and Kitamura (1999) identified large intergenerational imbalances in Japan, with future generations expected to pay about three or four times more in net taxes and social security contributions than the generation currently in retirement. Of course, these redistributional effects depend on Japanese households being non-Ricardian. If the Japanese elderly raise their bequests to completely offset the costs to the young of the higher government debt, then government debt has no redistributive effects.

Recent fiscal reform measures

To restrain increases in the debt–GDP ratio, the government proposed several fiscal reform measures in the 1990s. However, most of the measures were postponed or abandoned, as the government sought to stimulate demand, in light of the very weak domestic economy. Specifically, in 1997, the government enacted the Fiscal Structural Reform Law. The goal of the 1997 Law was to eliminate fiscal deficits by 2003. This goal was not realised.

The main instruments in the 1997 Law were cuts in government consumption and investment, rather than tax increases. Public investment spending was to be cut by 7 percent in 1998, with zero nominal growth until 2001; and energy, education, and overseas development assistance were to be cut by 10 percent in 1998, with annual reductions until 2001 (Ishii, 2000, p. 149). However, with the severe recession of 1997, fiscal consolidation was put on hold and a wide range of pump-priming measures were introduced. In particular, rather than declining, public investment for 1998 increased by over 10 percent.

Areas where the 1997 Law made progress were in healthcare and social security reform, which are important, given the aging of the population. In 1997, the contribution rate and co-payments by patients for the government health insurance schemes were increased sharply

(Ishii, 2000). In particular, patients aged 70 and above are required to pay a fixed proportion (10 percent) of their medical costs. The government also capped prescription drug prices, which are very high in Japan. In 2000, a pension reform bill based on the 1997 Law passed the legislature. The bill contained provisions to cut lifetime pension benefits by about 20 percent. Specifically, pension benefits for new retirees were cut by 5 percent; the age of pension eligibility will gradually (from 2013) be raised from 60 to 65; and pension benefits will be subject to an earnings test. Analysts have estimated that the 2000 pension reforms will reduce government unfunded social security liabilities from the current 60 percent of GDP to 30 percent of GDP (IMF, 2000).

Looking forward, the government is planning on implementing further budget cuts, once the economy fully recovers. Recently, a political commitment was made to cap government deficit bond issues at 30 trillion (0.6 percent of GDP) in 2002. Although “deficit” bonds reflect only a portion of total government borrowing, this bond issuance ceiling should help lower future fiscal deficits.

As stipulated in the 1997 Law, public investment is due for further cuts. Criticism has been directed at the economic value of the public works projects, as well as contracting procedures. To address the efficiency issues, new cost–benefit guidelines for review of public works projects were announced. Contracting procedures have also been reformed. Public works projects in 2002 were cut by 10 percent. In addition, the improvement in the economy in 2003 has allowed public works projects to be cut deeper than planned. Moreover, the government intends to change the form of public works from the traditional type of construction projects to broader social infrastructure investment, environment and energy-related projects, telecommunications networks, scientific research, nursing homes, and the like.

With regards to healthcare, contribution rates and co-payments, especially by the elderly, were increased. The government’s stated goal is to restrict the growth of medical costs of the elderly to no more than the rate of inflation. The age of eligibility for special elderly medical care will eventually be raised from 70 to 75. Further cuts are also planned in social security; for example, there are suggestions that average benefits should be reduced further by about 40 percent, to avoid large increases in future contribution rates (Sakurai, 1998).

Aging and support ratios

The economic consequences of population aging depend on the nature of underlying demographic change as well as on the relationship

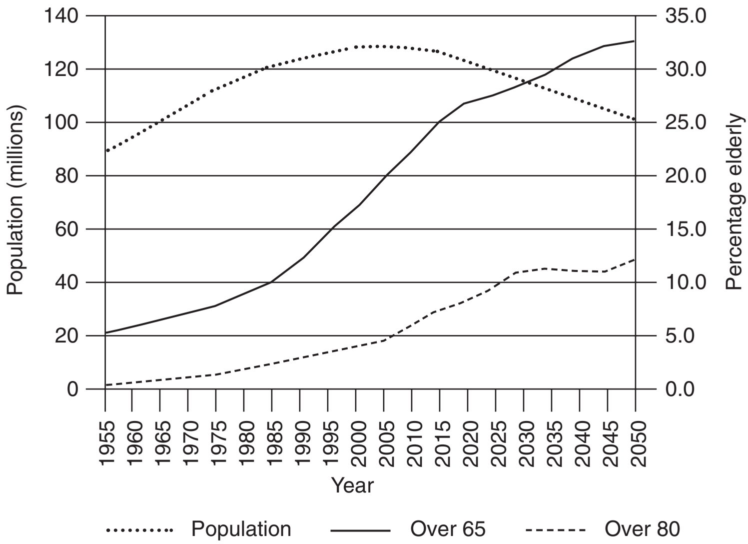

Chart 4.2 Population and elderly projections

between the resource needs of individuals of different ages. Chart 4.2 plots the Japanese government's projections of the country's population and the percentage of the total population that is elderly.[3] Japan's population is expected to peak at close to 130 million in 2005, then gradually decline to about 100 million by about 2050. The percentage of the population over the age of 65 has grown rapidly, especially since 1980, and now stands at about 15 percent. By 2020, that percentage should approach 25 percent, and by 2050, 33 percent. By 2030, the percentage of the very old (aged over 80) should exceed 10 percent. These rates of population aging are much higher than in other countries. For example, in the US, only about 15 percent of the population will be above the age of 65 by 2025.

Declining fertility is the principal source of the changing demographic patterns (Takayama, 1998). In the years following the Second World War, the total fertility rate in Japan rose to about 4 per household by 1950. However, fertility declined sharply during the 1970s and 1980s. It was 2.1 per household in 1974, but 1.4 per household by 1997. The total fertility rate is projected to decline to about 1.2 per household over the next several decades. Moreover, Japan has allowed almost no immigrants, who, especially in English-speaking countries, have helped to keep the population young. These trends have important implications for the demographic structure of the population over the next half-century.

The support ratio

Demographic shifts affect the economy's consumption opportunities because they change the relative sizes of the self-supporting and dependent populations. Following Cutler, Poterba, Sheiner, and Summers (1990), we summarize these changes by the *support ratio,* denoted by α, which we define as the effective labor force, LF, divided by the number of consumers, CON,

$$\alpha = LF/CON.$$

The first issue in measuring the support ratio concerns the relative consumption needs of people at different ages. We assume that all people have identical resource needs so that:

$$CON = \sum_{i=1}^{99} N_i,$$

where N_i is the number of people of age i.

The second issue concerns the effective labor force. The first measure, $LF1$, assumes that all people aged 20–64 are in the labor force, while individuals 19 and under or 65 and over are not:

$$LF1 = \sum_{i=20}^{64} N_i.$$

This measure is used by the Japanese government in projecting the future labor force.

The second measure, $LF2$, recognizes that both human capital and labor force participation rates vary by age. We use data on the average 1990 earnings of people of each age (measured in 5-year intervals) and sex (W_{ij}, where i is age, and $j = M$, male or F, female) along with data on age- and sex-specific labor-force participation rates (PR_{ij}).[4]

$$LF2 = \sum_{i=15}^{80} (W_{iM} * PR_{iM} * N_{iM} + W_{iW} * PR_{iW} * N_{iW}).$$

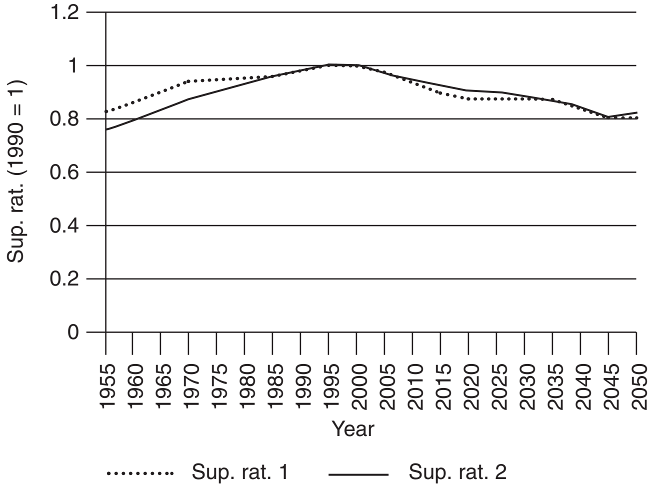

Chart 4.3 Support ratios

This measure assumes that earnings accurately reflect a worker's human capital. If age–earnings profiles are hump-shaped, then labor productivity peaks in middle age. Thus, this measure recognizes that the human capital of a society with a high fraction of people in middle age is higher than that of a society with many older workers, whose earnings and labor-force participation rates decline.

The two support ratios using the two measures of the labor force are reported in Chart 4.3. The two support ratios have very similar patterns, especially after 1995. Using *LF*1, the support ratio declines from 1 in 1990 to 0.80 in 2050. Using *LF*2, it declines to 0.78. Between 2005 and 2030, the second support ratio declines more than the first, owing to the fall in high-earning, prime-age males. Given the similarity in the two support ratios, for the remainder of this chapter, I focus on the government measure, *LF*1.

Demographic change, the optimal saving–investment balance, and government deficits

Here the impact of demographic change on future Japanese saving and investment rates, and government deficits, is simulated using the government's measure of the support ratio, LF1. I adopt the neoclassical framework and assume that consumers maximize lifetime utility. Households base their consumption on both current and future income. Thus, consumption can be detached from current income; households adjust their saving to keep consumption growth constant into the future.

In the simulations, I adopt the standard small-country, open-capital-markets, Ramsey optimal-growth model (Barro and Sala-i-Martin, 1995, chapter 3). Specifically, I closely follow Cutler, Poterba, Sheiner, and Summers' (1990) modifications to the Ramsey model, in examining the impact of changing demographics on savings and government deficits.[5] With the model, I can examine how a society can adjust its saving, investment, and government deficits in response to changes in demographic variables. The model simulations use plausible parameter values; and the projected future paths of the support ratio, and the growth in the population and the labor force.

Sketch of the simulation results

As consumers seek to smooth consumption over time, consumption per capita grows at a constant rate. However, as the support ratio falls, GDP per capita grows at a slower rate than consumption per capita, which raises the consumption–GDP ratio. That is, as the number of workers relative to population falls, there are relatively fewer people sustaining output (GDP), while consumers remain relatively numerous, raising the consumption–GDP ratio. The rise in the consumption–GDP ratio lowers the private saving rate. The private saving rate is projected to decline from about 28 percent today to about 15 percent by 2020, and about 12 percent in 2035–40.

To reduce distortions, the government seeks to maintain a per capita tax level that grows at the rate of per capita consumption growth, implying a *rising tax–GDP ratio* (given slower growth in GDP per capita). The tax–GDP ratio is projected to rise sharply from 28 percent today to about 45 percent in 2020, to reach almost 50 percent in 2040. Although aging raises social security and healthcare spending, increasing the government spending–GDP ratio, the rise in the government spending–GDP ratio is lower than the increase in the tax–GDP ratio. Thus, the *government saving rate gradually rises*. The government saving rate rises from about 2 percent of GDP today to about 10 percent in 2020. However, the decline in the private saving rate is larger than the rise in the government saving rate, leading to a *fall in the total saving rate*, from 30 percent today to about 24 percent in 2020, and about 20 percent in 2040.

The rising government saving rate eventually offsets today's outstanding government debt–GDP ratio, future government spending, and public investment. Consequently, after initially increasing, the government debt–GDP ratio starts to decline in about 2020.

As the labor force declines (in absolute number), the need to equip workers with capital equipment decreases, and both *private and public investment rates fall*, resulting in a decline in *total investment*. The private investment rate falls from 20 percent today to about 16 percent in 2040; the public investment rate falls from 8 percent today to about 6 percent in 2040.

The fall in total saving is sharper than the fall in total investment, resulting in a *decline in the current account–GDP ratio* from 2 percent of GDP today to −1 percent of GDP in 2020, and eventually to −3 percent of GDP in 2040. Thus, after initially increasing, Japan's *net foreign assets–GDP ratio* starts to *decline* around 2020 and approaches zero by 2040.

Behavior of firms

We begin with the production function of a representative firm that uses both private and public capital as inputs:

$$y_t = \hat{k}_t^{\gamma} \hat{m}_t^{\gamma} \alpha^{1-\lambda} e^{ht} \tag{4.1}$$

where y_t is gross output per population (capita), $\hat{k}_t$ is the private capital stock per effective population, $\hat{m}_t$ is the public capital stock per effective population, and h is the constant rate of labor augmenting technical progress. Constant returns to scale in private and public capital are assumed, so that $(1 - \lambda) = 2\gamma$. In the above production function, public capital is essential for the productivity of private capital, i.e. public capital is not wasteful. This goes against conventional wisdom regarding the wastefulness of recent public investment in Japan. In this production function we are mostly concerned with the productivity of public capital over the long run (over decades), and public investment was certainly productive in Japan in the past (1960s and 1970s), and may be productive again in the future.

Note that when $\hat{k}_t$, $\hat{m}_t$ and the support ratios are constant, output per capita grows at a constant rate h. When the support ratio is falling, however, output per capita grows at a slower rate than h.

The supply of private capital available to the firm depends on the global capital market; the marginal product of capital must equal $r + \delta$, where r is the gross international real interest rate, and δ is the rate of depreciation. We have:

$$\hat{k}_t = (r + \delta)(av\alpha_t^{1-\lambda})^{-1}\,\hat{m}_t^{\frac{v}{1-v}}\,, \tag{4.2}$$

and thus private investment per capita is:

$$\hat{i}_t = \dot{\hat{k}}_t + (n_t + h + \delta)\hat{k}_t \tag{4.3}$$

where n_t is the population growth rate. The paths of private capital and private investment are determined solely by the real interest rate, the rates of growth of the labor force and population, technical progress, and the path of public capital.

The government adjusts the level of public capital by changing the public investment rate, $\hat{j}_t$:

$$\hat{j}_t = \dot{\hat{m}}_t + \hat{m}_t(n_t + h + \delta). \tag{4.4}$$

Behavior of consumers

The consumption rate is determined from "forward-looking" household behavior. Assume that households wish to maximize their lifetime utility, U, given by:

$$U = \int_0^{\infty} \frac{c^{1-\theta}}{(1-\theta)} e^{nt} e^{-\rho t} dt \tag{4.5}$$

where c is consumption per capita, $1/\theta$ is the intertemporal elasticity of substitution, and ρ is the pure rate of time preference.

The budget constraint for households (in per-capita terms) is:

$$\dot{a}_t = \alpha_t w_t + (r - n_t)a_t - \tau_t - \frac{q\tau_t^2}{2} \tag{4.6}$$

where a_t is total assets per capita, which is comprised of private capital, government bonds, and foreign assets, which are perfect substitutes in international portfolios; w_t are wages; and τ_t is the lump-sum tax imposed on each person each period by the government. This lump-sum tax also imposes a "deadweight" welfare loss of $q\tau_t^2/2$ per person.

It can be shown (see the Appendix at the end of this chapter) that consumption per capita always grows at h. Thus, while consumption per capita grows at h, when the support ratio is declining, output per capita tends to grow at less than h (see the previous section). The consumption rate, c_t/y_t is rising, lowering the private saving rate.

The government budget constraint

Each period, the government issues government bonds, $\dot{b}$, to cover shortfalls in tax revenues:

$$\dot{b}_t = (r - n_t)b_t - \tau_t + g_t + j_t \tag{4.7}$$

where b_t is government bonds outstanding per capita. The increase in government bonds per capita is higher, the larger is the primary fiscal deficit, which is the difference between tax revenues per capita, and the sum of government consumption g_t and public investment j_t per capita.

As in Cutler *et al.* (1990), we assume that g_t is determined by age-specific patterns of government consumption.[6] Governments spend different amounts on people of different ages. Spending on education primarily benefits children, while the elderly are the primary beneficiaries of healthcare and social security. Thus, even without changes in the structure of government programs, demographic shifts can affect the level of g_t.

We calculate per capita *age-specific* government spending patterns for Japan, focusing on the three largest social expenditures: social security, healthcare, and education. For social security, we divide average social security expenditures in 1996–99 by the population over age 60. For healthcare, we allocate average healthcare spending in 1996–99 to different ages, using the age-specific expenditure patterns reported in Ishi (2000). For education, we divide total education spending in 2000 by the population between ages 5 and 20.

Demographic shifts can significantly alter government spending. Table 4.2 shows the projections of total government spending in 1995 yen and as a share of projected GDP. We assume that age-specific per capita expenditure patterns remain at the same *real level* between 2000 and 2040.[7] Consistent with current Japanese government objectives (Ishii, 2000), no real increases in age-specific healthcare and social security spending are allowed. That is, if the average 67 year old receives 190 thousand yen in government healthcare in 2000, an average 67 year old receives the same inflation-adjusted amount in 2035. Other government spending, mainly defense, policing, and administration, are assumed to always equal the average 1996–99 ratio to GDP of 5.6 percent.

Table 4.2 Projected government consumption, 2000–40

	Social security	*Health care*	*Education*	*Social security*	*Health care*	*Education*	*Other*	*Total*
	(in billions of 1995 yen)			*(in percent of GDP)**				
2000	57667	27271	16327	11	5.3	3.2	5.6	25.1
2005	65265	28471	15634	12	5.4	2.9	5.6	25.9
2010	74032	29462	15445	14	5.7	3.1	5.6	28.4
2015	78318	30550	15067	14	5.7	2.8	5.6	28.1
2020	78903	30659	14689	13	5.1	2.4	5.6	26.1
2025	79098	30089	13680	14	5.2	2.3	5.6	27.1
2030	79683	28392	12923	14	5.2	2.3	5.6	27.1
2035	81630	28764	12167	18	6.3	2.7	5.6	32.6
2040	81046	28407	11915	16	5.7	2.4	5.6	29.7

*GDP projections are from the simulation model in the text.

In my projections, government spending rises from 25 percent of GDP in 2000 to 28 percent in 2015, and 33 percent in 2035. While education spending is projected to decline, healthcare, and especially social security spending, are projected to increase sharply as the population ages. In particular, in 2035, the population over 65 increases significantly (Table 4.2), leading to sharp increases in social security and healthcare spending.

It can be shown (see the Appendix) that the government will choose to levy a per capita lump-sum tax of τ_t that grows at the rate of consumption per capita growth, h. The government must then satisfy the following intertemporal budget constraint:

$$\tau_0 = \int_0^\infty e^{ht} R_t \mathrm{d}t = b_0 + \int_0^\infty (g_t + j_t) R_t \mathrm{d}t \tag{4.8}$$

where b_0 is the government debt outstanding per person today, and R_t is a discount factor. This budget constraint says that the present value of tax revenues must equal the present value of government consumption plus public investment. If government tax revenues are insufficient to cover government spending today, then in the future, tax revenues must exceed government spending for the government to satisfy its intertemporal budget constraint.

Projections of optimal private and government saving, private and public investment

As in Clarida (1993), I assume that the government maximizes lifetime household utility [Eq. (4.5)], with respect to c_t and $\hat{j}_t$ subject to the constraints. The simulation model uses plausible parameter values, projected future support ratios (*LF*1), and future rates of population and labor force growth. In the simulations, I allow support ratios and rates of population and labor force growth to change every five years. Details of the simulation are given in the Appendix. For comparability with actual National Accounts data, the simulations are expressed in terms of ratios to GDP. The model is calibrated so that the starting year (2000) corresponds to the average of the actual data for 1996–99 (the data in Tables 1.1 and 4.1). For the initial government debt–GDP ratio, the ratio of *net* debt–GDP is used, *inclusive* of the social security net assets (equal to 45 percent of GDP). Net future social security unfunded liabilities are accounted for by explicitly incorporating future social security benefits and contributions into our model. Of course, as alluded

Table 4.3 Projection of saving and investment rates, government debt, current account (in percent of GDP)

	Private saving	*Tax rate*	*Government saving*	*Private investment*	*Public investment*	*Net gov. debt/GDP*	*Curr. acc./GDP*
2000	28	28	1	20	8	45	2
2005	28	31	0	20	8	88	0
2010	26	38	2	19	7	128	2
2015	18	43	6	18	7	153	−1
2020	15	45	10	18	7	155	−1
2025	13	45	9	17	6	140	−1
2030	11	46	10	17	6	122	−1
2035	12	47	7	16	6	102	−3
2040	6	49	13	16	6	89	−3

to earlier, there are other unfunded and contingent liabilities. The starting-year debt–GDP ratio should be viewed as the lower bound.

There is one exception to this starting-year calibration exercise. Between 1996 and 1999, the total taxes (including social security contributions) collected by the government averaged about 27 percent of GDP. This tax rate was found to be simply too low to be consistent with the model's tax smoothing and the satisfaction of the government budget constraint [Eq. (4.4)]. This is another way of saying that unless the government starts running primary fiscal surpluses, government debt will not be sustainable. Thus, I depart somewhat from tax smoothing, and allow taxes per capita to gradually increase from the year 2000 rate of 27 percent.[8] The government's intertemporal budget constraint is still satisfied, which means that future tax rates must be higher than when taxes are perfectly smoothed.

Table 4.3 presents my projections. Private saving rates decline a few percentage points until 2010, and then decline rapidly from 2010 to 2040. This pattern is a result of shifts in the support ratio and increases in tax rates, which reduces disposable income. Although consumption per capita always grows at a constant rate of h (equal to 1.2 percent), as the support ratio falls output per capita growth is lower. Essentially, consumers are seeking to smooth their consumption when income is growing very slowly by lowering their saving rates.

Under tax smoothing, taxes per capita increase at a constant rate, while output per capita grows at a slower rate; thus the tax–GDP ratio rises over time. As mentioned above, the actual tax rate in the starting year (average, 1996–99) at 27 percent of GDP, is lower than what is necessitated by tax smoothing (33 percent) and the satisfaction of the government's intertemporal budget constraint. That is, unless current tax rates are increased, the government will not be able to satisfy its intertemporal budget constraint. I allow taxes per capita to increase more rapidly between 2000 and 2015, and then smooth increases in taxes per capita from 2015 onwards. The sharp increases in tax rates between 2000 and 2015 also contribute to the decline in private saving rates by lowering disposable income. By 2040, tax rates need to increase to almost 50 percent of GDP for the government to recoup its current outstanding net debt (45 percent), projected future spending (Table 4.2), and projected public investment (Table 4.3).

Government saving rates rise from about 1–2 percent of GDP in 2000 to about 10 percent in 2020, owing to the increased tax receipts. Government saving rates decline somewhat in 2035 because of the spike in the over-65 population. Private and public investment rates gradually fall over time, as the need to equip workers with capital equipment declines. Because of high government saving and falling public investment, the fiscal surplus (government saving minus public investment) turns positive after 2020. Consequently, the government net debt–GDP ratio increases until 2020, and falls thereafter. The decline in the net debt–GDP ratio is fairly rapid between 2020 and 2040.

The decrease in private saving is sharper than the increase in government saving, resulting in a fall in total saving. The total saving rate declines from about 30 percent in 2000 to 24 percent in 2015, 21 percent in 2030, and 19 percent in 2040. Total investment declines from 28 percent in 2000 to 25 percent in 2015, 23 percent in 2030, and 22 percent in 2040. Thus, the decline in total saving is sharper than the decline in total investment, leading to declining current account surpluses. Japan's current account surplus is projected to become negative in 2015, and remain negative from then onwards. Consequently, Japan's net foreign assets, after peaking relative to GDP in 2015, will start to decline and will approach zero by 2040.

Comparison with earlier projections of the Japanese saving–investment balance and the government budget

Many studies have projected the impact of demographic change on the Japanese saving–investment balance, although studies projecting future Japanese government budget balances are fewer. Despite the variety of methodologies and modeling assumptions, most earlier studies – like the study here – project declining saving and investment rates, with saving rates declining faster than investment rates, leading to current-account deficits between 2025 and 2040. On the whole, the earlier studies predict deteriorating government budget balances, unless there is drastic fiscal reform. The proposed fiscal reforms in the earlier studies range from tax increases to cuts in social security benefits and in public investment. In this study, I have focused on tax increases.

Most earlier studies projecting future saving and investment rates are based on *ad hoc* econometric specifications. Horioka (1991, 1992), using reduced-form time-series econometrics, estimates that Japanese private saving will become −15 percent by 2020. Oishi and Yashiro (1997) develop a small (seven equations) simultaneous-equation econometric model. They project that in 2025, the gross saving rate and the gross investment rate will reach 6 percent and 14 percent of GDP, respectively, leading to a net export deficit–GDP ratio of 8 percent. The Economic Planning Agency's (1997) large (270 equations) simultaneous equation model of the Japanese economy projects that by 2025, the gross saving and gross investment rates will be 23 percent and 25 percent, respectively. Their model projects that by 2050, the gross saving and gross investment rates will be 15 percent and 20 percent, respectively. Also using a large-scale macroeconometric model, the Japan Center for Economic Research (2000) estimates that in 2025, the private saving rate will be 3.7 percent.

Recently, researchers have made projections based on explicit utility-maximizing frameworks. Auerbach *et al.*'s (1989) overlapping-generations model – based on the life-cycle hypothesis, where agents reduce their wealth in old age – finds that Japan's saving–investment balance will narrow until 2030, and become negative in 2035. Miles and Cerney (2001) apply Auerbach *et al.*'s model to the closed economy, and project that Japan's gross saving rate will be 18 percent by 2020, and 14 percent by 2040. McKibbin and Nguyen (2001) develop a multi-country model to simulate the economic effects of Japan's aging population. Since in their model Japan is no longer "small", changes in Japan's saving and investment behavior can impact international real interest rates, unlike in this study. In addition, the authors adopt the Blanchard (1985) saving function, where agents build up their financial wealth in their younger years to maintain a target level of consumption in their elderly years. McKibbin and Nguyen project that by 2040, the gross saving and the gross investment rates will be 20 and 22 percent, respectively, leading to a current account deficit–GDP ratio of −2 percent.

With regards to the effect of aging on Japanese government budget balances, most earlier research projects falling tax revenues and rising pension benefits. Masson and Tryon (1990) find that between 2000 and 2025, the budget deficit–GDP ratio will deteriorate by 2.5 percentage points, owing to increasing pension burdens. The Japan Center of Economic Research (2000) estimates that the government saving–GDP ratio will decline from 2 percent in 2000 to −2.4 percent by 2025. The Economic Planning Agency's (1997) simultaneous equation model predicts a −0.5 percent government saving rate in 2025, and a 0.3 percent government saving rate in 2050. To achieve this budget turnaround, tax rates (total taxes plus social security contributions, divided by GDP) are projected to gradually increase from the current 28 percent to 35 percent in 2025 and remain at that level thereafter. Muhleisen (2000) uses a simultaneous-equation econometric model and projects steadily improving government finances. The fiscal balance (government saving minus public investment) deficit–GDP ratio improves from the current −7 percent to 1 percent in 2025 and zero thereafter, mainly owing to an immediate reduction in the public investment rate from the current 8 percent to 4 percent.

Conclusion

The rapid aging of the population currently under way in Japan should lead to falling private saving and private investment rates over the next 25 to 40 years. Given current government debt levels and projected government spending and public investment, future taxes must be raised sharply for the government to remain solvent. My model predicts that taxes as a percentage of GDP must increase from the current 28 percent to 45 percent by 2025, and 50 percent by 2040. Assuming that the government raises future taxes, the current government fiscal deficit will turn to surplus over the next 25 years, leading to a fall in the government debt thereafter. Alternatively, if taxes are not raised, the government must sharply cut social security spending and public investment. However, if public investment is necessary for production, as it is assumed in this study, cutting public investment too sharply may be unwise.

Admittedly, the assumptions underlying my projections are somewhat special. I have assumed that Japanese households are dynastic, and do not follow life-cycle behavior. The implication of dynastic households is Ricardian equivalence, that government deficits do not affect the intergenerational distribution of wealth. Japanese citizens are mostly concerned about the unfairness of large unfunded liabilities in the Japanese social security system; the system transfers wealth from the current young to the current elderly. Because in my model I assume that the elderly offset their net benefits from social security by leaving larger bequests to the young, unfunded social security liabilities have no redistributional effects, although the liabilities certainly affect future tax rates and the division of total saving into private and government saving.

In life-cycle models, population aging causes aggregate private saving to fall by increasing the proportion of those who are bringing down their wealth (dissaving), and decreasing the proportion of those accumulating wealth (saving). In my dynastic model, population aging causes aggregate private saving to fall by raising the consumption rate (consumption to GDP ratio). The consumption rate rises because while consumption per capita growth is reasonably constant (in open capital markets), output per capita growth is lower (owing to the decline in the number of workers relative to the population). However, given the empirical evidence in Japan against the life-cycle hypothesis (Horioka, 2001), I believe my assumption of dynastic households is as plausible as most alternatives about Japanese household behavior.

Another special assumption underlying my projections is that real interest rates are determined internationally, and are exogenous to Japan. However, since currently Japan is a large capital exporter, if Japanese saving increases, international real interest rates should fall. Endogenous international real interest rates generally imply that saving and investment rates move closer together, which may imply an upper limit to future Japanese current account deficits (as in McKibbin and Nguyen, 2001).

In any event, most previous research – using a variety of assumptions and models – have predicted declining saving and investment rates as the Japanese population ages. Most previous research has also predicted worsening government budget deficits, unless there is fiscal reform. Thus, despite my special assumptions, the broad conclusions of my study are in agreement with those of most previous research.

Appendix

For convenience, we carry out the analysis in terms of effective population. The data for the population, n_t and the labor force, z_t (and therefore, α_t) are available only every 5 years. Thus, we assume that n_t and z_t discretely change only every 5 years; within any 5-year interval, say 2005 to 2010, n_t and z_t are assumed to be constant. From 2050 onwards, we assume that the values for 2050 hold.

From Eq. (4.1), real wages per effective population are:

$$\hat{w}_t = (1 - \gamma)\hat{y}_t.$$

In addition, we assume that there are adjustment costs to adjusting public capital, reflecting political lobbying costs, and bureaucratic implementation lags,

$$\text{adjcosts} = \hat{j}_t[1 + \frac{\chi}{2}(\frac{\hat{j}_t}{\hat{m}_t})], \tag{A4.1}$$

where χ reflects the costs of adjustment.

The government (or optimal planner) maximizes (4.5), in terms of effective population, with respect to Eqs (4.4), (4.6), (4.7), (4.8), and (A4.1).

Optimal consumption

The optimal path of consumption per effective population is:

$$\frac{\dot{\hat{c}}}{\hat{c}} = \frac{1}{\theta} * (r - \rho - \theta g).$$

To prevent consumption per effective labor from approaching zero asymptotically, we assume that $r = \rho + \theta g$, so that consumption per effective population is flat, or that consumption per capita grows at rate h. For h, we take, 0.012 (from Jorgenson and Nishimizu, 1978). Consumption per effective population at time 0, $\hat{c}(0)$ (in our case, the year 2000), depends in a complicated way on the parameters of the lifetime utility function, and the entire future paths of n_t, α_t, $\hat{\tau}_t$, $\hat{g}_t$, $\hat{j}_t$, $\hat{w}_t$, the parameters r, h, and the starting values, $\hat{a}_0$, and $\hat{b}_0$. Rather than calculating $\hat{c}(0)$, we assume that the actual level of consumption per capita between 1996 and 1999 (in the data) was at or near the optimal level. (Of course, we are not assuming that the Japanese economy was in steady state between 1990 and 1999; we are only assuming that consumers were optimizing in 1996–9).

Optimal public and private investment, output

The optimal path of public capital per effective population is:

$$\frac{\dot{\hat{m}}_t}{\hat{m}_t} = \left[\frac{1}{\chi}(\frac{\phi_t}{\mu_t} - 1) - (n_t + h + \delta)\right], \tag{A4.2}$$

where μ_t is the marginal utility of total assets, and ϕ_t is the marginal utility of public capital. Investment in public capital raises utility by raising output; on the other hand, investment in public capital lowers utility because total assets decline. Thus, ϕ_t/μ_t represents the shadow value of public investment. μ_t and ϕ_t evolve according to:

$$\dot{\mu}_t = (r - n_t + h)\mu_t \tag{A4.3}$$

$$\dot{\phi} = (h + \delta + h_t)\phi_t - \left[\frac{d\hat{y}_t}{d\hat{m}_t} + \frac{(\frac{\phi_t}{\mu_t} - 1)^2}{2\chi}\right]\mu_t \tag{A4.4}$$

where $d\hat{y}_t/d\hat{m}_t$, after substituting the expression for $\hat{k}_t$, [Eq. (4.2)], is a function only of $\hat{m}_t$. To determine the optimal path of $\hat{m}_t$, we discretize Eqs. (A4.2), (A4.3), and (A4.4), and simulate the path of $\hat{\mu}_t$, $\hat{\phi}_t$, and $\hat{m}_t$ forward, for plausible parameter values. For the parameters used in the simulations, we take values culled from the literature. For γ, h, δ, r, and χ, we use 0.20, 0.012, 0.13, 0.06, and 6. These values are fairly standard, except that since we have no empirical data for the adjustment speed of public capital, we took the value 6 from the private capital adjustment cost literature (Hayashi, 1982).

Our simulation strategy is to start from 2000 (from the actual values in the data, 1996–99), and simulate forward using the values of n_t and α_t. We imposed the condition that $\phi(0) = \mu(0)$, and chose a value of $\phi(0)$ so that the path of $\hat{m}_t$ did not vary much. As mentioned, we assume that the demographic variables change discretely only every 5 years. As it turned out, given our parameter values, new steady states for $\hat{m}_t$, ϕ_t, and μ_t were reached in about 5 years for all n_t and α_t.

Finally, from the path of $\hat{m}_t$; $\hat{j}_t$ [from Eq. (4.4)], $\hat{k}_t$ [from Eq. (4.2)], $\hat{i}_t$ [from Eq. (4.3)] and $\hat{y}_t$ [from Eq. (4.1)] can be calculated . Thus, we can calculate the private and public investment rates, which are depicted in Table 4.3.

Optimal government taxes

It can be shown that $\hat{c}(0)$ is maximized when $\hat{\tau}_t$ is constant (Barro, 1979). That is, the government maximizes the path of consumption (and of utility) when lump-sum tax taxes per effective population are constant, or that taxes per capita are growing at the rate h.

Satisfaction of the government's intertemporal budget constraint [Eq. (4.8)] means that the present value of lump-sum taxes per effective population is equal to the present value of government spending per effective population:

$$\hat{\tau} = \frac{\hat{b}_0 + \int_0^{\infty} \hat{g}_t R_t \mathrm{d}t + \int_0^{\infty} \hat{j}_t R_t \mathrm{d}t}{\int_0^{\infty} R_t \mathrm{d}t}, \tag{A4.5}$$

where the discount rate $R_t = \exp[-\int_0^t (r - h - n_v)\mathrm{d}v]$. From Eq. (A4.5), we calculate the optimal value of $\hat{\tau}_t$, from our estimated (exogenous) path of $\hat{g}_t$ (from Table 4.2), and our simulated path of $\hat{j}_t$ (from above). In practice, we truncate the integral at 2050, since beyond that, $\hat{g}_t$ and $\hat{j}_t$ are discounted to the extent that they are negligibly small. By dividing $\hat{\tau}_t$ by $\hat{y}_t$, we obtain the tax rate. Finally, from $\hat{c}_t$ (above), $\hat{g}_t$, $\hat{j}_t$, $\hat{y}_t$ and $\hat{\tau}_t$, we can calculate the private and public saving rates that are depicted in Table 4.3.

5 Aging and the role of foreign immigration in impacting saving, investment, and foreign capital inflows

Introduction

The last chapter showed that given current demographic projections, saving and investment rates will be declining, with saving rates declining faster than investment rates, leading to current account deficits and capital inflows. It also showed that government budget balances will continue to deteriorate unless there is drastic fiscal reform.

As in the last chapter, past work projecting the impact of demographic change on Japan's saving–investment balance are voluminous; see for example Horioka (1991, 1992), Oishi and Yashiro (1997), Auerbach *et al*. (1989), Miles and Cerney (2001), McKibbin and Nguyen (2001), and many others. The distinguishing feature of this chapter is that in my projections, I compare the capital inflows that will occur without immigration (the last chapter), to the inflows that occur *with immigration*. Consistent with the United Nations' recommendations, I assume that from 2005 to 2040, Japan will allow 400,000 immigrants annually. With the larger labor force from immigration, output will be 22 percent higher by 2020, and 50 percent higher by 2040. The higher output means that less capital needs to be imported. In my projections with immigration, by 2015 only 15 percent of Japanese consumption will be sustained by foreign capital inflows. To the best of my knowledge, the study described in this chapter is the first to simulate the impact of increased immigration into Japan on that country's saving–investment balances and capital inflows.

The benefits of immigration into Japan are a hotly debated topic. While in recent centuries Japan has allowed virtually no immigrants, immigration has been significant in some previous centuries. Some anthropologists believe that the import of wet-rice cultivation, and of iron and bronze tools and implements from China and Korea during the

Yayoi period (400 BC to AD 300) were accompanied by massive or at least modest immigration from those two countries (Seki, 2000). Japan's population at the beginning of the Yayoi period was estimated to be between 75 and 250,000; the population grew 70-fold during the Yayoi period. Some anthropologists also believe that during the Kofun period (AD 300 to 700), Korean, but not Chinese, immigration was extensive (Diamond, 1998). These Korean immigrants brought Buddhism, writing, horseback riding, and new ceramic and metallurgical techniques.

Immigration into Japan and support ratios

Between 1970 and the mid 1980s, Japan annually allowed between 20 and 30,000 immigrants. During the late 1980s and early 1990s, because of the severe shortage of labor, annual immigration increased to about 70 to 90,000 per year, but that number has declined in recent years. In terms of stocks, Japan's immigrant population numbered 1.5 million, or 1.2 percent of the population, with perhaps another 500,000 in illegal immigrants in 1997. This is contrasted with the US, which in the same year had a stock of 26 million legal immigrants, or 9.7 percent of the population. Annual flows of legal immigrants to the US is about 1 million (0.4 percent of the population), with an additional estimated illegal immigrant flow of 1 million.

The United Nations Population Division (1998) projects that to keep the size of the Japanese population constant at today's level of 127 million, Japan would need an average of 400,000 immigrants per year between 2005 and 2050. In my projections of the Japanese population structure *with immigration*, I assume that 200,000 men and 200,000 women immigrate annually. They are assumed to be equally divided between the age groups of 20–24 and 25–29. We also assume that all immigrant couples have two children each within five years of their arrival in Japan.

Under these assumptions, Chart 5.1 depicts the total population and the population over age 65, *with immigration*. Instead of peaking in 2005 at 128 million with immigration, the population peaks at 2015 at 135 million and stays at about that level.[1] The labor force is kept robust with immigration. The labor force is projected to slightly dip from 79 million to about 74 million in 2050.

By 2050, the immigrants and their descendents will comprise about 18 percent of the total population of the country. As immigrants reach age 65 after 2040, the elderly population increases somewhat. The proportion of those over the age of 65 reaches 25 percent in 2020, and

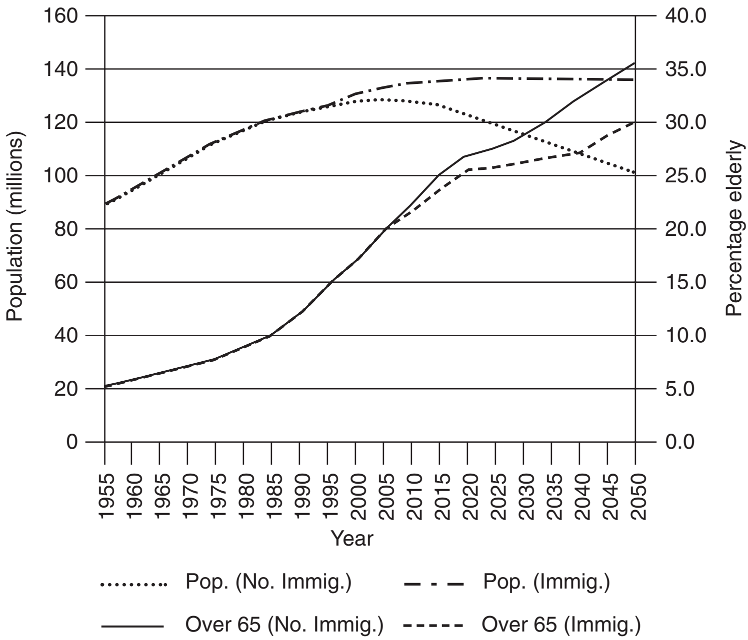

Chart 5.1 Population and elderly projections with immigration

29 percent in 2050. Thus, even with this immigration, the population of Japan will be considerably older than in the US.

Chart 5.2 plots the support ratios without (LF) and with immigration (LFIM). As the population falls, the support ratio declines under both scenarios, but the decline in the support ratio is much steeper without immigration. Without immigration, the support ratio falls from 1.0 in 2000 to 0.86 in 2025 and 0.80 in 2050. With immigration, the support ratio falls from 1.0 in 2000 to 0.89 in 2025 and 0.86 in 2050.

Projections of optimal saving, investment, government deficits, and capital flows with immigration

Table 5.1 presents my projections *with* immigration of 400,000 people a year. Private saving rates decline about 10 percentage points until 2015. The decline in private saving between 2010 and 2040, however, is much milder with immigration than without, owing to improvements in the

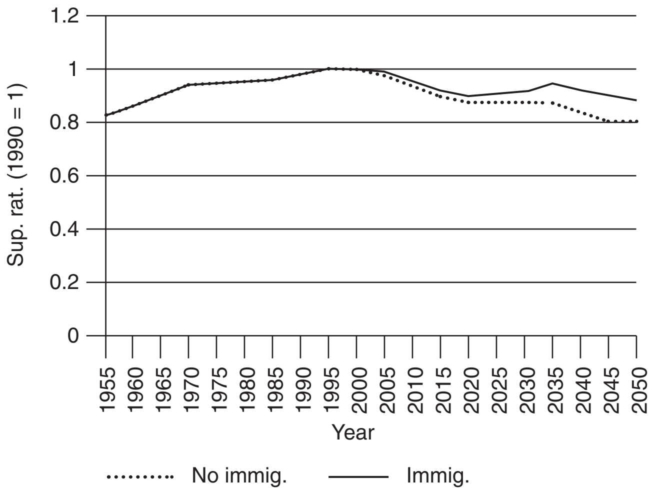

Chart 5.2 Support ratios: with and without immigrants

support ratio, especially after 2015. By 2040, private saving rates decline to about 10 percent of GDP.

With immigration, the growth in GDP is higher and projected government spending as a percentage of GDP is smaller, meaning that feasible tax rates can be lower. However, even with lower feasible tax rates, the actual tax rate in the starting year (average, 1996–99) at 28 percent of GDP, is below what is necessitated by tax smoothing (33 percent), and the satisfaction of the government's intertemporal budget constraint. Thus, as in Chapter 4, I allow taxes per capita to increase more rapidly between 2000 to 2015, and then smooth increases in taxes per capita from 2015 onwards. By 2040, tax rates need to increase to only 45 percent of GDP – instead of almost 50 percent without immigration – for the government to satisfy its intertemporal budget constraint.

Government saving rates rise from about 1–2 percent of GDP in 2000 to about 21 percent in 2040, owing to increased tax receipts. Private and public investment rates gradually fall over time, but the decline is less rapid with immigration, as the labor force stays roughly constant from 2005. The government net debt–GDP ratio increases until 2020, and falls rapidly thereafter.

The decrease in the private saving rate is somewhat larger than the increase in the government saving rate, resulting in a slight fall in the

Table 5.1 Projection of saving and investment rates, government debt, current account (with immigration) (in percent of GDP)

	Private saving	*Tax rate*	*Government saving*	*Private investment*	*Public investment*	*Net gov. debt/GDP*	*Curr. acc./GDP*
2000	28	28	2	20	8	45	2
2005	28	31	1	20	8	87	0
2010	27	37	3	19	7	124	−4
2015	20	42	7	18	7	142	−1
2020	18	44	9	19	7	142	−1
2025	16	44	10	18	6	132	1
2030	14	44	14	18	6	104	3
2035	14	44	17	17	6	58	3
2040	10	45	21	18	7	−7	7

total saving rate between 2000 and 2040. The total saving rate declines from about 30 percent in 2000 to 27 percent in 2020; rises to 28 percent by 2030, and bounces back to 31 percent by 2040. Total investment declines from 28 percent in 2000 to 25 percent in 2030–40. The current account deficit, while worsening to 4 percent of GDP in 2010, improves to rough balance by 2025, as the government saving rate increases.

6 Housing and Japanese saving and consumption behavior

Introduction

Chapters 2–5 investigated the impact of aging on Japanese household saving behavior and investment, and found that the aging of the population will significantly worsen Japanese saving, resulting in large future capital inflows. One factor that has not yet been considered is the impact of housing prices on Japanese saving behavior. Because of the scarcity of land, housing prices in Japan are quite high. One would imagine that these high land prices will affect Japanese saving behavior.

In this chapter, I will examine how land and housing prices impact the residential choice and saving behavior of the Japanese elderly. Total wealth is the sum of financial wealth and real estate wealth. Earlier, I showed that the Japanese elderly do not desire to bring down their total wealth. I attributed this to the desire of the elderly to leave bequests to the next generation. However, if there are constraints to bringing down their real estate wealth, then although the elderly may prefer to lower their total wealth, they may be prevented from doing so by the existence of these constraints. In this chapter, I examine whether the constraints on reducing real estate wealth are binding – that is, whether the elderly desire to reduce their real estate wealth, but are prevented from doing so. If constraints on reducing real estate wealth are binding, then the removal of these constraints may result in greater consumption and dissaving by the Japanese elderly.

Land prices, residential choice, and saving of the Japanese elderly

The life-cycle saving model developed in Chapter 4 assumes that changes in wealth levels are unconstrained for the elderly. Total wealth is defined as the sum of financial wealth and real estate (land) wealth.

For many of the elderly, the bulk of land wealth is equity in owner-occupied housing. Changes in housing equity may be constrained if there are costs to selling the house and moving into rental housing, or if there are imperfections in the home equity loan market.[1] If consumption of home equity is constrained by the capital market, then the failure to dissave from total wealth may be a result of this capital market constraint, rather than to the lack of desire to dissave. The elderly are simply unable to consume at an acceptable transaction cost the equity embodied in their owner-occupied home.

The constraint on the consumption of home equity exists only for the independent elderly. The intergenerational elderly are free to consume their housing equity by exchanging it for services from their children. For example, Ando (1985) calculates that on average, the present value of the goods and services rendered by the child to the elderly is about two-thirds the value of the assets the elderly had initially owned. Ando's raw data show that over 75 percent of the elderly's average net worth is in the form of housing. If Ando's calculations are correct, then the intergenerational elderly are on average consuming their home equity.

This chapter develops a simple two-period simulation model, in which the elderly's choice of housing type is made endogenous. The comparative-statics results of my model show that for plausible parameter values, the Japanese elderly desire to dissave from their home equity. For every simulation case, desired financial bequests are negative. These simulations suggest that the earlier estimation results should be interpreted with caution. It is conceivable that the intergenerational elderly, not facing the constraint, are bringing down their "actual" net wealth. Ando's empirical finding that the intergenerational elderly are dissaving may be correct.

The model

Assume that when the household head is aged 60, he maximizes the following rest-of-life utility function,

$$\frac{c^{1-a}}{1-a} + \frac{sH^{1-a}}{1-a} + \frac{bB^{1-a}}{1-a}, \tag{6.1}$$

subject to one of the three constraints,

$$\begin{aligned} W + y &= c + P(60) * H + S, \\ B &= S(1 - tf) * (1 + rf) + P(T) * H(1 - tb), \end{aligned} \tag{6.2}$$

or, the above two constraints plus S greater than or equal to zero, (6.3)

or

$$W + y = c + S + R * H$$
$$B = S * (1 + rf) * (1 - tf). \quad (6.4)$$

The definitions of the variables are:

T: The age of death of the elderly head, assumed to be age 85
W: Total tangible wealth at the end of age 59
B: Total bequests net of borrowing at age T
C: Non-housing consumption
S: Financial wealth at the end of age T
$P(60)$: The price of the owner-occupied home at age 60
$P(T)$: The price of the owner-occupied home at age T
H: The physical size of the home
a: Reciprocal of the Hicks–Allen elasticity of substitution
b: Intensity of the bequest motive
s: A constant which converts the home into a flow of housing services. The value of the constant may differ between the owner-occupied and the rented home
y: The sum of the present value of post-mandatory retirement earnings and the present value of social security benefits
R: Rental cost of rented housing
rf: Real interest rate on financial assets
tb: Inheritance tax on bequests of the owner-occupied home
tf: Inheritance tax on bequests of financial assets.
If T is 85, the consumption period will be 25 years = (85 − 60).

Constraint (6.2) applies when the household head decides to own housing. Constraint (6.3) applies when the head owns housing, but is prohibited by the financial market from consuming his wealth in real estate. Finally, Constraint (6.4) holds when the head decides to rent. The model above will be simulated with actual parameter values facing the elderly substituted in.

Results

Table 6.1 depicts the assumed and estimated parameter values facing the average Japanese elderly. Following Hayashi, Ito, and Slemrod (1988),

Table 6.1 Assumed and estimated simulation benchmark parameter values

Parameter
Assumed
Initial wealth (*W*)
Intensity of housing services (*s*)
Intensity of bequest motive (*b*)
Inverse of substitution elasticity (*a*)
Estimated
Present value of income (*y*)
Price of home at age 60 [*P(60)*]
Price of home at age *T* [*P(T)*]
Rental cost of rented home (*R*)
Interest on financial assets compounded for 25 years (*rf*)
Tax rate on financial bequests (*tf*)
Tax rate on real estate bequests (*tb*)
Tax rate on rental income (*tr*)

W and *s* are normalized to equal 1 and 0.15, respectively. It is assumed that services from owner-occupied and rental housing give identical utility flows for the same-sized house, and this assumption may bias the decision towards renting. Two values, 2 and 4, are tried for *a*, implying elasticities of substitution of 0.5 and 0.25, while *b* is allowed to range from 0 to 2; the latter is the Barro (1974) altruistic case: the elderly person is altruistic to the extent that he lets all future generations consume at the same real level as himself.

Simulations (not shown) predict that when the elderly person faces Constraint (6.2), for all values of *a* and *b*, then he will never choose to rent and *S*, financial wealth, will always be negative. He will decide to consume part of the equity embedded in his home. Since real housing prices are expected to rise at a rate higher than *rf* – the real interest rate on financial assets – the elderly person will invest his entire *W* in housing. Given the high relative price of housing in Japan, the value of the home at death will always be larger than what the average elderly person desires to bequeath. Borrowing from home equity lets him adjust his net bequest to his desired level. The constraint on second mortgages for the Japanese elderly is therefore always binding.

The binding borrowing constraint on home equity helps explain why the elderly in Japan do not dissave from their wealth in real estate. The average elderly person desires to consume his wealth in real estate, but is prevented from doing so by the binding constraint. As Ando (1985) argues, it is thus likely that the unconstrained intergenerational elderly are even today dissaving. The removal of the home-borrowing constraint should increase dissaving by the independent elderly in the future, and should reduce the propensity of the Japanese to form intergenerational households.

7 Conclusion and lessons for developing countries

Conclusion

The population base in Japan is rapidly growing older. This book examined the consequences of that aging on Japanese saving, investment, and budget balances. I have shown that immigration may help somewhat reduce the negative impact of aging on Japanese saving, and particularly on budget balances. A resumption of strong growth in real GDP would also reduce the need for spending and tax adjustments. If real interest rates are 3 percent, a real GDP growth rate of slightly in excess of 3 percent can imply falling debt–GDP ratios. An aging population does not necessarily mean that Japan will sink into international oblivion. Certainly, Japanese policymakers are aware not only of the problems associated with aging, but also of a slew of proposals to address the problems, both directly and indirectly, through removing the impediments to growth.

In this book, I showed that Japanese saving and investment are determined by fundamentals. In particular, saving in Japan is determined by growth and demographics. Thus, developing countries, for example, cannot change their saving rates via public policy. However, public policy can help transfer funds from the small, informal sector, where returns to investment are small, to the large, modern sector, where the returns to investment are high. For example, in Japan, in the pre-war period when the country was still developing, the Postal Saving system was created to transfer funds from the small, local sector to the modern efficient sector.

The Japanese government introduced the Postal Saving system to solve difficult market failure problems in the Japanese pre-war private banking system. Funds collected from Postal Saving were transferred to the coffers of the Japanese Ministry of Finance, and in the pre-war period, the funds were used as credit directed to sectors deemed strategic by the Japanese government. In the pre-war period, the priority sectors were in heavy-industrial manufacturing.

Problems with Japanese banks in the pre-war period

The early Japanese banking laws such as that of 1890 promoted open competition. As the Meiji period (1868–1914) progressed, entrepreneurs founded many banks. After the 1890 Act, the number of private, commercial banks jumped from 678 in 1893 to 1802 in 1900. For our purposes, there were two types of private, commercial banks: the large Zaibatsu affiliated banks, and the smaller private banks. The Zaibatsu banks such as Mitsui and Yasuda, because of transactions costs, would only accept deposits from large firms and rich entrepreneurs, merchants, and landowners (Asakura, 1988). Mitsui and others wanted to become investment banks, making money by investing their own capital.

The smaller private banks mostly operated in rural areas and port cities, and engaged in commerce and production, in addition to finance. Much of the lending was very speculative – in stocks and in land. Some industrialists founded private banks to finance start-ups and affiliated trading companies. An example is the bank started by local sake brewers, the Nada Shogyo Ginko in Hyogo prefecture (Patrick, 1966).

The management of these small banks was often unscrupulous. Teranishi (1982) gives an example of a small private bank that collected deposits in Chiba prefecture in the morning, closed shop, and moved to Kanagawa prefecture in the afternoon to collect more deposits. When bank examiners descended on the bank the next morning, the bank had already moved to Saitama prefecture. The bank had no records of the collected deposits, and the officers and managers of the bank had not shown up at work for several months.

In addition to unscrupulous management, a problem common to the small private banks was that they were too dependent on one borrower or industry. When the borrowing firm failed, the bank often failed as well. The failed Fifteenth bank, for example, mainly loaned to Kawasaki Shipping (a shipping company). During the world-wide slump in shipping in the mid 1920s, Kawasaki Shipping could not meet its loan obligations, worsening the balance sheet of the Fifteenth bank.

These examples suggest that there were apparently severe informational problems inherent in the Japanese pre-war private banking system. Given the unobservability of the portfolio holdings of the banks, the average depositor probably could not discriminate between a "good" small bank and a "bad" one. Theories of adverse selection and moral hazard pointed out that banks would likely be constrained in the quantity of deposits that they collected (Stiglitz and Weiss, 1981). Believing that the banks that catered to him were on average unsound, the lender, the small saver may have rationed his lending.

Rotating credit associations and other informal financial institutions may reduce moral hazard through "peer pressure" (Stiglitz, 1990). However, the contract that ensures repayment by the borrower may require that the saving be invested locally. For example, in Banerjee, Besley, and Guinnane's (1992) model of a German credit cooperative, a non-borrowing member is assumed to observe the quality of the project undertaken by the borrower. Clearly it would be more difficult to observe projects that were not local or were unfamiliar to the association members.

In a developing country like pre-war Japan, many of the projects in the modern sector involved advanced technology that was unfamiliar to most participants in the informal financial markets. Familiar projects in the informal, traditional sector, however, may not be where the social returns to investment are the highest. For example, DeLong and Summers (1991) showed that the social returns to equipment investment are higher than the returns to investment in other physical assets, although the private returns are the same.

Stiglitz (1993) offers another reason why private markets may be unable to allocate capital optimally. Given that private banks must scrutinize loan applications carefully, it may be difficult for banks to screen for a broader set of criteria, and in any case, private banks will not much care whether the difference between the social and private returns are large. Sectors in which the gap between the social and private returns are large may be targeted with directed credit. These sectors may include technology-intensive sectors, and export-oriented industries.

Because of these reasons, the government may be able to improve upon the private allocation by transferring funds that otherwise would have been invested in the rural sector to the modern, capital intensive sector. The pre-war Japanese government's intervention in the financial system may have helped solve the twin problems of (a) alleviating the information problems inherent in introducing private modern banking in the informal sector; and (b) the need to finance the modern sector. An important example of the Japanese government's intervention was the founding of the Postal Saving system in 1875.

The pre-war development of the Japanese Postal Saving system

Japan was the fourth nation in the world to introduce postal saving, after Britain, New Zealand, and Belgium. The system started in August 1875 when Hisoka Maejima, the Postal Minister, started accepting postal deposits at several major branches of the postal service. At first there were only 18 branches in Tokyo and one in Yokohama that accepted postal deposits. The number of offices grew to 89 in 1876 and 161 in 1877, and the branches were mainly in the major cities of Tokyo, Kyoto, Kobe, and Osaka. It is remarkable that the Japanese Postal Saving system was started a scant six years after the Japanese Postal Ministry itself was established in 1869.

At first, deposit growth was slow, and initially most of the depositors were Post Office officials and mail collectors. To popularize the system, the government Postal Bureau accelerated its public relations campaign, and sent out pamphlets to government offices and commercial establishments, emphasizing the security of the system and the potential of postal saving to contribute to economic growth. From 1875, the government paid pensions through the system, and pensioners were strongly encouraged to save a portion of their pensions in the Postal Saving accounts.

In 1876, the system started to spread nationwide, although it was well into the 1880s before the system reached most rural villages. In the late 1880s, the Japanese population was still 80 percent rural, but anywhere horse-drawn carriages or land runners could go, postal saving was accepted.

As it spread throughout Japan, the system increasingly attracted the small saver. Between 1884 and 1915, the average size of an account decreased from 22 yen and reached a minimum of 8 yen. The number of accounts exploded through the Meiji period, from 0.15 per 1000 citizens in 1876 to 250 per 1000 by 1915. Although there are several competing hypotheses to explain these phenomena, one is that greater numbers of small rural savers were attracted to the system. As the number of Post Office branches increased, rural residents started to make postal saving deposits.

These residents were not attracted by high interest rates. Nominal interest rates on postal saving always remained about 5 percentage points below the rates paid by the most reputable banks, and 10 percentage points below the rates paid by the banks that normally catered to the small saver. Rather, it appears that it is the safety of the Postal Saving system that appealed to the small saver.

Not only was the rate of interest paid on deposits lower than that paid by the more reputable banks, but also postal deposits were inconvenient. Often, a depositor had to wait weeks before he could withdraw his deposits. In the pre-war period, medium and large depositors were attracted to the Postal Saving system only during times of financial panic, when the private banking system appeared to be at risk, or when forced by the government, as during World War II. There was also an upper limit to the size of a deposit an individual could hold. The upper limit was probably unnecessary, since medium and large depositors would not have used the Postal Saving system anyway.

During World War II, the Japanese government pursued a strategy to make Japanese production more capital-intensive. Interest rates were lowered through financial repression and Japanese citizens were exhorted to save, especially in the Postal Saving system, as exemplified by the slogan, ". . . saving during the war is a duty. Individual profits should be neglected." Within the Ministry of Finance, an institute to increase saving was founded, and subsidies were given to Post Office branches to help collect saving. There were also some institutional innovations during this period. In 1942, the Post Office started offering long-term saving deposits with an interest rate somewhat higher than that offered by private banks, and for regular deposits, withdrawal was made easier.

The fiscal investment and loan program

As mentioned, the main intention of the Japanese government in starting the Post Office Saving system was to collect the savings of the small rural saver and then channel them into the modern, industrial sector, where the gap between the social and private returns was believed to be the largest. Since the Meiji era, the funds collected from postal saving were used to finance public investment projects.

Early in the Meiji era (1868–1912), the government began placing postal saving deposits with the Ministry of Finance. Initially the funds were used almost exclusively to purchase government bonds. In 1925, the government enacted the Finance Ministry Deposit Fund Bureau Deposits Law, which stipulated that money collected from the Post Offices should be deposited in the Ministry of Finance's Trust Fund Bureau. Actual trust fund operations still centered primarily on the purchase of government and municipal bonds, but as Japan moved toward the war, more emphasis was placed on providing funds to "national policy" companies and munitions firms.

Postal saving and the economic development of Japan

The Postal Saving system in Japan is a public scheme of absorbing small saving into the modern, industrial sector. The funds collected by the system were used to implement industrial policy by financial incentives, as well as to finance social overhead capital. Money was lent by the system and related government agencies to key or targeted industries.

However, there are some problems related to the Postal Saving system. First, to be gigantic creates monopolistic tendencies. Moreover, the controlled interest rates on Postal Saving deposits often works against the deregulation of financial markets of Japan. Banks complain that the existence of the Postal Saving system hinders the market mechanism.

Despite these problems, we consider that the Postal Saving system in Japan succeeded in mobilizing small local saving that otherwise would have gone to informal finance. It channeled saving to industrial sectors that were considered to be important for future growth. From these observations, one could recommend to developing countries, at least to look at the possibility of introducing a Postal Saving system.

The lesson of the Postal Saving system in Japan for developing countries is that the regulation of the financial sector, and the introduction of public sector financial institutions, could improve their economies. Presently, the policies recommended by many international organizations and those pursued by the developing economies themselves are almost exclusively directed towards financial liberalization. Japan probably represents the unique case of a developing country that increased government regulation as its economy developed.

Notes

1 Introduction

1 I depict gross saving and investment. Gross savings includes the depreciation on capital. In this book, I use "gross," instead of "net" savings because the latter requires data on depreciation. There is enormous controversy regarding the proper measurement of the capital depreciation rate in Japan, and the use of "gross" savings allows us to sidestep this controversy (Dekle and Summers, 1991).

2 The private sector includes households, private unincorporated non-financial enterprises, and corporations. Corporate saving is small in Japan, and if households "pierce the corporate veil," corporate saving can be considered part of household saving. The government sector includes the central, prefectural, and local governments. Government saving excludes government investment, which is included in total investment.

3 See Hayashi (1986), Horioka (1990), and Dekle (1993) for a catalog of reasons for Japan's high private saving.

2 The saving behavior of the Japanese elderly

1 In the 1979 Prime Minister's Office *Opinion Survey on Inheritance*, 78.3 percent of the elderly said that they will leave all of their bequest to the child who took care of them. Only 12.1 percent said that their bequest should be equally divided among their children. By Japanese civil law, the elderly cannot give their entire net bequest to one child. Half of the estate must be equally divided among the heirs. However, the intergenerational elderly still have control over who receives the bulk of the bequest. Suppose the aged individual has three children. He can legally give any one child up to 67 percent of the entire estate (0.50 + 0.33*0.50). In practice, most young families who look after the aged receive a higher a fraction of the inheritance, since there is rarely litigation over the division of the estate.

2 Fukutake (1981, pp. 34–43), Vogel (1967) among others claim that a strong *ie* ethos still prevails in rural areas where the son, whether the oldest or not, inherits the home and the family name. When the family has only daughters, then one of the daughters will marry and make her husband adopt her last name. The objective is to keep the family name from disappearing. Fukutake

says that in urban areas, the *ie* tradition started to crumble even before the Second World War.

3 It is well known that with heteroskedastic errors, the coefficient estimates in a censoring model as that above will be inconsistent. Arabmazar and Schmidt (1981) and Nelson (1975) through Monte Carlo techniques show that if the censoring is not severe (less than half the observations are at the limit), the biases arising from heteroskedasticity are rather mild. Inferences must be made with caution, however, since the standard errors will still be biased.

4 Simulating the impact of aging on future saving, investment, and budget deficits

1 I estimate the full-employment government saving by regressing government saving on the output gap and a constant. I interpret the estimated value of the constant, which is the government saving rate when the output gap is equal to zero, as full-employment government saving.

2 The total of public funds actually spent – and included in government consumption – in 2000 was about 8 trillion yen (0.16 percent of GDP).

3 The figures for 1955–99 were calculated from data presented in Japan's *Statistical Yearbook*. The figures from 2000–50 were calculated from the medium projections of the population by age group presented by the Ministry of Health and Welfare (1998).

4 The data on earnings and labor-force participation rates are from the Ministry of Labor (various years).

5 The Ramsey model assumes that households are dynastic: they care about their children's and grandchildren's welfare (utility) as much as their own. Of course, an important implication of dynastic households is that Ricardian equivalence holds; government debt does not affect the intergenerational distribution of wealth.

There is a large literature testing whether the dynastic model is applicable to Japan (for a review, see Horioka, 2002). The dynastic model can be contrasted with the life-cycle model, in which households do not care about their children. Thus, in the life-cycle model, households bring down their wealth (dissave) in old age. On the whole, the empirical tests support the dynastic model, and reject the life-cycle model. The Japanese elderly, on average, leave large bequests to their children, and this appears to be motivated by altruism towards the next generation.

6 I also assume that g_t either yields no utility to households, or that government benefits do not affect the household's optimal choice of private consumption.

7 For social security, however, we assume that the age of eligibility increases from 60 to 65 in 2015 (in accordance with current laws), although we assume that benefits per recipient remain the same.

8 Cutler *et al.* (1990) show that deadweight losses arising from departures from tax smoothing are small.

5 Aging and the role of foreign immigration in impacting saving, investment, and foreign capital inflows

1 My population projections are somewhat higher than the United Nations projections, because I assume higher immigrant fertility rates.

6 Housing and Japanese saving and consumption behavior

1 For example, there are often high realtor fees associated with selling a house or renting an apartment. The home equity loan market is greatly underdeveloped in Japan. Trust banks do lend out funds with the home as collateral, but usually the loan stipulation is that the minimum net worth of the home has to be in excess of 100 million yen. Few Japanese households satisfy this minimum requirement.

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