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Why the saving rate has been falling in Japan

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Abstract

The paper estimates Japan's household saving rate function for the 1958-1998 period. We find that the contribution of the increase in net financial assets to the fall of the saving rate varies directly with the amount of assets. This has overwhelmed other factors and has caused the saving rate to fall since 1976.

Keywords: Japan's Household Saving Rate, Income and Financial Assets, Aging of Population, Cointegration Analysis
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I. Introduction

Japan's post-war household saving rate rose until the middle of the 1970s, and then has been falling. In order to explain these phenomena, we analyze the determinants of Japan's household saving rate using National Income Accounts data for the 1958-1998 period. This research was originally motivated by the prolonged slump of the Japanese economy since 1990s. The high saving ratio that had been an engine to economic growth has now become the major cause of the prolonged slump. Thus the downward trend that we have now observed in Japan's saving rate could work as a remedy for the slump. The matter in question is whether this downward trend will persist or not. From this view point it is more important than ever to explain why the saving rate has been falling in Japan.

A theoretical prediction of the Life Cycle hypothesis is that the saving rate falls either as the household wealth rises or the population ages, or both. Thus theory alone cannot answer specifically why the saving rate has been falling in Japan. In recent empirical studies the negative impact of an aging population on the saving rate has attracted attention (e.g., Horioka (1997)). We agree that an aging population must be one of the factors that contributes to the decline in the saving rate. However we feel that household saving rate may have already started to fall before the onset of an aging population.

To clarify this point we first estimate Japan's household saving rate function using conitegration analysis. According to the Life Cycle hypothesis we consider disposable income, net financial assets, and the proportion of non-working population, which is highly correlated with an aging population. Then we use the estimates to calculate the contribution ratios of each explanatory variable to the change in the saving rate. In calculating the contribution ratios we divide the whole sample into the 1958-1976 period, in which the saving rate had risen, and the 1976-1998 period, in which the saving rate has been falling.

Section II below explains the data. Section III summarizes the results of the cointegration analysis. Section IV shows the contribution ratios and concludes by explaining why the saving rate has been falling in Japan.

II. Data

We use calendar year data for the 1958-1998 period. A household saving rate (SHR) is defined as SH/YD, where SH and YD are the saving and the disposable income, respectively, of households, including private unincorporated non-financial enterprises. As a measure of assets we use the closing balance-sheet account of households, including private unincorporated non-financial enterprises and private non-profit institutions serving households. From this account we take net financial assets (FA), net fixed assets (H) and land (L). FA is defined as financial assets minus liabilities and H consists of mainly residential buildings. SH, YD, FA, H and L are all real magnitude (1985=100) converted using the price deflator for private final consumption expenditure. All the data above are taken from 68SNA, "Annual Report on National Accounts." We also use the ratio of working population (LPM), which is defined as the ratio of working male population to total male population of age larger than 15. The remaining fraction is positively and highly correlated with population aging.

III. Cointegration analysis

Studies in empirical macroeconomics almost always involve nonstationary variables, which causes a problem of spurious regressions. To deal with this problem, we use cointegration analysis that consists of unit root tests, cointegration tests, and the estimation of error correction model.

Step 1: Unit root tests

In table 1 we summarize the results (p-values in parentheses) on the augmented Dickey-Fuller test [Dickey and Fuller (1979)], which is the most widely used, the augmented Weighted Symmetric Tau test [Pantula, Gonzalez-Farias and Fuller (1994)], which is the most powerful, and the Phillips-Perron test [Phillips and Perron (1988)]. All these tests include constant term and trend as explanatory variables. Taking first differences of SHR, YD, FA and LPM produces stationary processes, meaning that all these variables are integrated of order one, denoted by I(1). At the p-value of p=0.05, we see that, although H is close to being an I(1) variable, it fails the test in every case. Therefore we have treated H, as well as L, as a non-I(1) variable.

[Insert table 1]

Step 2: Cointegration tests and the estimation of the saving rate function

The next step of the cointegration analysis is to test whether these I(1) variables are cointegrated. For that purpose we obtain an estimate using the cointegration regression suggested by Engle and Granger (1987). This simply means to estimate household saving rate function using the method of ordinary least squares. Given that all variables are I(1), if the error terms are stationary, then the variables are cointegrated. In this case the estimation result shown in equation (1) is stable in the long-run and could be interpreted as a model for household saving rate. Notice that, although t-values are reported in parentheses, we have to be careful in applying t-tests because the residual variance is not finite.

(1) $SHR = -47.00 + 0.98YD - 0.33FA + 0.66LPM,$

$\quad\quad (-1.94) \quad (9.32) \quad (-10.97) \quad (2.33)$

Adjusted $R^2 = 0.777$ and $CRDW = 0.87$.

CRDW is the Cointegration Regression Durbin-Watson statistic introduced by Sargan and Bhargava (1983). The critical value of 1% level for cointegration is about 0.51, and thus the reported CRDW value of 0.87 indicates the existence of cointegration. We also performed the cointegration test proposed by Engle and Granger (1987). For the existence of cointegration, p-value should be more than 0.1, and the actual p-value is 0.63. The most useful cointegration test is the trace test in the maximum likelihood procedure developed by Johansen (1988) and Johansen and Juselius (1990). Table 2 summarizes the test result in which r denotes the number of cointegrating vectors. This table shows that the hypothesis that there is one cointegrating vector or less ($r \leqq 1$) is not rejected, whereas we can safely reject the hypothesis that there is no cointegrating vector where r=0. Hence we conclude that there is a unique cointegrating vector and that equation (1) represents this cointegrating vector.

[Insert table 2]

Step 3: The estimation of error correction model

Our interest is to analyze the long-run relationship between the saving rate and its explanatory variables. As shown in the Granger representation theorem, however, the same assumption that we make to produce the cointegration implies and is implied by the existence of an error correction model, which is supposed to express the short-run adjustment process. As one of the explanatory variables, the error correction model has a one-period lagged residual (RES_{t-1}) taken from equation (1). In deciding the specification of error correction model we use a t-test. Note that, although we cannot use a standard t-test for RES_{t-1}, Hendry (1986) shows that t-value is still applicable for RES_{t-1} and the critical value is about 3 in absolute value. In addition, the coefficient of the residual term should be negative and larger than -1. The estimated result shown in equation (2) satisfies all of these conditions.

$$(2)\quad \Delta SHR_t = +\underset{(2.82)}{0.43}\,\Delta SHR_{t-1} + \underset{(3.20)}{0.41}\,\Delta SHR_{t-3} + \underset{(2.08)}{0.29}\,\Delta SHR_{t-4}$$

$$+\underset{(2.25)}{0.11}\,\Delta W_{t-2} + \underset{(3.74)}{1.90}\,\Delta LPM - \underset{(-3.37)}{2.10}\,\Delta LPM_{t-1} + \underset{(2.66)}{1.36}\,\Delta LPM_{t-2} - \underset{(-3.90)}{0.54}\,RES_{t-1},$$

$R^2 = 0.55$ and Adjusted $R^2 = 0.45$.

IV. Summary and conclusion: why the saving rate has been falling

Table 3 summarizes the contribution ratios of each explanatory variable to the change in the saving rate, which is calculated based on equation (1). In calculating the contribution ratios we divide the whole sample into the 1958-1976 period, in which the saving rate was rising, and the 1976-1998 period, in which the saving rate was falling (as it has continued to fall to date). Note that, when the adjusted R^2 is not large enough, the contribution ratios calculated using the fitted values of the saving rate might not properly explain the actual change in the saving rate. Thus, in parentheses, we also replace the fitted value of the saving rate with the actual value.

[Insert table 3]

Table 3 suggests the following explanation for the hump-shaped pattern of Japan's post-war household saving rate. The rise in household disposable income during the 1958-1976 period contributed greatly to the rise of the saving rate, overwhelming the negative effects of the rise of net financial assets. However, during the 1976-1998 period, the positive effect of the disposable income was still strong, but was more than offset by the strong negative effect of rising net financial assets. The key finding here is that the contribution of the increase in net financial assets to the fall of the saving rate varies directly with the amount of assets, that is, the higher the amount of household net financial assets, the higher the contribution to the fall of the saving rate. Table 3 also clarifies that the contribution of the aging population to the fall of the saving rate is minor compared with either disposable income or net financial assets.

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Table１. Tau-Values in the Unit Root Tests

(A) Level

	SHR	LPM	YD	FA	H	L
Wtd.Sym.	-1.14	-1.80	-0.88	-1.21	-0.52	-2.19
	(0.95)	(0.76)	(0.98)	(0.95)	(0.99)	(0.51)
Dickey-F	-1.71	-2.28	-2.33	-2.14	-1.52	-2.78
	(0.74)	(0.44)	(0.41)	(0.51)	(0.82)	(0.20)
Phillips	-4.64	-6.58	-6.00	-4.87	-6.35	-7.34
	(0.84)	(0.69)	(0.74)	(0.83)	(0.71)	(0.63)

(B) First Differences

	△SHR	△LPM	△YD	△FA	△H	△L
Wtd.Sym.	-3.06	-3.44	-3.04	-3.80	-2.70	-2.27
	(0.07)	(0.02)	(0.07)	(0.00)	(0.18)	(0.44)
Dickey-F	-2.77	-3.50	-3.91	-3.49	-2.56	-1.95
	(0.20)	(0.03)	(0.01)	(0.03)	(0.29)	(0.62)
Phillips	-39.47	-23.05	-14.66	-35.77	-20.38	-12.95
	(0.00)	(0.03)	(0.19)	(0.00)	(0.06)	(0.26)

Table2. Johansen's Maximum Likelihood Trace Test

Hypothesis	r=0	r≦1	r≦2	r≦3
Trace	80.54	18.36	9.83	3.11
P-value	(0.00)	(0.74)	(0.48)	(0.07)

Table3. Contribution Ratios

	YD	FA	LPM	SUM
1958-1976	2.29 (1.27)	-0.88 (-0.49)	-0.41 (-0.22)	1.00 (0.55)
1976-1998	1.56 (1.28)	-2.24 (-1.84)	-0.31 (-0.25)	-1.00 (-0.81)