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Lee, Ronald, Mason, Andrew & Timothy Miller

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From Transfers to Individual Responsibility: Implications for Savings and Capital Accumulation in Taiwan and the United States

Ronald Lee
Demography and Economics
University of California
2232 Piedmont Ave.
Berkeley, CA 94720
e-mail: rlee@demog.berkeley.edu

Andrew Mason
Department of Economics
University of Hawaii at Manoa, and
Program on Population
East-West Center
E-mail: amason@hawaii.edu

Timothy Miller
Demography
University of California
2232 Piedmont Ave.
Berkeley, CA 94720
e-mail: tmiller@demog.berkeley.edu

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Abstract

A transition in a Third World society from a system of familial support for the elderly to a system of individual responsibility through saving and investment would have effects in some respects similar to a transition from a Pay As You Go public pension system to a funded system. Such a transition might lead to "super-saving" as individuals find themselves behind the normal life cycle trajectory of asset accumulation, and as the elderly continue to be supported by their adult children (or the public pension) so that their dissaving does not offset that of the working age population. But there are other factors at work as well, and the net effect is difficult to intuit. This paper uses a demographically realistic model which incorporates life cycle saving motives in the presence of changing familial or public transfers. We use it to simulate the effects of the change from transfer-based old-age support to a funded system, for Taiwan and for the US, and examine changes in aggregate saving and capital accumulation. We consider a variety of possibilities regarding the degree of foresight and the degree to which pre-existing transfer obligations are honored.

Under pure life cycle saving, the demographic transition leads to a large surge in aggregate saving during the later phase of fertility decline, followed by a decline in saving as the population ages. Capital per worker, however, increases substantially and permanently over the transition. Population aging contributes to growth in output per worker, because old hold large capital stocks. This is evident in simulations for both Taiwan and the US. With a transfer system in place to provide for old age support at least partially, these effects on saving rates and capital per worker are muted, and both saving rates and capital follow a substantially lower path. Population aging causes a much smaller increase in capital under transfer systems. Population aging dramatically increases the implicit debt in a transfer system, making a change of system more costly and difficult. An early change to a funded system, while still costly, harnesses the power of population aging to drive capital accumulation, despite falling saving rates. Transfer systems for old age support generate large transfer wealth and corresponding implicit debts in the US Social Security system and in the family transfer system of Taiwan. In our simulations, these are between 1 and 4 times annual GDP. If obligations are honored, these implicit debts must be repaid during a transition toward individual responsibility for old age support through saving, prolonging the effects of the transfer system past the system's dissolution. The working age population at the start of the transition and for some time after bears the cost of the transition, and has reduced consumption, at least under the relatively low interest rates we have assumed.

Introduction

Downward transfers for the sustenance of children are dictated by nature and are universal, since reproduction itself is an allocation of scarce resources to create and nourish the next generation. Upward transfers to the elderly, however, are wholly a social construction both in their existence and in their form.

Often the working age population commits some of its output to the elderly for theirconsumption. The social contract which defines and supports this commitment may be embodied in different institutional structures. Transfers may be organized through the family, as in most preindustrial societies, or through the government as in most industrial societies, in the form of Pay As You Go pensions. Although these systems are very different in most respects, in some they are similar. In both, consumption by the elderly derives from a commitment by younger adults, not from the elders' control of physical or financial assets. In both, adults' expectation of future support is itself, in a sense, a form of wealth, which we will call transfer wealth.

When adults do not have such expectations, then they must take other steps to provide for their old age. To some extent, they can plan to continue to work even when old, but the biological realities of vigor and health in old age limit this option. A different strategy is to accumulate wealth which can be used in old age to claim a share of the output of the working age population. In an agricultural society, ownership of land, livestock or other property can be the basis of exchange with one's children or other adults for a flow of goods and services. Alternatively, the property can be rented out, or sold, or workers can be hired to use it productively. In an industrial society, savings throughout the life cycle can be invested in equities, bonds, a home, or other assets, and the elderly can live off the returns on the assets or on the proceeds from their sale when old. Funded pensions, whether public or private, serve the same purpose, and link old age support ultimately to ownership of physical assets. It is then the system of property rights which undergirds the use of assets to derive income streams in old age.

For present purposes, the important point is that transfer wealth substitutes for physical wealth when adults plan for old age. Transfer wealth is nothing more than a socially constructed set of expectations which can be created or destroyed just as expectations are, and has no greater fundamental reality than they do. Physical wealth, by contrast, is real and substantial. Unlike transfer wealth, it is either directly consumable (stored food, live stock, housing) or it can be used for production, raising the productivity of labor. In theory at least, a society in which old age consumption is backed up by transfer wealth will have less physical wealth and therefore lower income and consumption than a similar society without transfer wealth, in which old age consumption is instead backed up by accumulated productive assets. For this reason, transfer systems matter to the aggregate economy. When old age is supported by transfers, then population aging increases the support burden for the working age population. However, when old age is supported by ownership of reproducible capital, then population aging increases capital per worker, and thereby raises productivity and output.

Because transfer systems are social constructs, they can change as quickly as laws or customs. Economic development typically, perhaps always, erodes the system of family transfers. In many Third World countries (or countries recently in this category), the commitment to familial support of the elderly is waning, and expectations of elder support on the part of both young and old are declining. The percentage of Japanese elderly living with their children declined by 30 percentage points between 1950 and 1990. About half continued to live with their children in 1990 (Feeney and Mason, 1998). In 1973, more than 80 percent of Taiwan's elderly lived with their children (Weinstein et al., 1994) In 1993, sixty percent of elderly men and seventy percent of elderly women were living with their children (calculated by authors employing the Family Income and Expenditure Survey).

The accumulation of wealth depends more on expectations about support by those who are currently working than on the current arrangements of those who have already retired. Surveys of young Japanese adults indicate that they are increasingly likely to discount the family as a future source of old age support. In 1950, 65% of women of childbearing age expected to rely on their children in old age. By 1990, only 18% expected to turn to their children for support in the future (Ogawa and Retherford, 1993).

If the family system is replaced by a pay-as-you-go public pension system which transfers income from those who are currently working to those who are currently retired, one form of transfer wealth (public) is simply substituted for another form (private). Under these circumstances, the demographic transition increases transfer wealth (or the size of the public pension system), and has a fiscal impact (raising taxes on earnings), but has no direct impact on capital formation. Taiwan itself is planning to institute a public pension program that will be partially funded and partially unfunded (see Hu et al, in press). We have not attempted to take it into account in the analysis reported below.

If the family transfer system is replaced by a system based on individual responsibility in which workers accumulate real wealth in order to fund their retirement, then demographic transition leads to increased holdings of capital. The institutional form of the individual responsibility system varies from country to country. Farmers and small businessmen may save by investing directly in productive enterprises. Workers may save directly through a variety of financial instruments or by participating in funded company-sponsored pension programs. Fully funded public pensions would have the same effect. Some countries, Singapore and Malaysia, for example, have now institutionalized such individual "life cycle saving" through large mandatory saving/retirement programs.

In a number of industrial nations the commitment of workers to their Pay As You Go (PAYGO) pension programs also appears to be weakening. In the US many young workers doubt that they will receive benefits from Social Security when they retire. There is public discussion of privatizing the system, or of changing its taxes and benefits in serious ways. Public pension programs throughout the world have come under pressure for reform for three major economic reasons: they yield a rate of return lower than funded systems; as the population ages, they are increasingly costly for the working age population, unlike funded systems[1]; and they displace savings and capital. In some cases, they have been replaced by systems of private retirement accounts as in Chile.

One might expect, then, that this erosion of transfer wealth in both Third World nations and in the industrial world would stimulate wealth accumulation through saving and investment. Might this have contributed to the phenomenally high savings rates in East Asia, and thereby have contributed to the rapid economic growth in that region? Might a phase-out of Social Security in the United States and in other industrial nations lead to higher savings rates and increased capital stock? This paper will explore these questions.

We will build on our earlier work on life cycle savings and the demographic transition in East Asia, as well as on earlier work on the US, to simulate the effects of changing transfer systems on aggregate saving and capital accumulation under various assumptions about foresight and recognition of transfer obligations predating the change. While we will construct starkly contrasting systems of old age support for our analysis, the reality is less clear-cut, and all kinds of systems contribute to elder support to some degree.

In our analysis, we take labor supply by age as given. We formulate a set of decision rules based on life cycle saving theory, which determine saving and consumption at each age. These rules are constant, and identical for the US and Taiwan. However, they are applied in different contexts, these contexts are subject to change. First, there is demographic change, as fertility fluctuates and declines and mortality declines, and the population consequently ages. Second, there is institutional change, as the familial transfer system or public pension program is phased out. Third, there is economic change as interest rates and productivity growth rates vary according to their historical values. We do not attempt to take into account the general equilibrium effects on wages and interest rates in this paper.

There is a slightly different set of issues for which this paper is also relevant. There is an extensive literature on the determinants of saving behavior, and within this literature, there are many cross-national studies. Many of these studies are based at least loosely on life cycle saving theory or on cruder discussions of the effects of old and young dependency rates (see Mason, 1987 and 1988 for a survey of the literature; see Higgins and Williamson, 1996, for a recent example). Surprisingly, none of these studies addresses the role of transfer systems in supporting the elderly, although transfer systems should be a prime influence on savings behavior. This paper is also a first step towards incorporating transfer systems and their changes into a study of saving rates, and we hope that this line of inquiry might eventually point toward useful ways to incorporate information about transfer systems in empirical cross national studies.

[1] If returns to capital fall as capital labor ratios rise, then population aging will also require greater savings with funded systems. In a closed economy, returns to capital would be expected to fall in this way.

How Changing Transfer Systems Influence Life Cycle Savings: a Heuristic View

Over the life cycle, the desired age profile of consumption differs from the desired profile of labor earnings, mostly because of the widespread preference for reducing labor time and effort in old age. To realize the desired age-time shapes of consumption and earning requires that wealth in some form be accumulated during the working years, and then used as a source of consumption in old age. Call the implied age-time path of wealth holdings over the life cycle W(x), and the average value of wealth in the population W. This wealth can be held either in the form of property or capital, K(x) and on average K, or in the form of transfer wealth, T(x) and T. W = K + T is an accounting identity. Transfer wealth is defined as the present value of the expected survival weighted future benefits to be received minus the expected contributions to be made (e.g. to elderly parents, or in taxes to a PAYGO pension program). People first assess their transfer wealth based on their personal situation and the relevant rules or customs, and then plan their saving and investment so as to accumulate the necessary K(x) so that they meet their overall demand for wealth.

So what happens when there is a change in transfer system, and therefore in the expectations about T(x)? If a transfer system is phased out, then in the long run, after a transitional period, we would expect that people would save at a higher rate so that the capital stock per person would rise by an amount equal to the missing transfer wealth (subject to the reservations expressed in a later section). However, it is far from clear what will happen during the transitional phase in which the transfer system is being phased out.

There are several considerations in assessing these effects. First, of course, is the increased need for savings to replace the prior expectation of support in old age through transfers. Depending on the details of the transition, each person may find themselves behind-schedule in saving, since they had previously been relying on transfers which are no longer expected to materialize. If people are behind their normal life cycle saving schedule, they will have to save in excess of the normal life cycle saving amount at each subsequent age, and aggregate saving may also exceed the rate. We will call this “super saving”. Super saving would be more likely in the case in which prior obligations are not honored, so that those closer to old age would have to save at a very high rate, while those already old would not have the assets from which to dissave.

A second effect tends to offset this first, leading to higher consumption at each age. Compared to the market, a transfer system for old age support is a bad deal, with a rate of return on “contributions” equal only to population growth rate plus productivity growth rate in steady state, usually a few percentage points below the rate of return available in the market. In the US, for example, the present value of participation in Social Security is roughly -$17,000 at age 21, evaluated relative to a market rate of 6%. If the system were abolished, the life cycle budget constraint of a 21 year old would shift outwards by this $17,000, other things equal. Consequently, at any age they could consume more, and under life cycle savings would indeed plan to consume more. But since the stream of labor earnings is unaffected (to a first approximation), this will mean that savings rates will be less than the former contribution rates, and less than they would otherwise be. There would be similar consequences when a familial transfer system is dissolved. Because a higher rate of return can be earned through the market, less income needs to be set aside to provide for old age.

A third effect arises from the need to pay off the implicit debt of a transfer system, during the transitional stage. When the collapse of a transfer system is brought about by the collapse of a system of government, as in Eastern Europe and the former Soviet Union, there is a possibility that prior obligations will not be honored. In most real world transitions from public sector PAYGO pension plans to individual accounts, however, prior obligations are fully honored (e.g. in Chile or in proposed plans for the US). If prior obligations are honored to any extent, there is an implicit debt which survives the demise of the system, and which must be repaid. When a family system declines, adult children will presumably continue to support their elderly parents if these parents do not have other viable options. During the transitional phase, a young worker has to continue to pay into the transfer system by supporting elderly parents or by paying payroll taxes, with no expectation of receiving full transfers in return. This will, of course, reduce the resources available for non-elder household consumption below their previous level, and therefore lead to reduced savings. The implicit debt of a transfer system is identically equal to the transfer wealth—it is just the other side of the coin.

These complicated effects will interact with the changing demography. In addition there will be general equilibrium effects, since the varying capital stock will influence the interest rate and earnings, which will in turn alter saving and consumption behavior. Our simulations do not currently incorporate these general equilibrium effects.

Modeling Life Cycle Savings

We will begin by describing the life cycle savings theory and how we model it (more details are in the appendix). According to this theory, adults save and dissave in order to achieve a smooth consumption path despite fluctuations in their labor earnings and their eventual retirement. Since household size and age distribution changes over the life cycle, we will assume that it is consumption per equivalent adult consumer that is smoothed, rather than household consumption itself. Under assumptions that are standard in economics for this model, people will plan that their consumption over the life cycle will rise at a rate equal to the interest rate, r, minus the rate of subjective time preference, ρ, times the elasticity of intertemporal substitution, $1/\gamma$ (γ is the parameter describing relative risk aversion). This elasticity describes the willingness of people to substitute consumption later in life for current consumption in response to an increase in the interest rate which allows them to consume more in the future than they forego in the present. With an interest rate of 3%, subjective time preference of 0, and $1/\gamma = .6$, a person would plan that their consumption would rise at 1.8% per year. This plan, together with the expected age-time path of earnings over the life cycle, then implies a life time plan for savings and consumption.

Consumption plans are made such that the present value of the survival-weighted consumption for the household over its life cycle equals the survival-weighted present value of expected labor earnings over the life cycle for all members of the household, plus the survival weighted expected value of net transfers received over the life cycle (where negative values represent net contributions). To formulate these plans, then, people must form an expectation of how rapidly their wage rates will rise; when they will retire; survival probabilities for all household members; ages at which children will leave the household and establish their own; future interest rates; and the future of all relevant transfer systems. Then they must carry out complex calculations to solve the optimization problem.

Given the complexities of this approach, perhaps it is not surprising that many analysts find the theory implausible, and that empirical studies often reject it (Carrol and Summers, 1991). Indeed, it is clear that many people live on a month-to-month basis with little or no saving and asset accumulation, beyond a relatively small amount to buffer against uncertainties in their income streams and in their emergency consumption needs. Although many people do not life-cycle save in the spirit detailed above, doubtless many others do. This is particularly true in the US where employer provided private pensions have institutionalized such saving for a substantial number of employees, around 30% in any given year, and a greater proportion over the life cycle. Such saving is also institutionalized in some countries such as Singapore, and would be under proposed privatization plans to replace Social Security in the US.

There are, of course, other reasons to save as well. One, the precautionary motive, has already been mentioned. Another is the wish to leave a bequest to one's children. A third is uncertainty about time of death, leading some people to over-save to protect against the risk of outliving their savings. In this case, on average people die leaving unintended bequests to their children. This is consistent with life cycle savings, provided it is not assumed (as in our model) that people plan, in effect, to exhaust their savings at the instant of death, by purchase of annuities that spread the uncertainty of time at death across their generation.

Simulating Pure Life Cycle Saving During Demographic Change

In earlier papers, we have simulated the effect of the demographic transition on saving rates and wealth accumulation in Taiwan (Lee, Mason and Miller, in press a, b and c) under the assumption of pure life-cycle saving, ignoring the familial transfer system. We begin by discussing these results, because they provide a benchmark for comparison. For these simulations, we used actual data on productivity growth rates and interest rates when it was available, and made assumptions for the remainder of the years. The demography is based on the history of fertility and mortality in Taiwan since early in the century, but we have abstracted from immigration to Taiwan since we are not interested in the experience of Taiwan per se, but rather in the patterns that might generalize to other countries in the region. Hence we sometimes call it "pseudo-Taiwan".

The implied path for the aggregate saving rate can be seen in Figure 1, where it is labeled Life-Cycle Saving. It is already rising in 1900, at the first date shown. Although fertility remains high for all working age people alive in 1900, they are increasing their saving rate because they foresee that mortality will fall, and therefore that they will live increasing years during the retirement ages and require more wealth. However, declining mortality also means that a higher proportion of births will survive through childhood in households, and therefore that the numbers of child dependents will increase, as they also foresee. In the late 1950s, this effect begins to outweigh the increased longevity effect, and saving rates stop rising and then decline slightly. Around 1960 fertility begins to fall rapidly, and when it has fallen sufficiently to offset the effect of increased child survival, savings rates resume their upward course. Saving rates during this period are also buoyed by changes in the age distribution of the population, as the working age population grows more rapidly than the elderly, so that ratio of workers who save to elderly who dissave is rising. This is a transitory effect, however. Saving rates peak around 2010, and then decline dramatically, returning almost to the levels of 1900 by 2050. This is because of population aging: the ratio of elderly to working age population rises substantially, increasing dissavers relative to savers. The simulated savings rate matches some key features of the measured savings rate for Taiwan since 1965, although the correspondence is far from exact. The simulated increase is less than the actual, and it begins later than the actual increase.

One might think that population aging in Taiwan would cause a reduction in capital per worker as saving rates plummet. But this does not happen, because the decline in fertility which causes population aging also causes slower labor force growth. Figure 2 shows the simulated ratio of capital to output in Taiwan under life cycle savings, and it can be seen that despite the plunge in saving rates in the first part of the 21st century, this ratio continues to rise from 1.5 in 1980 to 6 in 2050. Capital per worker rises correspondingly[2]. This should not be surprising: it is the elderly in most populations who hold the most wealth, and aging increases the proportion of wealthy elderly in the population. They may be dissaving, which is a negative flow, but they are holding large positive stocks under life cycle saving. This is an important and little recognized aspect of population aging which has been lost in the focus on saving rates.

Figure 4 shows the simulated effect of demographic change in the US on aggregate saving rates under life cycle saving. We simulate a major increase in the savings rate late in the 19th century, with a dramatic but temporary increase of five or more percentage points from 1980 through 2015, as the baby boom generations swell the labor force. The difficulty here is that these simulated changes are not reflected in measured savings rates. Far from being dramatically high, saving rates now are dramatically low, possibly even negative. But this is by a measure that is deeply flawed for our purposes. The run-up in the stock market has greatly increased wealth during this period, raising the average person’s life cycle wealth, which under the life cycle saving model should be counted as saving, and which should lead to increased consumption as it evidently has. Periods of steep increases in housing prices similarly invalidate standard measures of saving. These measurement problems aside, however, fluctuations in the simulated saving rate do not correspond to variations in saving rates. Below, we will consider the extent to which

[2] With constant returns to scale and output proportional to $K^{.3}$, the capital labor ratio will be proportional to the capital output ratio raised to the 3/2 power. The per capita demand for wealth W will equal the capital labor ratio multiplied by the ratio of the labor force the total population.

incorporation of Social Security taxes and benefits improves the fit to historical experience.

Figure 5 shows the simulated effect of demographic change on demand for capital. The demand for capital rises dramatically as the baby boom ages, and continues to rise thereafter as mortality continues to decline. In these simulations, the average demand for wealth should double over the next century.

Modeling Transfer Systems and Their Change

For familial transfers, we assume that an elder is fractionally coresident with each of the elder's surviving children, and consumes an amount equivalent to an adult in those households. It makes no difference whether we treat this as a financial transfer to a separate household of the elder, or we treat the elder as fractionally joining the child's household, or randomly choosing one child's household to join. For accounting convenience, we assume separate coresidence for the elder, with financial transfers from children. This governs planning by both the young and the old.

Although the erosion of the family support system in East Asia has been gradual, in our simulation we assume a sudden break in 1960, around the time when fertility began to decline. This sudden break makes it easier to identify consequences in the simulations. Under one scenario labeled "Collapse", we assume that all obligations, even to those already old, are suddenly and unexpectedly canceled in 1960. This is highly unrealistic, so we consider two other scenarios as well. In both, children continue to honor their traditional parental support obligations by the fraction of the parent's life time earnings that had been earned at the time of transfer system change. At the same time, the children begin saving themselves for their own retirement, since they do not expect support from their own children, except to the extent implied by the fractional rule. In the second scenario, labeled "Unexpected", the change in support system is not anticipated. In the third scenario, labeled "Anticipated", everyone has full foresight about the system change, so they begin saving before it actually occurs.

In the case of US Social Security, we incorporate the historic trajectories of payroll tax and benefit levels, and for the future we adopt explicit scenarios for taxes and benefits. Where appropriate, we incorporate the legislated increase in the Normal Retirement Age from 65 to 67 over the next two decades. We treat the system as including OASI (Old Age and Survivors Insurance) but not DI (Disability Insurance) or HI (Hospital Insurance or Medicare). All changes in taxes and benefits are treated as unexpected, except in so far as changes are legislated far in advance as with the increase in normal retirement age. In one scenario, the Social Security system is continued indefinitely into the future. Payroll taxes are left at their current level until the trust fund is exhausted in 2033, and then the taxes are raised each year as necessary to meet the next year's costs of benefits.

In another scenario, the system begins to phase in personal saving accounts along the lines suggested by the most radical privatization plan in the report of the 1994-96 Advisory Council on Social Security. Simplifying a bit for clarity, all current obligations are met in the same fractional sense as described for Taiwan, but future benefits are reduced to 50% of their current level. Taxes are also cut, and maintained flat until the trust fund is exhausted; then they are raised to meet costs as described above. The plan includes specific plans for personal savings accounts, but those are simply absorbed into our general life cycle saving scheme.

Both these transfer systems for old age support provide an income stream for the elderly. This income stream may or may not be adequate for the elderly to achieve the life cycle consumption path that is desired. If not, then we assume that people save over their working years so as to accumulate the assets needed to achieve their optimal consumption paths. In the case of the US, only 40% of the income of the elderly comes from Social Security. The rest comes from private pensions (which are generally funded, and which should be counted as saving) from private saving, and from other assets. It could also happen, in principle, that transfer income exceeded the desired level for old age consumption, in which case people would like to borrow against their transfer income to increase consumption earlier in the life cycle. Typically such borrowing is not possible, however. It is also possible that working age people may borrow and save in order to smooth their consumption over the periods in which they have elder support obligations as a result of the system.

Results of Simulations: Transfer Wealth and Implicit Debt

Our simulations provide a measure of the demand for life cycle wealth[3], conditional on demography, economic expectations, expectations about transfer systems, and various technical parameters in the utility function. Under the assumption of pure life cycle saving, with no transfers to the elderly, this demand for wealth is also the demand for capital stock. Our simulations also provide a measure of the demand for capital in the presence of a transfer system. The difference between these two hypothetical demands for capital measures the transfer wealth generated by the transfer system. This transfer wealth is equal to the implicit debt generated by the transfer system, which is the sum of the unfunded obligations not covered by future taxes to the existing adult population.

For the US in the year 2000, the implicit debt (discounting at 3%) generated by Social Security (OASI) amounts to 1.75 times GDP or 15 trillion dollars, which is 46% of the total demand for wealth. This can be compared to a calculation by Feldstein (1997:9) who gives an estimate for implicit debt that is found to be slightly lower than ours, after adjustment for the five year difference in reference year.

For Taiwan in the year 1960, the implicit debt generated by the family transfer system (as we have modeled it) is about 50% of the demand for wealth, or about 90% of GDP.

It is interesting to compare these figures to calculations made by Jorge Bravo (199*) for Latin America around 1990. He calculated for public pension programs in many countries the ratio of implicit debt to GDP. Among those with higher ratios were the

[3] As noted in the previous footnote, what we actually plot is the capital output ratio. From this it is possible to compute the demand for wealth W, but for most purposes the capital output ratio will suffice, as discussed in the text.

following: about 1 for Costa Rica, about 1.5 for Chile, Panama and Cuba, about 2 for Brazil, and about 3 for Uruguay and Argentina.

When a transfer system is phased out, and replaced by a system of individual responsibility through saving, this implicit debt must be somehow repaid. The generations responsible for repaying it, who are mostly the current and future working age population, will then have a double task: to make payments out of current income to honor past obligations by repaying the implicit debt, and to save out of their current income to prefund their own retirements. In Third World countries, these heavy obligations may be accompanied by a wish to invest in increased education for their children.

Savings and Capital in Taiwan

Also shown in Figures 1 and 2 are the saving rate and capital/output ratio with the family transfer system in place. In the simulations for 1950 and thereafter, the aggregate saving rate is 5 to 13 percentage points lower with familial transfers than without; the difference before 1950 is smaller. We also see that savings rates would decline toward zero over a fifty year period, declining under the transfer system at a time when they are rising under life cycle saving.

We also see a large and growing gap between the capital output ratio with and without the family system, representing the transfer wealth and implicit debt. There are some very important points to observe here. First, as the transition proceeds, the size of the implicit debt relative to GDP increases, from a ratio of 0.5 in 1900, to 0.9 in 1960, to 1.5 in 2000, to about 3 by 2050. It will become increasingly costly and difficult to phase out the family support system the later this is done. At the same time, if it is done relatively early before implicit debt is great, then population aging will drive up the capital stock. This is a fundamental result.

Now let's turn to the transitional phase itself. If the system collapses, then the aggregate saving rate immediately shoots up to 3 percentage points above the life cycle saving level, thereafter converging rapidly to it. This is the "super saving" discussed earlier, arising as people in the working ages strive to catch up in their asset accumulation, while the elderly, deprived of their income source, no longer dissave. This scenario is unrealistic, so we turn to scenarios in which obligations are honored. In this case, there is very little difference between an anticipated demise and an unexpected one. In both cases, there is a steady convergence to the life cycle saving path. After 10 years, 25% of the gap has been closed; after 20 years, 90% of the gap is made up; and after 30 years, the discrepancy has become negligible. When the demise of family support is anticipated, however, saving rates begin to rise some decades before. Thus even assuming a sudden change in the system, modeling foresight and honoring obligations creates a gradual transition.

Under the scenarios in which obligations are honored, the capital-reducing effects of the transfer system are prolonged, so that savings rates and capital accumulation are both substantially lower for a few decades. In the long run, however, they all end up indistinguishable from the life cycle saving scenario, once all the original participants in the family system have died off. The collapse scenario leads to much more rapid convergence to the life cycle saving path.

Savings and Capital for the US

Figure 4 also plots the saving rate for the US with the historical Social Security system in the past, and as currently legislated in the future. Without OASI, saving rates rise steadily after 1940; with OASI, savings rates decline until the mid-1970s, after which they rise dramatically with the entry of the baby boom into the labor force, falling again with the baby boom's retirement in the early 21st century. The simulated trajectory with OASI is closer to the experience of the measured saving rates, although the massive increase due to the baby boom generations is still present; in any event, as noted earlier, no direct comparison to the measured saving rate is possible.

Under the scenario of system collapse, we again see saving rates exceeding the life cycle saving levels, exhibiting super saving. In the more realistic phase down of Social Security this does not happen, and saving rates remain between the life cycle saving level and the continued Social Security level.

As in Taiwan, the implicit debt has grown substantially and will continue to grow relative to GDP over the next 50 years, from a ratio of 1.75 in 2000 to 2.6 in 2050. Under the Collapse scenario, the capital output ratio rapidly converges to the life cycle saving level; under the phase down, the transition is, of course, slower, and capital remains lower because the system maintains a 50% level of benefits.

Who Bears the Cost of the System Change?

We have seen that phasing out the transfer systems raises saving rates and dramatically increases the capital stock. From where does the increased capital come? It comes from reductions in consumption by some or all members of the population following the system change. The process is by no means costless. Figure 3 for Taiwan shows the ratio of aggregate consumption under each of the scenarios to consumption under pure life cycle saving. Under the family transfer system, consumption rises to about 5% above that for life cycle saving by 1980, and then declines to about that much below it by 2050. This initially high consumption is due to the exceptionally favorable age distribution of those years, and cannot survive population aging. The collapse of the system leads to an immediate drop in consumption by 12% from its previous level, as the consumption of the elderly is drastically reduced and working age people also must raise their savings to prepare for old age. Under the scenarios in which obligations are honored, the consumption adjustments are less drastic, but more prolonged.

The story is similar for the US, as we see in Figure 6. Once again, aggregate consumption with Social Security is initially higher than would be possible under life cycle saving, by an average of 4 or 5%. This situation cannot be sustained, and once the trust fund is exhausted in 2033, and taxes are raised to equal costs of benefits, consumption drops below the life cycle saving level. Collapse leads to a 13% reduction, but it is relatively short-lived. The Phase-Down in which obligations are honored leads to a milder but much longer lived reduction. Because benefits are continued at half their former level, consumption remains permanently below the life cycle saving level, by 2.5%.

It is also interesting to look below the aggregate changes in consumption, to consider which generations bear the cost of the transition. First, consider a system collapse in which obligations are not honored. Clearly the elderly are hit hardest, because they have no working years left in which to adjust their savings and consumption. But most working age people also suffer from a complete collapse, if they have participated in the transfer system for more than a few years. We have calculated the present value of participation in the transfer system for different generations, as the present value of survival weighted future benefits expected minus contributions expected, discounting at the relatively low rate of 3%, which is often used as the "risk free" real rate of return (in contrast to the stock market rate of return of 7% or so; a good case can be made for using a higher rate, between 3.5% and 5.5%, based on actual portfolio compositions in the US, perhaps adjusted for administrative costs). At age of beginning to participate in the system, this present value is negative (about –17,000 in the US), and it remains so up until age 27, when it becomes positive. Roughly speaking, all those for whom it is negative would benefit from the system collapse; all those for whom it is positive would lose from the collapse. (More precisely, the change of system also raises the break-even age from 27 to 31). Those age 65 at system collapse lose the most, which in the US in 2000 would be 120,000 dollars per household.

Now consider the more realistic case in which obligations to people who have participated in the system in the past are honored, such that someone who had contributed throughout the first two thirds of their earnings-weighted career would receive two thirds of the old system benefit, but be expected to save out of the remaining one third of life time earnings (with adjustments for discounting and survival). In this case, the elderly are not affected at all by the transition, and those close to retirement are affected least. For those in the working years, contribution rates are reduced because the number of beneficiaries and/or level of benefits paid begins to decline relative to the old system. But expected benefits are also reduced, and the key is that taxes are reduced proportionately less than benefits because of the need to meet obligations that are based on the original higher level of benefits. Consequently, all those in the working ages, and many of those not yet of working ages, suffer a lifetime loss of income and consumption. These generations bear the cost of the phase-down of Social Security or of the familial transfer system. The beneficiaries are later generations. In our calculations, all generations born after the year 2000 would benefit substantially from a phase-down of Social Security, and all generations born between 1935 and 2010 (not yet retired by 2000, and working during a period in which former obligations still required to be repaid) would lose from it, some as much as 13,000 dollars in present value. Results would differ according to the discount rate used, and for higher discount rates those who lose from the transition would be fewer and losses smaller. Also, it is possible to use a bond issue to spread the costs of the transition over a longer period and more generations. But the general point would remain: the change in system is an intergenerational transfer from current working age people to future generations, just as the start up of the system represents a transfer from future generations to the original generations who realized a windfall gain.

Reservations About This Approach

According to the assumptions of our simulation, ending a transfer system for the elderly will inevitably lead to a substantial increase in saving rates and in capital accumulation. But in the real world, this might not happen. *First*, systems like public pensions exist in part because many people are thought to be improvident. In the absence of a mandatory public program, many would fail to provide for their own old age, and so receive need-based benefits in old age in place of pension based benefits, or simply reduce their consumption in old age. It is for this reason that in our main scenario, we phase down Social Security benefits to 50% of their current levels, but we do not eliminate them entirely. In truth, the US Social Security system is already not much more than a safety net, since its replacement rate is so low.

Second, it is possible that if a public transfer system is phased out, that people will respond by altering their private transfers so as to completely offset the change. For example, the elderly might stop leaving bequests to their children after a Social Security phase out, instead using their assets to purchase annuities. This would neutralize the effect on savings and capital accumulation. Such a response would simply reverse the famous argument of Barro (1974), that the introduction of Social Security would not reduce savings, because people would simply increase their private transfers to their children. To the extent that the elderly do make transfers, either inter vivos or bequests, to their children out of altruistic motives, the Barro argument could apply. To the extent that elderly do not make transfers to their children, or if they do, make them for exchange purposes (that is, in exchange for attention and assistance from their children), then the Barro argument would not apply. There is an extensive but inconclusive literature on these issues (see for example McGarry and Schoeni, 1997, and Cox, 19**). It appears safe to say that some people would alter their private transfer behavior to offset the changes in public transfers, while others would not.

In a similar vein, when a family transfer system declines, it is possible that the elderly would then begin to sell-off or mortgage their assets such as farm or house, to raise money for their own consumption, rather than increasing their saving during the working years and continuing to bequeath these assets to their children. It is also possible that the decline in the family system of support would lead directly to the substitution of a public transfer system. The public system could be preferable because it does not depend on filial loyalty, on the accidents of family size and sex of children, on the economic fortunes of ones children, nor on their locational decisions as adults.

For these reasons, our simulations probably over-state the size of the effects of change in transfer system. Nonetheless, there should be some tendency towards the changes we have simulated.

Our simulations suggest that the phase-out of a transfer program for the elderly would boost savings rates and capital accumulation. There are many other considerations in deciding whether a phase-out would be a good idea. The transition is costly, and requires that some generations consume less than they would have otherwise. We have not attempted to compare the costs to the benefits using a Social Welfare function. Family support systems also involve caregiving and coresidence, and there is much more to these arrangements than their purely financial aspect. Transfer systems, particularly public ones, also are intended to perform a redistributional function: the replacement rates are higher for low income participants than for high income ones. (It is possible that differences in mortality largely undo this redistributive effect.) The public pensions are annuities, which spread the risk of length of life; private annuity markets are afflicted by adverse selection and do not function well. These programs also force people to provide for their old age at a minimal level at least, and therefore have a forced-saving aspect. They have very low administrative costs. The question whether to privatize old age support systems is highly complex, and we take no position on this question here.

Conclusions

- Under pure life cycle saving, the demographic transition leads to a large surge in aggregate saving during the later phase of fertility decline, followed by a decline in saving as the population ages. Capital per worker, however, increases substantially and permanently over the transition. Population aging contributes to growth in output per worker, because old hold large capital stocks. This is evident in simulations for both Taiwan and the US.
- With a transfer system in place to provide for old age support at least partially, these effects on saving rates and capital per worker are muted, and both saving rates and capital follow a substantially lower path. Population aging causes a much smaller increase in capital under transfer systems.
- Population aging dramatically increases the implicit debt in a transfer system, making a change of system more costly and difficult. An early change to a funded system, while still costly, harnesses the power of population aging to drive capital accumulation, despite falling saving rates.
- Transfer systems for old age support generate large transfer wealth and corresponding implicit debts in the US Social Security system and in the family transfer system of Taiwan. In our simulations, these are between 1 and 3 times annual GDP. If obligations are honored, these implicit debts must be repaid during a transition toward individual responsibility for old age support through saving, prolonging the effects of the transfer system past the system’s dissolution. The working age population at the start of the transition and for some time after bears the cost of the transition, and has reduced consumption, at least under the relatively low interest rates we have assumed.
- With the complete collapse of a transfer system, without recognition of obligations, super saving occurs, with aggregate saving rates exceeding normal life cycle saving by about 3 percentage points as people try to make up for lost time in accumulating capital to consume in retirement. This brutal scenario generates the most rapid transition to the pure life cycle saving economic growth path.
- More realistic scenarios in which obligations are honored generate a more gradual convergence to the PLS growth path, with a somewhat faster transition when the changes are anticipated.
- Certain redistributive aspects of transfer systems might be lost, and new risks would be traded for old ones. We have not attempted any kind of assessment of the welfare gains or losses from a change in system. We are not recommending such changes, but rather noting that they are occurring and seeking to understand their effects.

Appendix

Details of the basic model can be found in the appendices to Lee, Mason and Miller (in press). Here we first describe a few elements of the model for the static case of pure life cycle saving. Then we sketch the dynamic life cycle saving model. Finally we indicate how transfers are added.

Steady State (Static) Life Cycle Saving

When a household is formed, the heads seek to maximize lifetime utility V:

$$V = \int_z^{\omega} e^{-\rho x} u[C(x), H(x)]dx$$

where z is the age of forming a household, ω is oldest age with non-zero survival probability; C(x) is total household consumption at age x; H(x) is the expected (survival weighted) total household size measured in equivalent adult consumer units (EAC), and ρ is the discount rate.

The instantaneous household utility function in V is specified as:

$$u[C(x), H(x)] = H(x)\left(\left(\left[\frac{C(x)}{H(x)}\right]^{1-\gamma} - 1\right) \Big/ 1-\gamma\right)$$

where γ is the inverse of the intertemporal elasticity of substitution.

For Taiwan, we assume the intertemporal elasticity of substitution to be .6, based on an estimate by Ogaki et al (1996), which appears to be the only estimate available. Studies relevant for the US include the following: Ogaki et al (1996) estimate .64 for the US (p.57). Attanasio, Banks, Meghir and Weber (1997) "Humps and Bumps in Lifetime Consumption" estimate a value of .64 with a standard error of .33, for US micro data. Auerbach and Kotlikoff in *Dynamic Fiscal Policy* choose .25, after discussing a wide range of estimates (p.51). 4. Deaton (1992) in Understanding Consumption reports favorably an estimate of Attanasio and Weber using English micro data for the coefficient of consumption growth on the interest rate, which was .735. This should estimate the intertemporal elasticity of substitution (page 73). Deaton asserts that econometric studies of the growth of aggregate consumption in relation to the expected interest rate, based on the representative individual assumption, are nonsensical. The Attanasio/Weber paper avoids this pitfall, but not the Ogaki et al estimate we use for Taiwan. We conclude that a value of .64 seems reasonable for the US, but we should consider a range of possibilities.

We assume that labor supply decisions over the life cycle are exogenous. That is, we take $y_l(x)$ to be given. This is for simplicity and convenience only. There is every reason to believe that labor supply decisions are affected by transfer arrangements, and there is a substantial literature on the subject for industrial nations.

Life cycle utility is maximized subject to the constraint that the present value of expected future life time earnings of householders, and their children while co-resident (PV(Yl)), evaluated when the heads are age z), plus the present value of transfers expected to be received in old age minus the present value of expected transfer obligations to own parents, equals the present value of expected future household consumption. Both expectations are survival weighted. In the absence of transfers, the maximization yields the following planned age-time path for household consumption:

$$C(x)=\frac{H(x)PV[Y_l]e^{(r-\rho)x/\gamma}}{\int_z^{\omega} e^{-ra}H(a)e^{(r-\rho)a/\gamma}da}$$

It follows that the life cycle trajectory of consumption per EAC rises at the rate (r-ρ)/γ, where γ is the inverse of the intertemporal elasticity of substitution.

Life Cycle Saving with Changing Demography and Economy

The extension to a context of economic and demographic change is based on rules for formulating expectations as circumstances change, and then on reoptimization at each age, taking as the new initial conditions the asset position resulting from earlier decisions. We assume that every decision is made under complete certainty about the future (except that survival is a probability, albeit a fully insured one), despite the fact that householders are repeatedly surprised as the future unfolds, which is an inconsistency on our part. It would be preferable to model decision making under uncertainty, but that would substantially increase the complexity.

In our current implementation of the dynamic model, actors are fully aware of future demographic change. Therefore, their only source of (uninsured) uncertainty is future economic change reflected in productivity rates and interest rates. Actors form their life cycle plans based on their expectation of future productivity rates and interest rates which turn out to be incorrect. Each year, they must form new life cycle plans since their current circumstances are different than what they had foreseen.

The dynamic version of the age-time path of consumption is listed below. It differs from the static version in that optimization occurs at all ages $x \geq z$ rather than solely at age $x = z$ and that these optimizations are based on expectations about future interest rate [$r^*(t)$] and productivity growth rates [which are reflected in Y^*_l]. Consumption is optimized at age x looking forward a years ($a \geq 0$) into the future when the household head will be aged $x+a$ in year $t+a$. In the dynamic equation, the value of future life time wealth must include expected future earnings (as in the static model) but also expected future transfers and current wealth that reflects the accumulation of past savings. Wealth [$W(x,t)$] is defined so that cohort wealth is maintained. That is, there are lateral, not vertical, bequests – wealth saved by last year's households aged x-1 is shared among this year's surviving heads aged x. In the absence of expected transfers, the dynamic consumption path would be:

$$C(x,a,t)=\frac{H(x,a,t)\left\{W(x,t)+PV\left[Y_l^*(x,a,t)\right]\right\}e^{\left(r^*(t)-\rho\right)a/\gamma}}{\int_0^{\omega-x}e^{-r^*(t)g}H(x,g,t)e^{\left(r^*(t)-\rho\right)g/\gamma}dg}$$

In the special case in which household expectations about interest rates and productivity rates turn out to be correct, households would have no need to re-evaluate their age-time path of consumption. Households would only need to make one optimization decision at age *z*. Then the dynamic equation simply reduces to the static equation.

Life Cycle Saving with Changing Expectations About Transfers

Now suppose that there is a transfer system. Its rules generate the expectation for a person aged x in year t of a flow of future transfer obligations and benefits, with a net value (benefits minus obligations) after a years, in year t+a, of $\tau(x,a,t)$. The decision maker calculates the present value of the survival weighted stream of benefits evaluated at age x in year t, call this $PV\left[\mathrm{T}^*(x,a,t)\right]$; it is completely analogous to $PV\left[Y_l^*(x,a,t)\right]$ in the equation above, and it is simply added to $W(x,t)+PV\left[Y_l^*(x,a,t)\right]$ in that expression. $PV\left[\mathrm{T}^*(x,a,t)\right]$ will typically be negative for x near the start of the working years, for reasons discussed in the text: transfer systems yield a rate of return that is inferior to the market rate, as a rule. However, at older ages, it becomes positive since people are closer to retirement when they claim the benefits, and an increasing share of their life time contributions are sunk costs which no longer enter the calculation.

We will not write down mathematical expressions for the transfer system rules; the descriptions should suffice. The rules are taken as given. In the case of US Social Security, we simply assume the historic trajectories of payroll tax and benefit levels, and for the future we adopt explicit scenarios for taxes and benefits, incorporating the legislated increase in the Normal Retirement Age from 65 to 67. We make differing assumptions about the degree of foresight of future changes, and about the degree to which past obligations incurred by the system are honored, as described in the text. For familial transfers, we assume that an elder is fractionally coresident with each of the elder’s surviving children, and consumes an amount equivalent to an adult in those households. It makes no difference whether we treat this as a financial transfer to a separate household of the elder, or we treat the elder as joining the child’s household. We assume separate coresidence for accounting convenience. This governs planning by both the young and the old.

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Figure 1: Savings Rate, Pseudo-Taiwan, 1900-2050

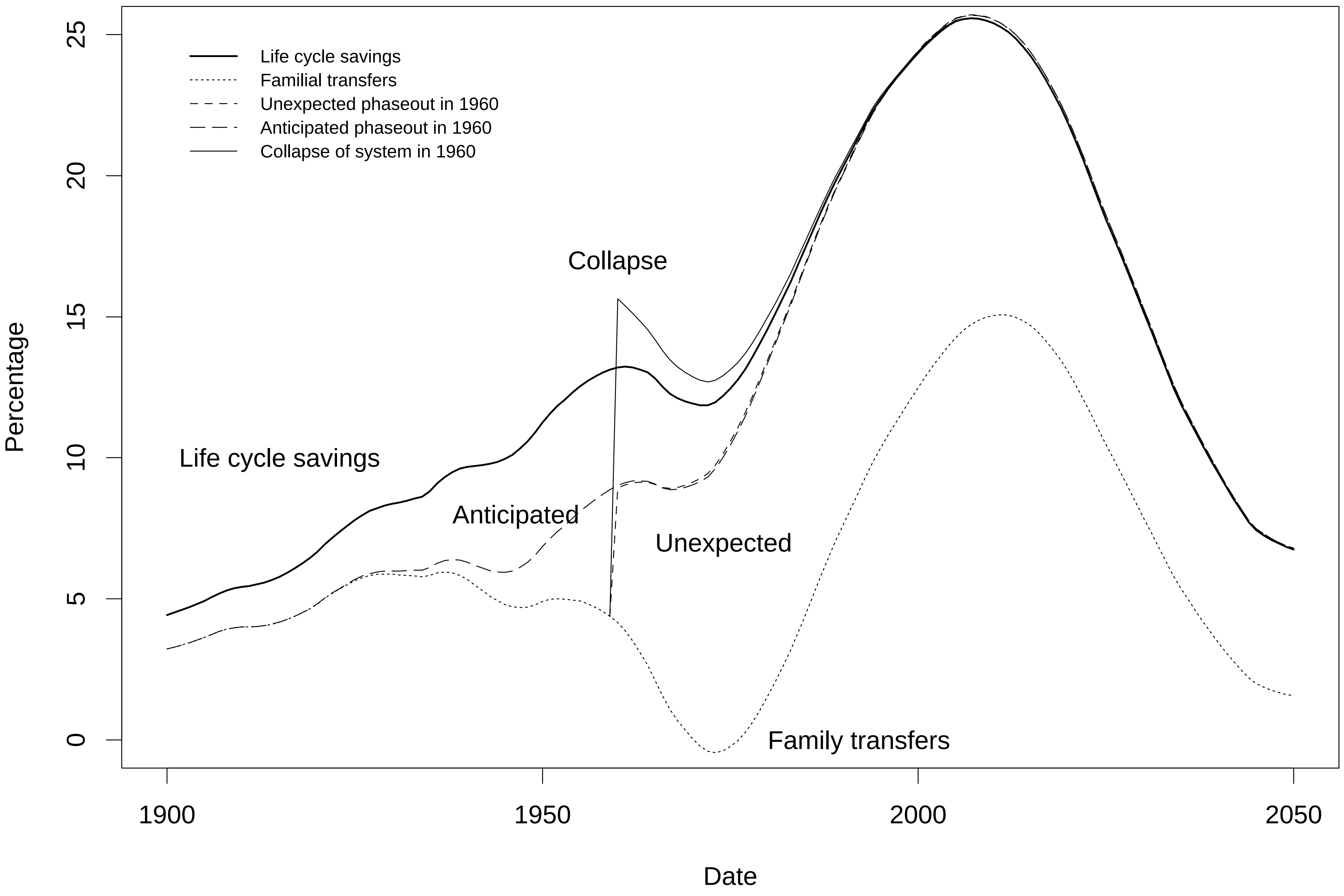


Figure 2: Capital/Output Ratio, Pseudo-Taiwan, 1900-2050

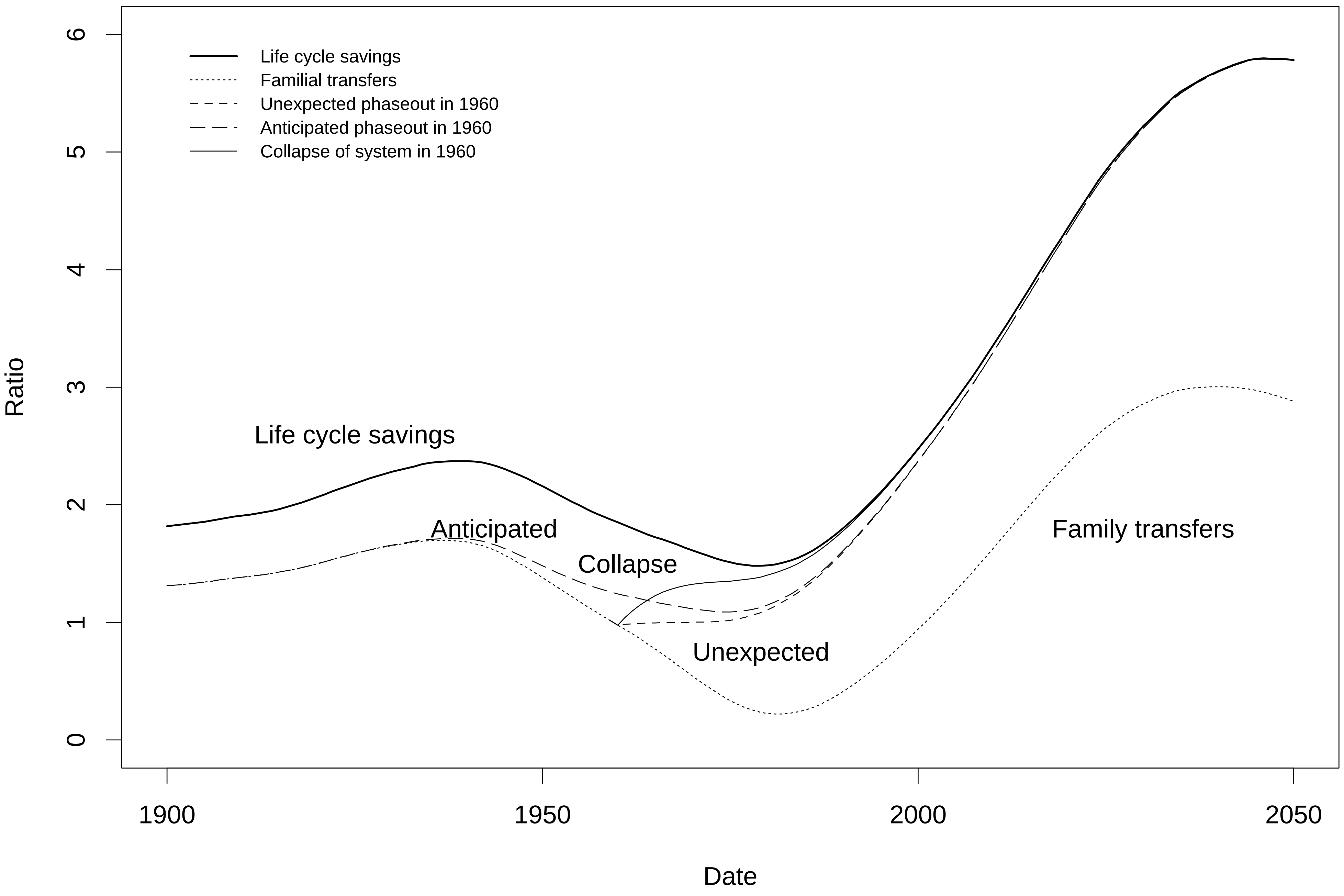


Figure 3: Total Consumption Relative to Life Cycle Savings Scenario

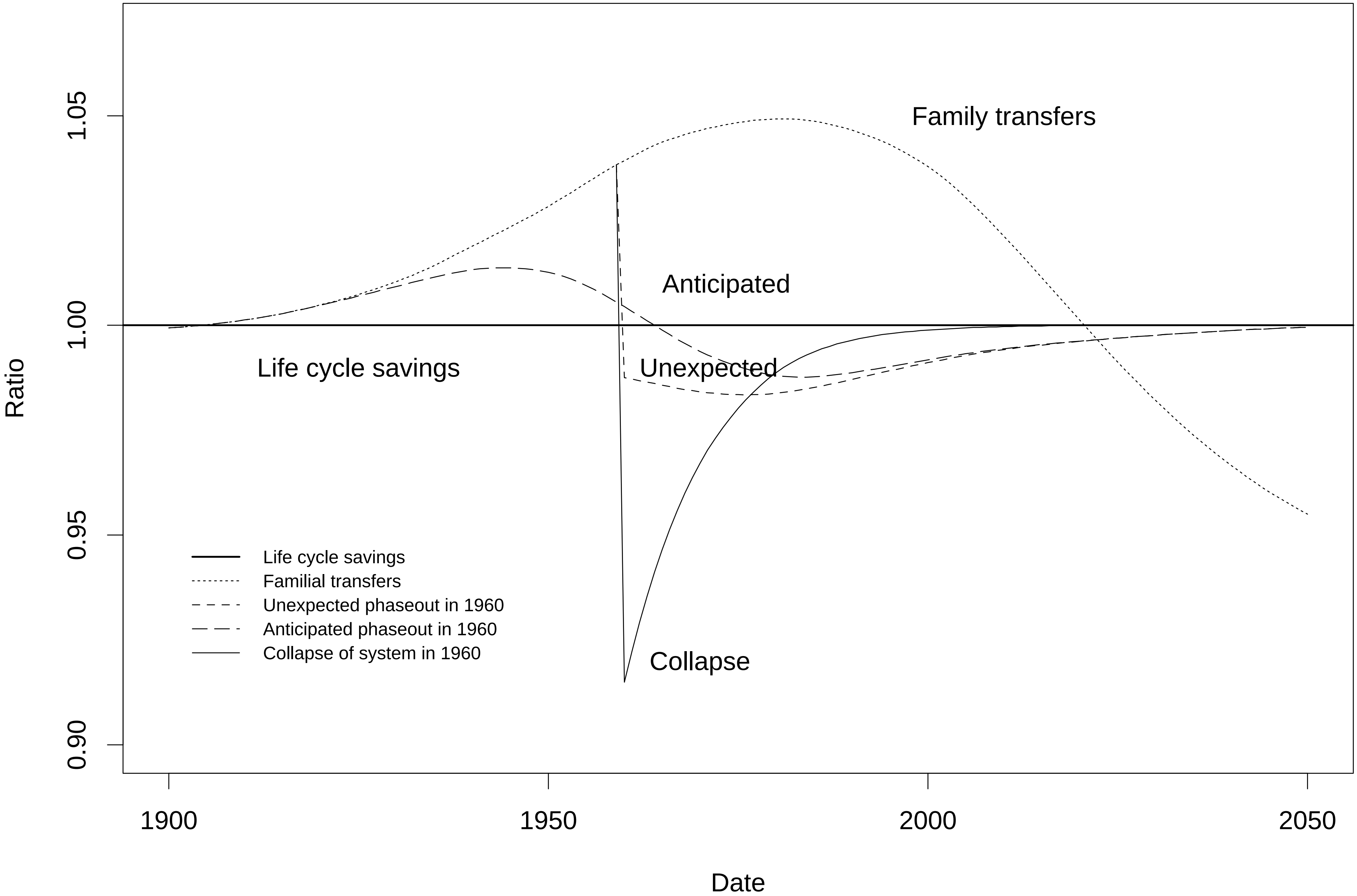


Figure 4: Savings Rate, US

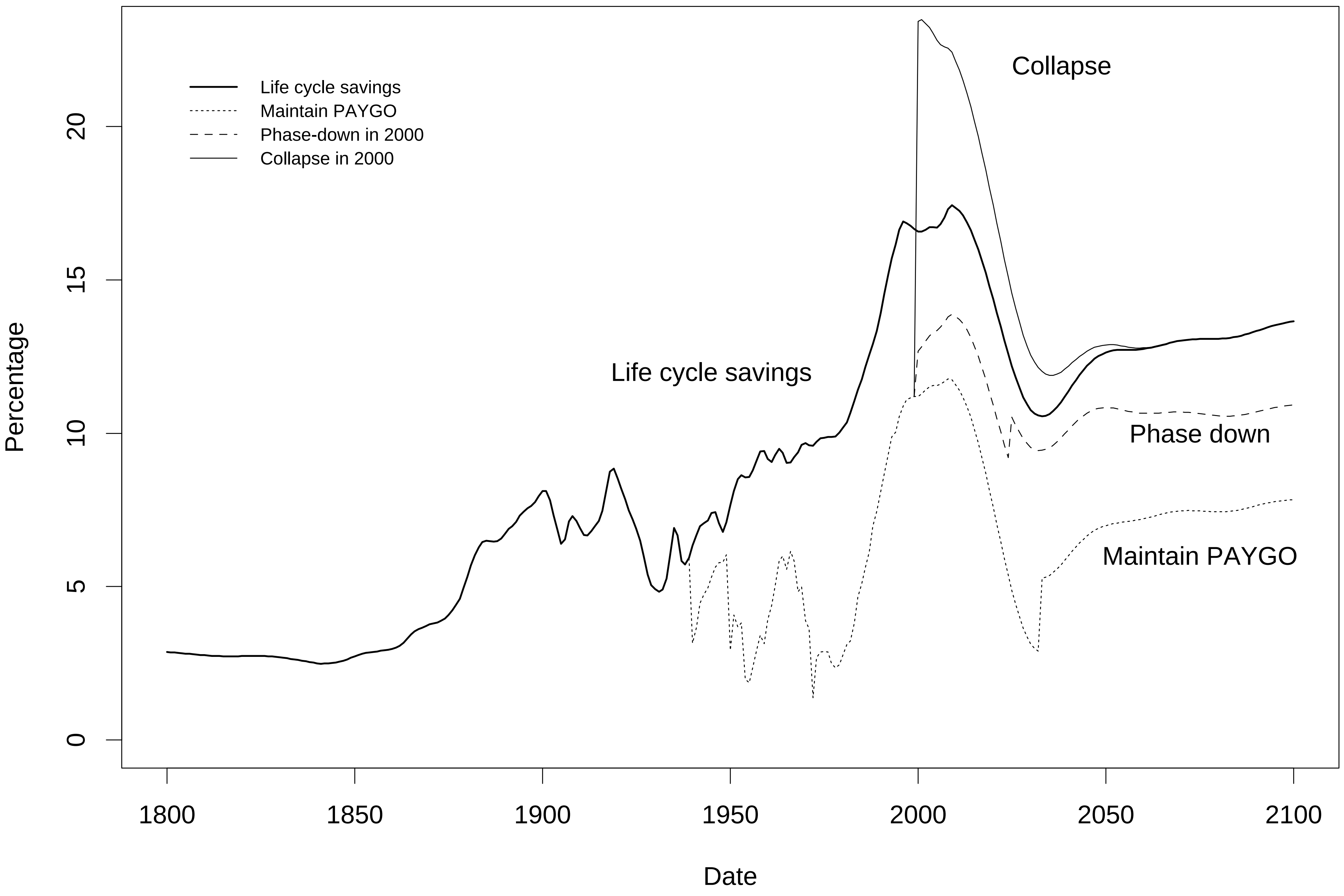


Figure 5: Capital/Output Ratio, US

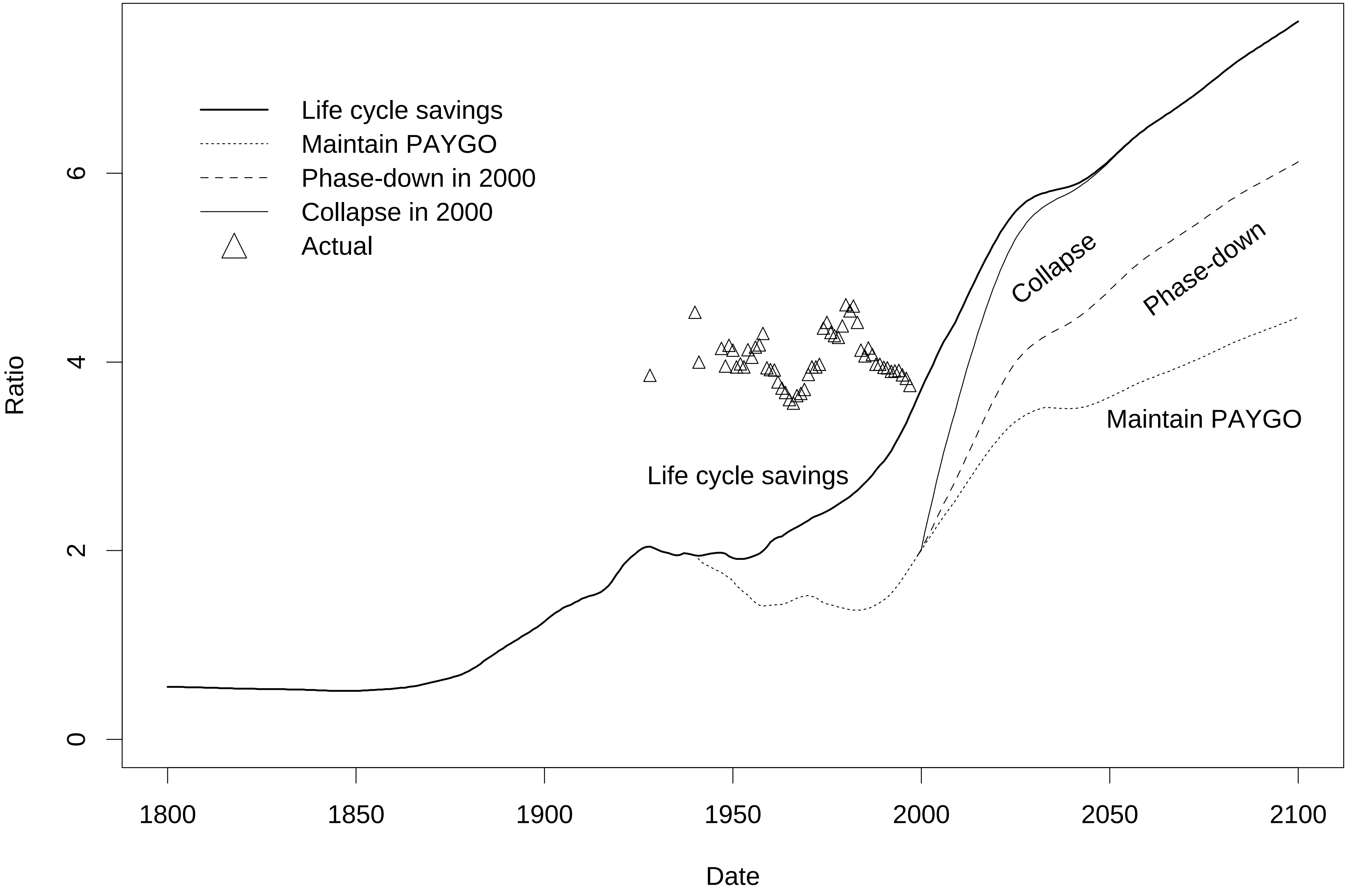
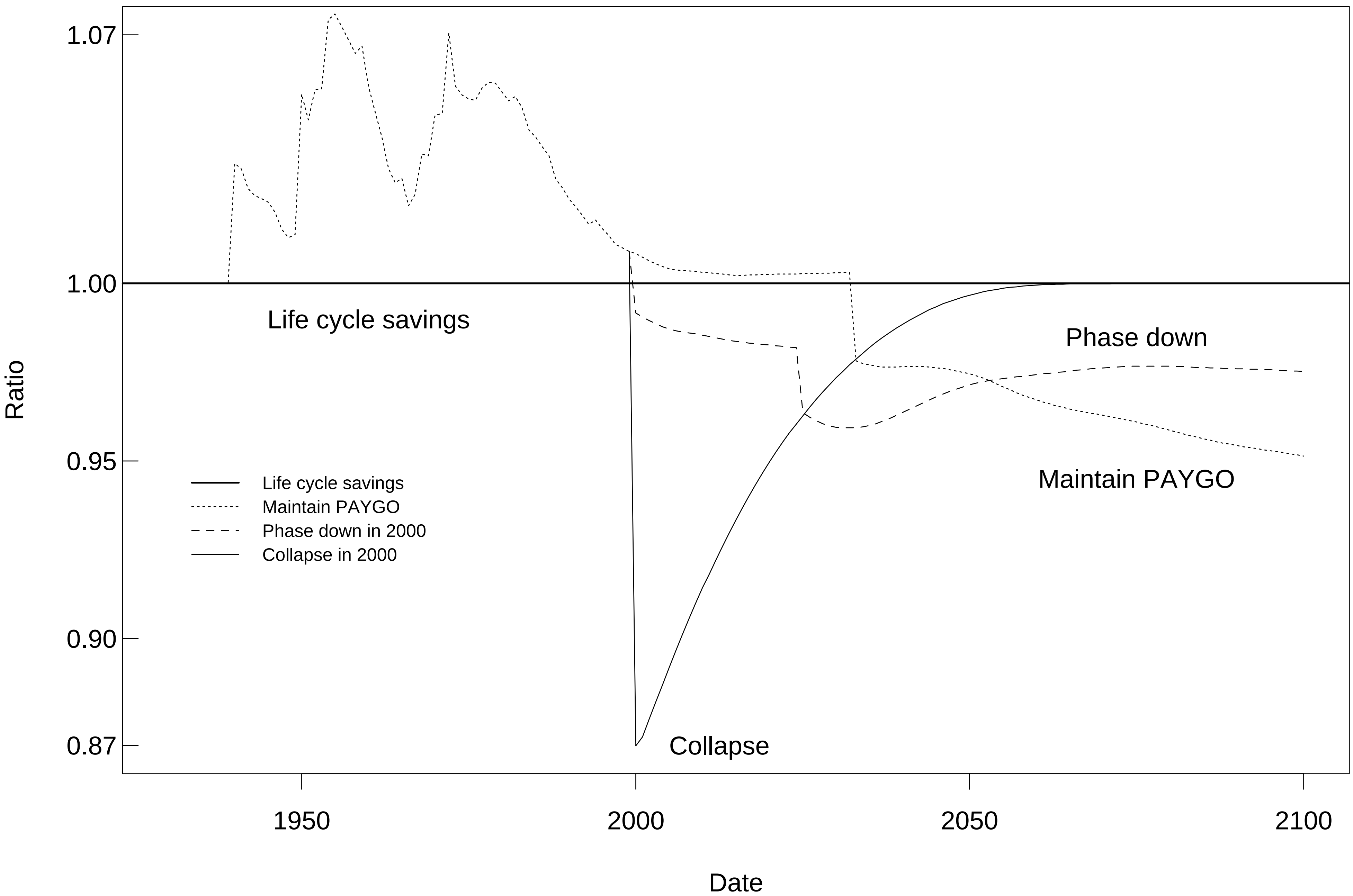


Figure 6: Total Consumption Relative to Life Cycle Savings Scenario



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