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Why is Japan's Private Savings Rate So High?

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I. Introduction

It is well known that Japan's savings rate is one of the highest in the world, but there is little agreement over the reasons for the high savings rate. This paper analyzes intercountry differences in private savings rates, and the results of the analysis are used to assess the relative importance of the various factors that have been suggested as possible causes of Japan's high private savings rate.

Table 1 presents data for the member countries of the Organization for Economic Cooperation and Development (OECD) on the household savings rate and the private savings rate for the 1976-82 time period. The household savings rate is defined as household saving as a percent of household disposable income, while the private savings rate is defined as private savings as a percent of private national income, where private savings is the sum of household savings and corporate savings and private national income is the sum of household disposable income and corporate savings. As the table shows, there is considerable variation among countries in both savings rates, with the household savings rate ranging from 3.5 percent in Sweden to 21.6 percent in Italy and the private savings rate ranging from 6.5 percent in Iceland to 33.1 percent in Luxembourg. Japan ranks high with respect to both saving rates: her household savings rate of 21.2 percent is second only to Italy and her private savings rate of 22.7 percent is second only to Luxembourg. By contrast, the United States has a household savings rate of only 8.1 percent and a private savings rate of only 10.4 percent, both of which are the fourth lowest among the OECD countries for which data are available and less than one half of the corresponding figures for Japan.

1/ This study was prepared by Mr. Horioka, Associate Professor, Kyoto University, during the period when he was a consultant in the Asian Department in 1985.

Table 1. Household Savings Rates and Private Savings Rates in OECD Countries

Country	Time Period	Household Savings Rate	Private Savings Rate
Australia	1976-82	13.3	15.8
Austria	1976-82	10.3	16.0
Belgium	1976-82	16.1	16.8
Canada	1976-82	12.0	17.8
Denmark	1976-82	na	11.5
Finland	1976-82	5.5	9.9
France	1976-82	12.7	12.4
Germany, Federal Republic of	1976-81	12.8	15.2
Greece	1976-82	na	22.1
Iceland	1976-80	na	6.5
Ireland	1976-81	na	21.5
Italy	1976-82	21.6	21.4
Japan	1976-82	21.2	22.7
Luxembourg	1976-80	na	33.1
Netherlands	1977-82	12.3	15.7
New Zealand		na	na
Norway	1979-82	4.1	10.6
Portugal		na	na
Spain	1976-81	8.8	12.3
Sweden	1976-82	3.5	7.5
Switzerland	1976-82	10.9	17.1
Turkey		na	na
United Kingdom	1976-82	8.5	11.0
United States	1976-82	8.1	10.4
Yugoslavia		na	na
Average		11.4	15.6

Notes: Refer to the text and to the Data Appendix for calculation method and data source.

Na denotes not available.

The objective of this paper is to explain why Japan's savings rate is so high relative to the other OECD countries, in general, and to the United States in particular, and to predict future trends in Japan's savings rate. Accordingly, the paper is organized as follows: Section II describes the savings model with Section III providing the estimation results of the model. Section IV presents an analysis of the factors responsible for the Japanese private savings rate. Section V discusses the future of the savings rate and the concluding Section VI summarizes the findings.

II. The Specification of the Model

This section provides a description of the specification of the model. The specification is based largely on the life-cycle hypothesis and is similar to the specifications used in previous econometric analyses of international differences in savings rates (see, for example, Barro and MacDonald (1979), Feldstein (1977, 1980), Kopits and Gotur (1980), Koskela and Viren (1983), Modigliani (1970), and Modigliani and Sterling (1983)). More detailed descriptions of all variables (including definitions, calculation methods, and data sources) are given in the Data Appendix.

Following Feldstein (1977, 1980), Modigliani (1970), and Modigliani and Sterling (1983), the private savings rate SPVT, is used as the dependent variable. As discussed earlier, the private savings rate differs from the household saving rate by the inclusion of corporate savings (undistributed corporate profits) in both the numerator and the denominator, and its use requires the assumption that household savings and corporate savings are perfect substitutes. Although the empirical evidence on this point is mixed, theoretical considerations favor the use of the private savings rate "... because any wealth-oriented theory of saving will suggest that increments of asset value, wherever they are located, will be of approximately equal relevance to the saver" (Solow, 1982, p. 163). In any case, the two saving ratios appear to be highly correlated with one another, as can be seen from Table 1. A final caveat concerns the treatment of purchases of consumer goods. As Modigliani (1970, p. 203) and others have noted, savings in the form of net additions to the stock of durable goods should be included in savings, but as was the case in previous studies, this component is omitted owing to a lack of data.

According to the life-cycle hypothesis of Modigliani et al., the primary motive for saving is to provide for one's retirement; thus, individuals save during their working years and dissave during their retirement years. In a stationary economy, the savings of the young will be exactly offset by the dissaving of the old, leading to an aggregate household savings of zero; however, in the presence of either population growth and/or productivity growth, a positive amount of household savings will result because the savings of the young will exceed the dissaving of the old. Moreover, the higher the rate of population or

productivity growth is, the higher will be the household savings rate. Thus, the life-cycle hypothesis predicts that population growth and productivity growth will be important determinants of the level of household savings (see, for example, Modigliani (1966) and Modigliani and Brumberg (1980)).

Therefore, the growth rates of population and productivity are logical candidates for inclusion as explanatory variables in the savings function. However, as Modigliani (1970, pp. 210-13) has argued, it is not population growth per se but the ratio of retired households to working households that would be expected to influence the savings rate, and moreover, if population growth were not balanced, the rate of population growth would not necessarily bear a stable relationship to the above ratio. Since population growth has been far from balanced, it appears preferable to use the ratio of the aged population to the working-age population rather than the population growth rate. Moreover, since the population that has not yet reached working age contributes to consumption without contributing to income, their ratio to the working-age population may also exert a positive impact on the savings rate (Modigliani, 1970, p. 213). Therefore this study utilizes the variables AGE (the ratio of the population aged 65 and over to the population aged 20 to 64) and DEP (the ratio of the population aged 19 and under to the population aged 20 to 64). The variable GPOP (the average annual rate of change of population) has also been tried in lieu of AGE and DEP in certain variants.

With respect to productivity growth, the appropriate variable is the rate of growth of output per worker, but because data on employment are not available on an annual basis for all countries, population has been adopted as a proxy for employment. Thus, the variable used was GYPC (the average growth rate of real per capita private national income). In addition, GY (the average growth rate of real private national income) was also tried because this is the variable used by Feldstein (1977, 1980).

Another influence on the savings rate that is identified by the life-cycle hypothesis is the ratio of the retirement span to life span (Modigliani and Brumberg, 1980, pp. 130-36). The higher this ratio is, the higher will be the percent of income that must be saved during one's working years in order to insure adequate resources to finance one's life during retirement. The earlier the retirement age and the longer the life expectancy at retirement, the longer will be the retirement span, and hence the retirement age would be expected to exert a negative impact on the savings rate, while life expectancy at retirement would be expected to exert a positive impact. With these considerations in mind, the following variables has been defined: LE65 (the life expectancy of males at age 65), RETAGE (the retirement age, proxied by the qualifying age for public old-age pensions), LERET (the life expectancy of males at the standard retirement age RETAGE), and LPAGED (the labor-force participation rate of males aged 65 and over). In addition, the methodology of Modigliani and Sterling (1983, pp. 32-33) has been used to construct

a rough measure of the average retirement span. Note that the retirement span of those retiring at the standard retirement age (RETAGE) is equal to LERET, while the retirement span of those not retiring is obviously zero. Thus, if we assume that LPAGED is a measure of the proportion of males who choose not to retire, the average retirement span, RETSPAN, can be calculated as follows:

$$(1) \quad \begin{aligned} RETSPAN &= LERET * (1 - LPAGED) + 0 * LPAGED \\ &= LERET * (1 - LPAGED) \end{aligned}$$

Alternatively, since RETAGE may not be an accurate measure of the actual retirement age, the average retirement span can be defined on the assumption that the retirement age is 65 for all countries:

$$(2) \quad \begin{aligned} RETSPAN' &= LE65 * (1 - LPAGED) + 0 * LPAGED \\ &= LE65 * (1 - LPAGED) \end{aligned}$$

Modigliani and Sterling essentially adjust PAGED for intercountry differences in the labor force participation rate of working-age males, but this practice has not been adopted because such variations are small (the labor-force participation rate of males aged 25 to 44 varies within the relatively narrow range of 93-98 percent).

The final set of variables identified by the life-cycle hypothesis are those relating to social security. As shown by Feldstein (1974) using his extended life-cycle model, public old-age pensions represent an alternative source of funds for financing life during retirement and hence will tend to reduce private saving (the wealth replacement effect), but to the extent that they induce workers to retire earlier, thereby necessitating more saving for retirement, such pensions will tend to increase private saving (the induced-retirement effect). Since the two effects operate in opposite directions, the net impact of public old-age pensions on private saving cannot be determined a priori.

The appropriate measure of public old-age pensions is the amount of benefits that current workers can expect to receive when they retire, but, in the absence of such data, data on current benefit expenditures for public pensions have been used. Following Barro and MacDonald (1979), Feldstein (1977), Kopits and Gotur (1980), and Koskela and Viren (1983), SSPENY is defined as the ratio of public pension benefits per person aged over 65 to per capita private national income. Feldstein (1977, 1980) also uses a measure of social security which equals benefits per retired person in countries with a retirement test and benefits per aged person in countries with no retirement test. However, but since the detailed provisions of retirement tests (for example, the extent to which pensions are reduced or eliminated if the individual does not retire completely) vary greatly from country to country, it did not appear to be fruitful to make this distinction for the purposes of this study. Moreover, in some of his variants, Feldstein (1977) divides his social security variable into two components--benefits per recipient

and the coverage ratio (the number of recipients as a ratio of the aged population or of the retired population); the data needed to perform this calculation here (in particular, data on the number of pension recipients) are not available. Modigliani and Sterling (1983) use data on benefits per retired individual, but this procedure is conceptually flawed because, in many countries, retirement is not a precondition for receiving benefits. Finally, Feldstein (1980) and Modigliani and Sterling (1983) also use data on the "effective replacement rate" for a newly retiring standardized worker in the manufacturing sector. These data come closest to the theoretically appropriate concept, but they are not available for recent years and are available only for 12 of the selected countries.

An alternative measure, SSPENYT (the ratio of public pension benefits to aggregate private national income), was also tried, but SSPENY is the preferred measure because it controls for differences in the age structure of the population.

Two related variables pertain to a broader concept of social security, which encompasses not only pensions but also other forms of social insurance (sickness/maternity, employment injuries, and unemployment) as well as family allowances, public assistance, etc. The first of these variables is SSTY (the ratio of benefit expenditures for broadly defined social security to private national income), while the second is SSOY (the ratio of benefit expenditures for social security programs, other than public pensions, to private national income). (Kopits and Gotur (1980) use essentially the same measure.) Although the life-cycle hypothesis does not incorporate a role for social security programs other than old-age pensions, it is at least feasible that other forms of social security will reduce the need for precautionary savings, and thereby have a negative impact on private savings.

Two other social security-related variables are RT (a dummy variable that equals one for countries whose public old-age pension systems impose a retirement or earnings test on beneficiaries, and zero otherwise) and SSYR (the year in which each country's public pension system was established). RT would not be expected to influence the savings rate directly, but may have an effect through LPAGED. SSYR is included as a measure of the age or maturity of the public old-age pension system. A number of different effects are possible, as pointed out by Feldstein (1977, p. 188) and Kopits and Gotur (1980, p. 169), who include a similar variable in their analyses, and the sign of its coefficient is indeterminate.

Another variable that was tried is INVYPC (the reciprocal of per capita private national income in U.S. dollars, converted using purchasing power parities). Following Kopits and Gotur (1980), national currencies were converted into U.S. dollars using purchasing power parities which seems to represent an improvement over earlier studies. Note that the life cycle/permanent income hypothesis predicts that the

savings rate will be independent of the level of income, while the Keynesian absolute income hypothesis predicts that savings will be a function of the level of income.

Three variables relating to the real rate of return were tried: INT (the nominal yield on long-term government bonds), INFL (the rate of consumer price inflation), and RINT (the real interest rate). Owing to the unavailability of data, no account was taken of intercountry differences in marginal tax rates on property income. Assuming a positive interest elasticity of savings, INT and RINT should have a positive impact on savings and INFL a negative impact.

HRS (the average number of hours worked per week in the manufacturing sector) was also tried on the basis of the argument advanced by Makin (1985): If consumption and leisure are complementary goods, a greater number of hours worked (less leisure) should lead to less consumption (more saving).

Finally, two variables designed to proxy the relative price of land were included: GDPDEN (gross domestic product per square kilometer in U.S. dollars, converted using purchasing power parities) and POPDEN (population density, defined as persons per square kilometer). The relative price of land may influence private savings because, as discussed in Horioka (1985), higher land prices will necessitate higher savings for housing purchases, assuming a price-inelastic demand for housing.

Other variables tried by previous authors, such as the corporate savings rate (Feldstein (1977), Kopits and Gotur (1980), Modigliani (1970), and Modigliani and Sterling (1983)); some measure of the size distribution of income (Kopits and Gotur (1980)) or of the functional distribution of income (Modigliani (1970)), etc., could have been included but were not because the data needed to construct them were available for only a subset of the countries and because their coefficients were generally found to be insignificant in previous studies. It would have been desirable to include variables relating to household wealth, bonus income as a percent of total worker compensation, the tax treatment of property income, the availability of consumer credit, and other factors that have been suggested as possible causes of Japan's high savings rate, but unfortunately, the unavailability of data precluded their inclusion in the analysis.

The present study differs from past studies in the following respects: first, it makes use of more recent data, as discussed in more detail in the next section. Second, it includes variables that have never been tried before in similar cross-sectional analyses, such as the number of hours worked, the retirement age, life expectancy at retirement (computed using a country-specific retirement age), and proxies for the relative price of land. Third, it is one of the few studies (together with Kopits and Gotur (1980) and Koskela and Viren (1983)) that include variables relating to the rate of return on savings and

inflation. Fourth, it is the only study other than Modigliani and Sterling (1983) that makes use of a measure of the average retirement span, and moreover, one of the measures used here differs from the Modigliani-Sterling measure in that it uses country-specific data on retirement ages and life expectancies. Fifth, it is the only study other than Kopits and Gotur (1980) that converts income to U.S. dollars using purchasing power parities rather than exchange rates (Modigliani and Sterling (1983) also followed this procedure but did not introduce the income variable into the saving equation). Finally, it is the only study other than Kopits and Gotur (1980) that includes a measure of social security benefits other than pensions.

III. Estimation of the Model

The savings model discussed in the previous section was estimated using cross-sectional data for the 21 OECD member countries for which data on net private savings are available. The countries included are Australia, Austria, Belgium, Canada, Denmark, Finland, France, the Federal Republic of Germany, Greece, Iceland, Ireland, Italy, Japan, Luxembourg, the Netherlands, Norway, Spain, Sweden, Switzerland, the United Kingdom, and the United States. Four OECD member countries (New Zealand, Portugal, Turkey, and Yugoslavia) had to be omitted because of the unavailability of data on net private savings. In addition, variants that include variables relating to social security benefits or to the number of hours worked also exclude Iceland from the sample because such data are not available for that country. Finally, variants that include variables requiring information on the life expectancy of the aged also exclude Luxembourg because data on age-specific life expectancy are not available for Luxembourg. Thus, the sample size was reduced to either 19 or 20 in some cases.

The sample was restricted to OECD member countries for three reasons. First, the OECD compiles national income data for member countries which have been standardized to conform to the definitions in the United Nations System of National Accounts) (SNA) (see Blades and Sturm (1982)). Second, since data on savings are especially sensitive to measurement error because savings is typically calculated as a residual, a restricted sample limited to countries with more developed statistical frameworks was appropriate. Third and most important, it is desirable to compare countries that are at a similar stage of economic development and to which the life-cycle model would be expected to be applicable. As noted by Modigliani (1970, p. 215), it is not desirable to lump together countries differing radically in terms of socio-economic structure and stage of economic development:

> ... the life cycle model does not purport to represent a universal theory of individual and aggregate saving formation and wealth holding, but is instead basically designed to apply to private capitalistic economies in which at least the bulk of income, consumption, and

accumulation transactions occur through markets. Furthermore, even for economies satisfying this requirement, significant differences in economic structure might be associated with differences in such factors as tastes, life cycle profiles of earnings, and family structure, which, in turn, affect the parameters of the long run saving function.

Following previous studies, the dependent variable, SPVT, was averaged over a number of years (1976-82 for most countries in the case of the present study) in order to smooth out cyclical fluctuations. Note that, since the business cycle bottomed out in 1975, peaked in 1978, and bottomed out again in 1981, the seven-year period selected for this study has the virtue of corresponding to roughly one business cycle. Moreover, it has the added advantage of avoiding the abnormal period following the first oil crisis of 1973. Finally, it should be noted that the present study is the first to make use of the most recent data (much of which was published in 1985, the same year in which the present study was undertaken).

The explanatory variables relating to income growth, population growth, and interest rates pertain to the same seven-year period to which the savings rate data pertain, while the demographic, social security-related, and other variables, which are generally more stable over time than the economic variables, pertain to a single year (usually 1980 or the closest year to 1980 for which data are available). As noted earlier, a more detailed description of each variable (including its definition, calculation method, data source, and time period) can be found in the Data Appendix.

Following Feldstein (1977) and Modigliani (1970), each observation has been weighted by WT (the country's population multiplied by the number of years used to calculate its savings rate). (For several countries, the necessary data were not available for one or two years of the standard seven-year period). Feldstein (1980), Houthakker (1961, 1965), and some of the variants estimated by Kopits and Gotur (1980) weighed the observations by population alone, while Barro and MacDonald (1979) weighed the observations by the square root of population. Modigliani and Sterling (1983) weighed the observations by population divided by the sample variance of the savings ratio, and others employ no weight at all.

Preliminary results (not reported) showed that the coefficients of HRS, INT, and SSYR were always insignificant and that GDPDEN and INFL performed better than POPDEN and RINT, respectively. Moreover, GYPC and AGE/DEP performed better than GY and POPDEN, respectively, which is not surprising since they represent the preferred specification for the reasons discussed in the preceding section. Thus, HRS, INT, SSYR, POPDEN, RINT, GY, and GPOP were not used in the final variants.

Finally, when RT was included in the savings equation, its coefficient was negative and significant, but it was omitted in light of the lack of theoretical justification for its inclusion.

1. The estimation results for the full sample

Table 2 shows the parameter estimates based on the full sample of 21 countries. The results for the basic variant in which GYPC, AGE, DEP, LPAGED, and INVYPC are included as explanatory variables are shown first, followed by variants that include INFL, GDPDEN, and RETAGE, and a final variant that excludes INVYPC. All of the coefficients of the life cycle-related variables have the expected signs and are always highly significant (with the exception of the coefficient of GYPC in Variant 4). Moreover, their magnitudes are reasonable and are broadly consistent with the results of previous studies. For example, the coefficient of GYPC is in the range of 3.0-4.2 in Variants 1 through 3 and is, hence, higher than the estimates obtained by Feldstein (1977), Modigliani (1970), and Modigliani and Sterling (1983) but lower than those obtained by Feldstein (1980). 1/ The coefficients of AGE, DEP, and LPAGED are in the range of -2.3 to -2.8, -0.8 to -1.1, and -0.4 to -0.6, respectively, in Variants 1 through 3, which makes them somewhat higher than the estimates obtained in previous studies (except that Feldstein (1980) obtains similar estimates of the coefficients of DEP and LPAGED). In all, the results provide strong confirmation of the life-cycle hypothesis.

Turning to the coefficients of the other variables, the life cycle/permanent income hypothesis predicts that the coefficient of INVYPC will be zero, while the Keynesian absolute-income hypothesis predicts that it will be negative. Somewhat surprisingly, therefore, the coefficient of INVYPC is consistently positive and at least marginally significant, implying that the private savings rate falls as per capita income increases. It is not clear why this result obtains, 2/ but in Variant 5, Variant 3 is re-estimated with INVYPC omitted. As the results in Table 2 show, the other parameter estimates are not substantially affected by the omission of INVYPC, although the coefficients of GYPC, AGE, DEP, and LPAGED become smaller in magnitude and less significant while the coefficients of INFL and GDPDEN become larger in magnitude and more significant.

1/ Comparisons are made only with studies in which the private savings rate is used as the dependent variable.

2/ One possible explanation is that the coefficient of the income variable is, in part, capturing the impact of household wealth holdings, which are omitted as an explanatory variable owing to the unavailability of data. Since the wealth-income ratio would be expected to have a negative impact on the savings rate, if income and the wealth-income ratio are positively correlated (i.e., INVYPC and the wealth-income ratio are negatively correlated), the coefficient of INVYPC will be biased upward. I am indebted to Dr. Ching-yuan Ling for this point.

Table 2. Japan: Regressions Using the Full Sample

Variable	Coefficient	Standard error	T-statistic
Variant 1			
Constant	1.03493	0.172939	5.98436
GYPC	4.22669	1.16177	3.63814
AGE	-2.82422	0.357074	-7.90934
DEP	-0.883405	0.212860	-4.15017
LPAGED	-0.610472	0.109339	-5.58330
INVYPC	1782.12	163.233	10.9177
Number of observations: 21			
Standard error of estimate: 4.806			
Adjusted R-square: 0.9914			
Variant 2			
Constant	1.10793	0.153874	7.20023
GYPC	3.63100	1.04332	3.48024
AGE	-2.55118	0.331658	-7.69220
DEP	-1.14616	0.215692	-5.31386
LPAGED	-0.466309	0.112800	-4.13395
INFL	0.443456	0.185371	2.39226
INVYPC	1392.11	216.432	6.43211
Number of observations: 21			
Standard error of estimate: 4.191			
Adjusted R-square: 0.9934			

Table 2. Japan: Regressions Using the Full Sample (continued)

Variable	Coefficient	Standard error	T-statistic
Variant 3			
Constant	0.935003	0.169421	5.51880
GYPC	3.02952	1.01415	2.98724
AGE	-2.29778	0.334485	-6.86960
DEP	-0.82786	0.261962	-3.16023
LPAGED	-0.429624	0.105805	-4.06052
INFL	0.566761	0.183184	3.09395
GDPDEN	0.218134E-04	0.116911E-04	1.86581
INVYPC	820.003	365.803	2.24165
Number of observations: 21			
Standard error of estimate: 3.863			
Adjusted R-square: 0.9944			
Variant 4			
Constant	1.38070	0.231532	5.96331
GYPC	-0.327865	1.61533	-0.202971
AGE	-1.61389	0.397678	-4.05828
DEP	-0.921460	0.225649	-4.08361
LPAGED	-0.296343	0.104943	-2.82384
INFL	0.467043	0.160736	2.90565
GDPDEN	0.159764E-04	0.102063E-04	1.56534
RETAGE	-0.0074571	0.00303555	-2.45659
INVYPC	554.338	328.862	1.68562
Number of observations: 21			
Standard error of estimate: 3.280			
Adjusted R-square: 0.9960			

Table 2. Japan: Regressions Using the Full Sample (concluded)

Variable	Coefficient	Standard error	T-statistic
Variant 5			
Constant	0.725576	0.160369	4.52441
GYPC	2.24203	1.07950	2.07693
AGE	-1.77584	0.272484	-6.51724
DEP	-0.550336	0.261953	-2.10090
LPAGED	-0.287908	0.0962676	-2.99070
INFL	0.848249	0.151334	5.60513
GDPDEN	0.437812E-04	0.0723387E-04	6.05225

Number of observations: 21
Standard error of estimate: 4.383
Adjusted R-square: 0.9928

Variants 2, 3, and 4 show that inflation has a positive and highly significant impact on private savings, with the coefficient of INFL being in the 0.4 to 0.6 range; in Variant 5, however, it is 0.8. Theoretically, inflation can have either a positive or a negative impact on savings, depending on which effects predominate, and the results in this study suggest that the positive effects outweigh the negative ones. It could be, for example, that inflation induces households to increase their saving in order to maintain the real value of their financial assets or that inflation increases the amount of uncertainty about the future and hence the perceived need for precautionary savings. The implied impact of inflation on private saving is considerable, with a one percentage point increase in inflation raising the private savings rate by about half a percentage point.

Turning to the coefficient of GDPDEN, which is used as a proxy for relative land prices, the results of Variants 3 through 5 in Table 2 show that the coefficient of GDPDEN is always positive and at least marginally significant. This gives support to the notion that higher land prices do indeed induce greater savings for land/housing purchases.

Finally, Variant 4 shows the impact of RETAGE, which, like GDPDEN, is unique to the present study. It has a positive and significant impact on the private saving rates, as predicted by the life-cycle model, but its inclusion causes most of the other coefficients to become smaller in magnitude and less significant, with the coefficient of GYPC becoming totally insignificant.

Taken as a whole, the results are highly satisfactory, although the incorrect sign on INVYPC and the adverse impact of RETAGE on the other coefficients are somewhat disturbing. The overall fit of all of the variants is exceptionally good, especially considering the cross-sectional nature of the data. The fit is the best for Variant 4 (in which RETAGE is included), with Variant 3 having the next best fit. The results of these two variants will therefore be used in the analysis in Section IV.

2. The impact of social security and life expectancy of the aged

As noted earlier, owing to a lack of data, two countries (Iceland and Luxembourg) had to be dropped from the sample, reducing the sample size from 21 to 19, in the attempt to analyze the impact on savings of social security and the life expectancy of the aged. However, it should be noted that Iceland and Luxembourg were given only a small weight at the outset because of their small populations.

When the four variables relating to the level of social security benefits (SSPENY, SSTY, SSPENYT, and SSOY) were added to the savings equation, their coefficients were consistently positive but small in

magnitude and statistically insignificant, and the other parameter estimates were not significantly affected. With respect to the pension-related variables (SSPENY and SSPENYT), this result suggests that the wealth-replacement and induced-retirement effects of public pensions roughly offset one another, as a result of which their net impact on private savings is roughly zero (or perhaps slightly positive). With respect to the broader measures of social security (SSTY and SSOY), it appears that the underdevelopment of social security does not necessarily lead to increased savings for precautionary purposes.

The simple correlation between the variables relating to the level of social security benefits and the private savings rate is, as expected, negative and significant (-0.43 in the case of SSPENY), but their coefficients are not significant in the savings equation in large part because of their high correlation with AGE (+0.65 in the case of SSPENY). In other words, the countries with a high ratio of the aged tend to be the countries with generous pension benefits, perhaps because a larger aged population increases the political pressure for improvements in pension benefits. As a result of this problem of multicollinearity between AGE and SSPENY, it is difficult to estimate the independent impact of pension benefits on the private savings rate. Moreover, an additional problem is the crude nature of the benefit variable used. Thus, a definitive verdict on the impact of social security on savings will have to await the availability of better data. The evidence from previous international cross-sectional studies is mixed, but it is noteworthy that Feldstein (1980) obtains a negative and significant coefficient on the benefit variable when Olsen's data (1978) on replacement rates (the most careful estimates to date) are used, and Modigliani and Sterling (1983) also obtain a negative and significant coefficient on the Olsen variable in many of their variants. It is unfortunate that the Olsen data are available for only 12 countries and that more recent data are lacking.

Turning to the variables relating to the life expectancy of the aged, the four variables described in Section II (LE65, LERET, RETSPAN, and RETSPAN') were all tried, but LE65 and RETSPAN' were both dropped from the final variants because the coefficient of LE65 was always insignificant, while RETSPAN' always performed worse than RETSPAN. It is noteworthy that RETSPAN, which appears to be an improved measure of the average retirement span and which reflects intercountry differences in both retirement ages and life expectancy, performed better than RETSPAN', which allows for intercountry differences in life expectancy but assumes a retirement age of 65 for all countries.

The results, which are presented in Table 3, show that the other parameter estimates are not significantly affected by the inclusion of either LERET or RETSPAN (except that some coefficients, especially that of GYPC, become smaller in magnitude and also become less significant, with the coefficient of GYPC becoming negative if RETSPAN is used). The coefficients of LERET and RETSPAN are both positive and significant,

Table 3. Japan: Regressions with LERET and RETSPAN

Variable	Coefficient	Standard Error	T-Statistic
Variant 1			
Constant	0.801076	0.178114	4.49754
GYPC	0.228614	1.74049	0.131351
AGE	-1.71307	0.441662	-3.87868
DEP	-0.948396	0.261588	-3.62553
LPAGED	-0.352044	0.110077	-3.19816
INFL	0.510977	0.180041	2.83811
GDPDEN	0.185945E-04	0.114630E-04	1.62213
LERET	0.00844242	0.00432712	1.95105
INVYPC	651.753	365.226	1.78452
Number of observations: 19			
Standard error of estimate: 3.748			
Adjusted R-square: 0.9950			
Variant 2			
Constant	0.641989	0.135980	4.72121
GYPC	-1.21619	1.12694	-1.07920
AGE	-1.31436	0.130629	-10.0618
DEP	-0.984138	0.257162	-3.82692
INFL	0.531357	0.174606	3.04317
GDPDEN	0.203080E-04	0.111779E-04	1.81680
RETSPAN	0.0155418	0.00335776	4.62862
INVYPC	486.792	304.250	1.59997
Number of observations: 21			
Standard error of estimate: 3.683			
Adjusted R-square: 0.9952			

indicating that a longer expected retirement span induces more saving, as expected. (Note that LPAGED was dropped in the variants that include RETSPAN because RETSPAN incorporates information on the labor-force participation rate of the aged.) Despite the significance of the coefficients of LERET and RETSPAN, however, the fit of both variants shown in Table 3 is inferior to that of Variant 4 in Table 2, which includes LPAGED and RETAGE separately but no information on the life expectancy of the aged. It thus appears that incorporating information concerning the life expectancy of the aged does not lead to an improvement in the fit.

IV. An Analysis of the Factors Responsible for Japan's High Private Saving Rate

The parameter estimates presented in the previous section will now be used in order to determine the relative importance of each factor as a cause of Japan's exceptionally high private savings rate. In particular, the results of Variants 3 and 4 in Table 2 will be used because they were the variants with the best fit.

First, it is necessary to know how the values of the explanatory variables differ between Japan and other countries. As can be seen from Table 4, Japan has the lowest value for AGE of any of the 21 OECD countries included in the sample, the lowest value for RETAGE (along with four other countries), and the highest value for LPAGED. Moreover, GYPC and GDPDEN are higher in Japan than both the U.S. value and the OECD-wide mean, while DEP and INFL in Japan are below both the U.S. value and the OECD mean. Finally, YPC80 (per capita income in U.S. dollars) is slightly higher in Japan than the OECD-wide mean but lower than the U.S. value. There is usually an inverse relationship between the ratio of the young to the working-age population and the corresponding ratio for the aged, so it is somewhat odd that both ratios are relatively low in the case of Japan. The reasons for this are the following: first, the postwar baby boom has temporarily swelled the ranks of the working-age population. Second, wartime casualties reduced the number of older persons. Third, the low birth rate since the postwar baby boom has led to a decline in the number of young persons. In sum, Japan can be characterized as a country with both few young people and old people relative to the working-age population; a country with an earlier retirement age but a higher labor-force participation rate of the elderly; 1/ one with faster productivity growth, higher land prices, slower inflation, and one with a level of per capita income that is about equal to the OECD-wide mean but lower than the U.S. level.

It is possible to assess, on the basis of the estimation of the model, the relative importance of each of the variables in explaining the high level of Japan's private savings rate in comparison, for

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1/ See the footnote on p. 29 concerning this apparent inconsistency.

Table 4. Japan: Selected Values of the Key Variables 1/2/

Variable	Mean	Minimum	Maximum	Japan	United States
GYPC	0.0152	-0.0045 (Spain)	0.0371 (Luxembourg)	0.0164	0.0112
AGE	0.2264	0.1498 (Japan)	0.2844 (Sweden)	0.1498	0.1997
DEP	0.5440	0.4486 (Luxembourg)	0.8118 (Ireland)	0.5067	0.5447
LPAGED	0.2153	0.066 (Belgium)	0.502 (Japan)	0.502	0.243
INFL	0.1148	0.0377 (Switzerland)	0.4424 (Iceland)	0.0493	0.0785
GDPDEN	1023.52	16.35 (Australia)	3016.35 (Netherlands)	2555.11	278.39
RETAGE	63.90	60 (5 incl. Japan)	67 (3 countries)	60	65
INVYPC	0.0001708	0.0001067 (Luxembourg)	0.0002581 (Greece)	0.0001682	0.0001209
SSPENY	0.7133	0.3156 (Japan)	1.3804 (Netherlands)	0.3156	0.4734
SPVT	0.1559	0.0649 (Iceland)	0.3313 (Luxembourg)	0.2273	0.1040

Source: See Data Sources.

1/ All variables are in ratio form except for GDPDEN, which is in U.S. dollars; INVYPC, which is in 1/(U.S. dollars); and RETAGE, which is in years.

2/ All figures pertain to the full sample of 21 OECD countries except for those for SSPENY, which exclude Iceland.

example, with that in the United States. (Recall from Table 1 that Japan's private savings rate averaged 22.7 percent during the 1976-82 period, which exceeds that of the United States by a full 12.3 percentage points and the average for the 21 OECD countries in the sample by 7.1 percentage points.) The results of the calculations of the present study are summarized in Table 5, which shows that Japan's relatively low ratio of the aged to the working-age population is by far the most important factor. Because this variable exerts a negative influence on the private savings rate, the fact that it is by far the lowest in Japan can explain a full 8.1 to 11.5 percentage points (depending on which variant is used) of Japan's higher private savings rate when compared with that of the United States. Similarly, because higher land prices (proxied by GDP per square kilometer) exert a positive impact on the private savings rate, their much higher level in Japan appears to explain 3.6 to 5.0 percentage points of the gap between the Japanese and U.S. private savings rates. Furthermore, Japan's earlier retirement age, the lower ratio of the young to the working-age population, the lower per capita income, and the more rapid growth rate of real per capita income have also contributed to Japan's higher private savings rate, but to a lesser extent (3.7, 3.2-3.5, 2.6-3.9, and -0.2-1.6 percentage points, respectively). (The -0.2 figure arises because the coefficient of GYPC has the wrong sign in Variant 4 of Table 2; note also that Japan's lower level of per capita income acts to increase her private savings rate because the coefficient of the income variable has the "wrong" sign in both variants.)

By contrast, there are also factors that tend to reduce Japan's private savings rate, the dominant of which is the higher labor force participation rate of the aged. Because this variable exerts a negative impact on the private savings rate, its much higher level in Japan serves to lower that country's private savings rate by a substantial amount (by 7.7 to 11.1 percentage points relative to that of the United States). Similarly, because inflation exerts a positive influence on the private savings rate, the lower inflation rate in Japan has lowered the private savings rate by 1.4-1.7 percentage points relative to that of the United States.

In sum, Japan's higher private savings rate is attributable to the lower ratio of the aged and, to a lesser extent, higher land prices, an earlier retirement age, a lower ratio of the young, lower per capita income, and the more rapid growth rate of real per capita income, while a higher labor-force participation rate of the aged and, to a lesser extent, lower inflation have acted as negative influences.

Table 5 shows that the above mentioned factors can explain virtually all of the difference between Japan's private savings rate and that of the United States (the unexplained residual is virtually zero in both cases). This suggests that omitted variables such as cultural differences, tax incentives, the availability of consumer credit, the ratio of bonus income to total worker compensation, the distribution of

Table 5. Japan: The Contribution of Each Factor to the Excess of Japan's Private Savings Rate Over That of the United States 1/

Factor	Coefficient	The Contribution of Each Factor to the Excess of Japan's Private Savings Rate Over that of the U.S. Variant 1	Variant 2
Higher GYPC (growth rate of per capita income)	+/-	+1.58	-0.17
Lower AGE (ratio of the aged to the working-age population)	-	+11.47	+8.05
Lower DEP (ratio of the young to the working-age population)	-	+3.15	+3.50
Higher LPAGED (labor force participation rate of the aged)	-	-11.13	-7.68
Lower INFL (consumer price inflation)	+	-1.65	-1.36
Higher GDPDEN (GDP per km2) (a proxy for land prices)	+	+4.97	+3.64
Lower RETAGE (retirement age)	+	...	+3.73
Lower per capita income 2/		+3.88	+2.62
Residual		+0.06	0.00
Total difference in SPVT (Private savings rate)		+12.33	+12.33

Source: Staff calculations.

1/ All figures are expressed in terms of percentage points of the private savings rate.

2/ The coefficient of the reciprocal of per capita income was found to be positive, meaning that per capita income has a negative impact on the private savings rate.

income, household wealth holdings, etc., explain little of the difference between the Japanese and U.S. private savings rates. This may be because their effects are offsetting, or because they are correlated with one or more included variables, in which case the coefficients of the included variables will be biased. Other studies based on time-series analysis suggest that some of these factors, including tax incentives, may well be important.

An analysis of the factors accounting for the gap between Japan's private savings rate and that of the OECD countries as a whole showed generally similar results. The primary differences are that the contributions of the ratio of the aged and of inflation are greater while the contributions of both the level and the rate of growth of per capita income and of land prices are lower.

Modigliani and Sterling (1983, pp. 44-45) also conducted an analysis of the difference between Japan's private savings rate and the OECD-wide mean and found that the largest contributing factor was the growth rate of per capita income, a factor found here to be of minor importance. The reason for this difference is that the data used in the present study pertain to 1976-82, a time during which Japan's per capita income growth rate was only moderately higher than the OECD average, while Modigliani and Sterling used data for 1960-70 where Japan's growth rate was far higher than the average. Another difference is that Modigliani and Sterling found that the ratio of the young made a small negative contribution; in the present study it is found to make a large positive contribution. This difference is also attributable to differences in the time period: the ratio of the young in Japan during 1960-70 was close to the OECD average, whereas it is now one of the lowest among the OECD countries. A final difference is that Modigliani and Sterling found that Japan's low level of pension benefits made a large positive contribution whereas this variable is excluded here because its impact was found to be insignificant. However, the two analyses agree with respect to the two remaining variables included in the Modigliani-Sterling analysis: in both studies, it was found that the ratio of the aged made a large positive contribution while the labor-force participation rate of the aged made a large negative contribution. There is a suggestion, therefore, that the factors behind Japan's high private savings rate may differ from time period to time period, although some factors have apparently made a consistent contribution throughout. In other words as one contributing factor of Japan's high savings rate (such as a high growth rate) declined, it was replaced by other factors (such as the low ratio of the young), as a result of which the savings rate remained high. Will this process continue in the future as well? It is to this question that we now turn.

V. The Future of Japan's Private Savings Rate

It is not possible, in advance, to have a clear idea on how all the variables determining private savings behavior are likely to evolve in

the future. In looking at how the savings rate is likely to change, attention here is focussed mainly on the most important variables where the direction, and in some cases, magnitude of future changes can be anticipated with a reasonable degree of confidence. These include, in particular, expected changes in the ratio of the aged, the ratio of the young, the labor-force participation rate of the aged, and the retirement age.

Changes in the age structure of the population will be considered first because this factor was found to be, by far, the most important influence. As shown in Table 4, Japan's ratio of the aged is currently the lowest during the OECD countries included in the sample (0.1498 compared with 0.2264 in the OECD countries as a whole and 0.2844 in Sweden, the highest individual rate). However, the ratio of the aged in Japan is growing at an unprecedented rate owing to the sharp decline in the birth rate and continued increases in life expectancy. In fact, it is now projected that Japan's ratio of the aged will exceed 0.25 by the year 2000; official projections further suggest that it would rise further to above 0.40 by 2040, before tapering off. 1/ These estimates indicate that the Japanese population is, in the not too distant future, probably going to become the most aged in the world. It is clear from the model developed in this study that such a rapid aging of the population would have profound effects on Japan's private savings rate.

The increase in the ratio of the aged will be accompanied by a decline in the ratio of the young, at least until about the year 2000. This decline would be expected to increase Japan's private savings rate. Indeed, up until about 1995, the positive impact on private savings arising from a decline in DEP will slightly outweigh the negative savings effects of the projected increase in AGE.

Details of projected changes in the private savings rate at five-year intervals up to the year 2000 deriving from expected changes in AGE and DEP are given in Table 6. The net impact of these two factors would be to raise the savings rate by about 1 percent over the course of the 1980s. However, the more rapid increase in the ratio of the aged, combined with a projected turnaround in DEP, which would be expected to begin to increase again around the end of the century, would be expected together to contribute to a strong decline in private savings after about 1995. By the year 2000, it would be expected that these two factors would, taken in isolation, contribute to a reduction in the private savings rate of about 5 percentage points from the 1980 base level.

It is tentatively projected, based on these demographic projections, that there would be a much more pronounced decline in the private savings rate early in the 21st century. A substantial downward adjustment in the private savings rate should not be surprising inasmuch as

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1/ "New Estimates of the Future Population of Japan," Ministry of Welfare, Research Institute of Population Problems (November 1981).

Table 6. Japan: Future Movements in Private Savings Rate

(1) Year	(2) Value of AGE	(3) Change in AGE	(4) Change in SPVT Owing to Change in AGE	(5) Value of DEP	(6) Change in DEP	(7) Change in SPVT Owing Change in DEP	(8) Total Change in SPVT [(4)+(7)]	(9) Projected Value of of SPVT
1980	.1498	--	--	.5067	--	--	--	.2273
1985	.1661	+.0163	-.0263	.4721	-.0346	+.0319	+.0056	.2329
1990	.1880	+.0382	-.0617	.4278	-0789	+.0727	+.0111	.2384
1995	.2180	+.0682	-.1101	.3818	-.1249	+.1151	+.0050	.2323
2000	.2541	+.1043	-.1683	.3784	-.1283	+.1182	-.0501	.1772

Source: Future values of AGE and DEP were calculated using the "New Estimates of the Future Population of Japan (Nihon no Shorai Jinko Shin-suikei)" of the Ministry of Welfare, Research Institute of Population Problems (Kosei-sho, Jinko Mondai Kenkyu-sho) (November 1981).

Note: The estimated change in SPVT that is due to the change in AGE was calculated by multiplying the projected change in AGE by the estimated coefficient of AGE in Variant 4 of Table 2 (-1.61389). Similarly, the estimated change in SPVT that is due to the change in DEP was calculated by multiplying the projected change in DEP by the estimated coefficient of DEP in the same variant (-0.921460).

Japan's population growth rate is projected to become negative by about 2015; the life-cycle hypothesis would predict that, ceteris paribus, an economy with a declining population will have a negative savings rate.

The analysis thus far has assumed that all explanatory variables other than AGE and DEP will remain constant at their present levels in the future. This assumption is justifiable in the case of certain variables (for example, the inflation rate and the rate of growth of per capita income) whose future movements are difficult to predict, but it is unrealistic in the case of some of the other variables. For example, assuming that the growth rate of per capita income remains constant at a positive level implies that both the level of per capita income and GDP per square kilometer will gradually increase. The projected rise in GDP per square kilometer would, as an order of magnitude, be expected to raise Japan's private savings rate by about 2 percentage points by the year 2000 while the higher level of per capita income would lower the private savings rate by the same amount, or slightly more. Thus, the net change in the private savings rate resulting from changes in the income-related variables would not be expected to be significant.

Turning to future changes in the retirement age, the standard retirement age in Japan has been 55, but an increasing number of corporations have adopted a retirement age of 60 and further increases to at least 65 are likely in due course. The eligibility age for public old-age pensions, a closely related factor, is being increased from 60 to 65, which would, on its own, create pressures to increase the retirement age to 65. If this five-year extension of the retirement age does occur by the year 2000, this will precipitate a drop in Japan's private savings rate of about 4 percentage points as a later retirement age would shorten the average retirement span and hence reduce the need to save for retirement.

Finally, there are likely to be associated changes in the labor-force participation rate of the aged. This rate is likely to continue to decline, owing in part to improvements in public old-age pensions. 1/ The magnitude of the decline is difficult to estimate, but

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1/ The reader will note here an apparent inconsistency in assumptions. It has been assumed in this paper that an increase in the retirement age will occur simultaneously with a decrease in the labor-force participation rate of the aged, which at first seems rather odd because a higher retirement age should increase the labor-force participation rate of the aged. The explanation is as follows: whereas the retirement age has been assumed to increase from 60 to 65, LPAGED measures the labor-force participation rate of males aged 65 and over; thus, LPAGED refers to those past even the higher retirement age of 65. What has been assumed, in effect, is that the age at formal retirement from one's "lifetime" job will rise but that workers will be less likely to seek re-employment after formal retirement, a practice that has traditionally been relatively common in Japan.

under reasonable assumptions, the increase in the private savings rate induced by a lower labor-force participation rate of the aged will roughly offset the decrease in the savings rate caused by higher income levels and later retirement. Thus, the combined impact of changes in factors other than AGE and DEP on future movements in the private savings rate will probably be negligible, at least in the year 2000. Thus, the earlier discussion, which focused exclusively on the impact of changes in the age structure of the population, is probably not seriously misleading.

The conclusions of this paper would be altered if Japan's private savings rate were influenced by factors that have been omitted from the analysis. For example, if the wealth-replacement effect of public old-age pensions were relatively strong, the private savings rate might begin to decline earlier than predicted here owing to the maturation of the pension system and the attendant increase in benefit levels. Unfortunately, a lack of data prevented us from obtaining an estimate of the impact of pensions on the private savings rate. Nevertheless, the conclusion to be drawn from the projections is clear: despite the uncertainty concerning the impact of pensions, Japan's private savings rate, after a period of relative stability over the next ten years or so, will inevitably begin to decline steeply no later than in the mid-1990s.

VI. Summary

We have conducted an analysis of the determinants of intercountry differences in private saving rates and have found strong support for the life-cycle model, with income growth, the age structure of the population, the retirement age, the labor-force participation rate of the aged, and life expectancy at retirement all having the hypothesized effects. Moreover, other variables, such as the inflation rate, a proxy for the level of land prices, and the level of per capita income were also found to be significant influences on the savings rate. The level of social security benefits was not found to have a significant impact on the savings rate, a finding that was, however, due in part to a lack of data.

The regression results showed that Japan's exceptionally high private savings rate is due primarily to the lower ratio of the aged, with higher land prices, an earlier retirement age, a lower ratio of the young, and the lower level of per capita income also playing a role. By contrast, Japan's higher labor-force participation rate of the aged and, to a lesser extent, her lower inflation rate, have acted to lower the country's private savings rate.

With respect to future trends in Japan's private saving rate, the dominant influence will be the dramatic changes in the age structure of the population: a decline in the ratio of the young will cause the savings rate to increase slightly until 1995 while a rapid increase in the ratio of the aged will lead to a precipitous decline in the rate

thereafter. This suggests that policymakers would do well to act with caution in attempting to reduce Japan's current account surplus by policy changes aimed at reducing private savings. While such savings appear to be high and robust--and this is likely to continue for some time--they are by no means a permanent feature of Japan's economy. The decline in the private savings rate projected on the basis of demographic factors over the next 15 years would, in itself, be sufficient to eliminate Japan's current account surplus.

DATA APPENDIX

This Data Appendix provides a detailed description of each variable, the way in which it was constructed, and the source of the data.

SPVT = the private savings rate, defined as the ratio of net private savings to private national income. Net private savings were calculated as the sum of the net savings of the household sector (including households, private unincorporated enterprises, and private nonprofit institutions serving households) and that of the corporate sector (including nonfinancial and financial corporations and quasi-corporate enterprises). Private national income was calculated as the final consumption expenditure of the household sector plus net private savings. All data were obtained from Organization for Economic Cooperation and Development (1984b). Averages for the 1976-82 period were used for most countries, but shorter periods were used for some countries owing to data availability.

SHH = the household savings rate, defined as the ratio of net household savings to household disposable income. Net household savings were defined as the net savings of the household sector (as defined above in the section on SPVT), while household disposable income was calculated as the sum of net household savings and the final consumption expenditure of the household sector. The time period and the data source are the same as those for SPVT.

GYPC = the annual growth rate of real per capita private national income. Refer to the description of SPVT above for the definition of private national income. The average annual rate of growth during the 1976-82 period was used for most countries, but shorter time periods were used for some countries owing to data availability. For both the starting and ending years, the nominal private national income of each country was divided by the midyear estimate of its total population and then deflated by the implicit price deflator for private final consumption expenditures. The data on (nominal) private national income were calculated from Organization for Economic Cooperation and Development (1984b), while the population and price deflator data were taken from Organization for Economic Cooperation and Development (1984a) (p. 122 for the population data and p. 120 for the price deflator data).

GY = the annual growth rate of real private national income. The same calculation procedure, data source, and time period as those for GYPC were used, with the only difference being that total (rather than per capita) private national income was used.

YPC80 = per capita private national income in 1980 in U.S. dollars. Refer to the descriptions of SPVT and GYPC above for the data sources used for private national income and population. The conversion from national currencies to U.S. dollars was done using purchasing power

parities (PPPs) for private consumption (such data are available in Organization for Economic Cooperation and Development (1984a, pp. 123, 130).

INVYPC = the reciprocal of 1980 per capita private national income in U.S. dollars. Calculated as 1/YPC80.

INFL = the average annual rate of change in consumer prices. This variable was calculated from data on the implicit price deflator for private final consumption expenditures, which were taken from Organization for Economic Cooperation and Development (1984a, p. 120). The time period used was 1976-82 for most countries but somewhat shorter time periods were used for some countries owing to data availability. (The same time period as that used to calculate the private saving rate was used for each country.)

GDPDEN = gross domestic product per square kilometer in 1980 in U.S. dollars. Data on GDP in U.S. dollars, which were converted from national currencies into dollars using purchasing power parities, were taken from Organization for Economic Cooperation and Development (1984a, p. 124); for countries not included in the table on this page, the data on purchasing power parities which are given on page 130 of the same source, were used to make the conversion. Data on the surface area of each country in square kilometers as of mid-year 1980 were taken from United Nations Demographic Yearbook (1982, Table 3, pp. 136-45).

POPDEN = population density (population per square kilometer) in 1980. See the description of GYPC for the source of the population data and the description of GDPDEN for the source of the data on surface area. Data for mid-year 1980 were used.

DEP = the ratio of the population aged 19 and under to the population aged from 20 to 64. These data were taken from United Nations (1985, Table 7, pp. 188-253) and earlier editions of the same. Data for 1980 or the closest year to 1980 for which data were available (generally either 1979 or 1981) were used.

AGE = the ratio of the population aged 65 and over to the population aged from 20 to 64. See the description of DEP for the data source and time period.

GPOP = the average annual rate of change of population. See the description of GYPC for the data source used. The time period used was the same as that used to calculate SPVT (1976-82 for most countries).

WT (the weighting variable in the weighted regressions) = the number of years of data used to calculate SPVT (seven for most countries) multiplied by each country's population in 1980. See the description of GYPC for the source of the population data.

LPAGED = the labor-force participation rate of males aged 65 and over. These data pertain to mid-year 1975 and were taken from International Labor Office (1978, Special Table, pp. 15-47). More recent data are available for many countries in later editions of the same source, but the data used represent the most recent tabulation of age-specific labor force participation rates for which (1) the coverage is comprehensive, (2) the data pertain to the same year, and (3) the data for each country are adjusted for definitional differences.

HRS = the average number of hours worked by both sexes in the manufacturing sector in 1980. These data were taken from International Labor Office (1984, Table 12A, pp. 540-44). The figures refer to the number of hours paid for in some countries and hence are not strictly comparable across countries.

INT = the nominal interest rate. The average yield during the 1976-82 time period on long-term government bonds or (when not available) the closest available alternative. The data were taken from IMF, International Financial Statistics, February 1984.

RINT = the real interest rate. This variable was calculated as INT-INFL.

LE65 = the life expectancy of males at age 65 (in years). Data for the 1979-81 period were used for most countries, but earlier data had to be used for a number of countries for which recent data were not available. The data were taken from United Nations (1985, Table 22, pp. 470-97) and the corresponding table of earlier editions of the same source.

LERET = the life expectancy of males at the age of retirement, RETAGE. The time period and data source are the same as those for LE65. Since data are available at five-year intervals only, interpolations were done where necessary.

RETSPAN = the average retirement span of male workers. This variable was calculated as LERET * (1 - LPAGED). See the main text for a justification of this formula and the descriptions of LERET and LPAGED for information on data sources and time periods.

RETSPAN' = the average retirement span of male workers (alternative measure). This variable was calculated as LE65 * (1 - LPAGED); thus, it assumes a retirement age of 65 for all countries. See the main text for a justification of this formula and the descriptions of LE65 and LPAGED for information on data sources and time periods.

SSYR = the year in which a country's public pension system was established. The data were taken from the U.S. Department of Health and Human Services (1984).

RETAGE = the qualifying age for public old-age pensions. More specifically, we have used the age at which a male who has contributed for forty years becomes eligible for a full pension. The data were taken from the same source as that for SSYR.

RT = a dummy variable that equals one if the country's public old-age pension system imposes a retirement test on some or all beneficiaries past the age of 65 and zero otherwise. A retirement test (also called an earnings test) is a provision that specifies that a beneficiary's pension will be reduced or eliminated if the earnings exceed a certain level. Countries that impose a retirement test on workers under the age of 65 only were classified as not having a retirement test, while countries that impose a retirement test on only a segment of over-65 beneficiaries (for example, only on those below the age of 70) were classified as having a retirement test. Since countries vary greatly in the ages for which a retirement test is imposed, in the extent to which benefits are reduced, and in the maximum level of earnings which are permitted before benefits are reduced, this variable can be regarded only as a very rough measure of intercountry differences in restrictions on the earnings of beneficiaries. The data were taken from the same source as that for SSYR.

SSPENY = public pension benefits per person over 65 as a ratio of per capita private national income. See the description of SPVT for the calculation method and data source used for private national income, the description of GYPC for the source of data on the total population of each country, and the description of DEP for the source of data on population by age group. Data on the total amount of benefit expenditures for pensions were obtained from International Labor Office (1985, Table 8, pp. 92-105). Data on the total amount of benefit expenditures for social insurance and family allowances were multiplied by the percent of this amount that goes toward pensions in order to obtain the amount of benefit expenditures for pensions. Data for 1980 were used.

SSTY = benefit expenditures for social security broadly defined as a ratio of private national income. See the description of SPVT for the calculation method and data source used for private national income. Data on benefit expenditures for social security were obtained from International Labor Office (1985, Table 5, pp. 68-75). Data for 1980 were used.

SSPENYT = benefit expenditures for public pensions as a ratio of private national income. See the description of SPVT for the calculation method and data source used for private national income and the description of SSPENY for the source of data on benefit expenditures for pensions. Data for 1980 were used.

SSOY = benefit expenditures for social security programs other than public pensions as a ratio of private national income. This variable was calculated as SSTY - SSPENYT.

List of References

Data Sources

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