

Private Savings Behavior and Estimation of Structural Change: The Case of Korea

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This study analyzes the Korean private savings behavior, examines the interest rate-savings linkage and tests for structural change during the post-1979 period. A significant structural break is observed.

The savings model used in this study is modified to allow for structural stability analysis. The econometric results show that structural break did occur around 1979 in the savings behavior.

The analysis also reveals that permanent income has a positive and significant impact on savings, whereas both the nominal and real interest rates have a neutral direct effect. This seems to contradict the implied assumptions of the IMF policy recommendations.

I. Introduction

It is widely accepted that, in general, developing countries in relation to developed economies face more limitations regarding savings, fixed investment, capital growth, and economic growth.

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These constraints are said to be contributors in a number of countries (including Korea) to economic problems such as higher rates of inflation, larger trade deficits, and huge foreign debts. Some have partly attributed these difficulties to lack of sufficient domestic savings which constrain domestic fixed investment and encourage borrowing from abroad to finance capital growth.

In the case of Korea, it has been suggested that a number of factors may have contributed to a change in private savings behavior during the late 1970's and early 1980's. Typically, the following are mentioned as possible causes these changes: The first mentioned is the substantial upward adjustment, in August 1977, of the interest rate ceilings and other related policies applied by the government. These steps were taken to encourage increased domestic savings for financing domestic investment needs and to decrease dependence on foreign capital. The chaotic environment for private savings and investment created by political instability after 1979 is also referred to as a possible cause.

A number of empirical studies have concentrated on the pre-1979 savings behavior of the Korean economy. None to our knowledge, however, has emphasized its analysis on the more recent period, a period in which a structural break in the savings behavior may have occurred. Moreover, the limitations relating to private savings are evident in the recent recommendations made by a five-member mission of the International Monetary Fund (IMF) to the Korean government. It was recommended by the mission that the interest rate for bank deposits and loans be increased in order to encourage an increase in Korea's national savings and to sustain economic growth without excessive dependence on loans from abroad. It should be noted that in the last few years Korea's external debt increased substantially causing some concern. This is reflected in the IMF recommendations and in the subsequent government policy changes (the end of April, 1985) to accommodate the IMF recommendations.¹ In other words, it is suggested implicitly in their recommendations that the savings behavior changed structurally and the above-mentioned

¹ For more details see: "Interest Rates on Bank Loans and Long-Term Savings Deposits," *The Korea Herald*, U.S.A. Edition, 9848, April 18, 1985 and An Editorial Article, "IMF recommendation," *The Korea Herald*, U.S.A. Edition, 9849, April 18, 1985.

policy actions are intended to readjust the behavior. The IMF recommendations suggest that interest rates play a significant role in determining savings and that increase in interest rates will increase national savings. Although some studies indicate that such relationship may exist in a number of countries, traditional theory also suggests that interest rates affect negatively private fixed investment and thus economic growth.

It is also apparent from the IMF recommendations that the changed savings behavior may have contributed to the lower rate of economic growth and the huge foreign debts. Given the importance of this issue, the main objectives of this study are to analyze the Korean private savings behavior, examine the interest rate-savings linkage, and carry out stability analysis to test empirically the hypothesis of structural change during the post-1979 period. For this purpose, the private savings model used is modified appropriately to allow for such empirical analysis. More specifically, this study is unique in relation to previous studies in that it tests for the suggested structural break in light of the August 1977 interest rate target policy changes and the post-1979 political instability.

The empirical analysis using 1963-1982 annual data indicates that there is strong statistical evidence of a structural break in the private savings behavior around 1979. In contrast to suggestions made by others, the econometric results indicate a neutral relationship between the real (and nominal) interest and real per capita private savings. Section II of this study reviews some other recent empirical studies on this issue and presents the model used for estimation. Section III discusses the empirical results and the concluding remarks are presented in Section IV.

II. Review of Recent Studies and the Model

A. Review of Some Empirical Studies

In a recent study of Korea's household saving behavior, for the period of 1962-1976, Ortmeier concluded that a negative correlation exists between the lagged nonhuman wealth stock and the flow of household savings indicating a substantial preference for

consumption out of wealth.² Furthermore, the coefficient estimate of the expected real rate of return to the household wealth portfolio implies a positive real interest rate impact on savings and suggests that the substitution effect of an increase in the expected yield on the household wealth portfolio dominates any income and wealth effects.³ On the other hand, though, Ortmeier suggests that this result should not be interpreted as definite evidence of such a positive relationship. The same study also suggests that the marginal propensity to save (MPS) out of disposable non-property income is relatively large and that the real accrued capital gains variable is highly significant in explaining savings behavior.

Sung in a similar savings behavior study of the Korean economy, for the period of 1956-1973, arrives at the following conclusions: First, real disposable income is found to be statistically significant and to be positively related to the savings ratio. Second, both the nominal and real interest rates are also positively affecting savings whereas an increase in the rate of inflation has a negative effect on savings. Finally, he states that the lagged savings ratio variable is not statistically significant at the 5% level implying an unstable dynamic adjustment pattern of the aggregate savings function.⁴

In another paper, Gupta analyzes the behavior of Korea's financial savings and, independently, the savings in physical assets for the 1960-1977 period. His results reveal that permanent income is a significant explanatory variable only in the financial savings equation while transitory income is significant only in the savings in physical assets equation. He also concludes that the real interest rate has a positive and significant influence on financial savings but negative and significant effect on savings in physical assets.

Williamson also studied empirically the private savings behavior of Korea (along with other countries) for the period of 1955-1964, using the Friend-Taubman savings model as a basis. According to his savings estimations, the real interest rate and the

² For more details see Ortmeier, p. 586.

³ *Ibid.*, p. 588.

⁴ Note that it is significant at the 10% level and thus his conclusions raises some doubts.

real per capita permanent income have a negative and statistically insignificant influence on real personal savings. Real per capita transitory income has a positive sign but is not significantly related to real per capita savings.

The contradictory conclusion reached in the forementioned studies (conducted by Williamson; Sung; Gupta; Ortmeier) may primarily be a reflection of differences in the conceptual and statistical approaches adopted, model specification, sample limitations, and variable measurement differences. Therefore, given the conflicting results, this study also attempts (in addition to testing for a structural break) to re-examine the effects of changes in real interest rates, real per capita permanent disposable income, and real per capita transitory income on the Korean real per capita private savings behavior.

B. The Empirical Model

Economic theory, in general, suggests that changes in domestic savings are directly related to changes in income. The simple Keynesian savings function, which has been used widely, states that saving is a function of disposable income. A number of alternative savings function hypotheses have been presented in the literature. The "permanent and transitory income" hypothesis, initially presented by Milton Friedman, has also been applied extensively in examining the private savings behavior. Friedman expressed private savings as a function of permanent income and transitory income. Some of these savings relationships have been examined by Bodkin; Friend and Taubman; Williamson; and Wright among others.

For our estimations, the savings function used in this study reflects the basic model framework of Friend and Taubman and can be stated as follows:

$$S_t = f(Y_t^P, Y_t^T, S_{t-1})$$

where the variables measure in real terms:

- S_t : private savings
- Y^P : permanent disposable income
- Y^T : transitory income

S_{t-1} : private savings lagged one period

The lagged savings variable is used as a proxy for the change in private assets in the previous period. Expressing the above function in per capita terms, in order to take into account changes in population (N_t), results in the following estimable linear equation:

$$(1) \quad \left(\frac{S}{N}\right)_t = a_0 + a_1\left(\frac{Y^P}{N}\right)_t + a_2\left(\frac{Y^T}{N}\right)_t + a_3\left(\frac{S}{N}\right)_{t-1}$$

In order to test for the effects of changes in the interest rates on the real per capita private savings, equation (1) is modified (as suggested by Williamson) and takes the following form:

$$(2) \quad \left(\frac{S}{N}\right)_t = b_0 + b_1\left(\frac{Y^P}{N}\right)_t + b_2\left(\frac{Y^T}{N}\right)_t + b_3\left(i_t - \frac{\Delta CPI_t}{CPI_{t-1}}\right) + b_4\left(\frac{S}{N}\right)_{t-1}$$

where

$\left(\frac{S}{N}\right)_t$: real per capita private savings

$\left(\frac{Y^P}{N}\right)_t$: real per capita permanent disposable income

$\left(\frac{Y^T}{N}\right)_t$: real per capita transitory income

$\left(i_t - \frac{\Delta CPI_t}{CPI_{t-1}}\right)$: real interest rate on time and savings deposits

$\left(\frac{S}{N}\right)_{t-1}$: real per capita private savings lagged one period

In order to accomplish the major objective of this paper (testing for structural change) the appropriate dummy and an interaction variable are introduced into equations (1) and (2). This allows one to separately estimate the intercept and the coefficient(s) for the two different periods and also to suggest the source(s) of the structural instability. Thus, models (1) and (2) are reformulated as

follows in order to carry out the structural break analysis:⁵

$$(3) \quad \left(\frac{S}{N}\right)_t = c_0 + c_1 D_t + c_2 \left(\frac{Y^P}{N}\right)_t + c_3 \left(\frac{Y^T}{N}\right)_t + c_4 \left(i_t - \frac{\Delta \text{CPI}_t}{\text{CPI}_{t-1}}\right) + c_5 \left(\frac{S}{N}\right)_{t-1} + c_6 D_t \left(\frac{Y^P}{N}\right)_t$$

or

$$(4) \quad \left(\frac{S}{N}\right)_t = d_0 + d_1 D_t + d_2 \left(\frac{Y^P}{N}\right)_t + d_3 \left(\frac{Y^T}{N}\right)_t + d_4 i_t + d_5 \left(\frac{S}{N}\right)_{t-1} + d_6 D_t \left(\frac{Y^P}{N}\right)_t$$

where

i_t : the nominal rate of interest rate

D_t : 1 for the period 1979-82 and zero elsewhere⁶

$D_t \left(\frac{Y^P}{N}\right)_t$: interaction variable on real per capita permanent disposable income and where $D_t \left(\frac{Y^P}{N}\right)_t = D_t^* \left(\frac{Y^P}{N}\right)_t$

On an *a priori* basis, the coefficients of the dummy and the interaction variables can be either positive or negative depending on the direction of change in the intercept and slope of the savings equation, during the post-1979 period.

C. The Data

The real per capita private savings variable in the above model includes savings from households, private non-profit institutions, and public and private corporations. Such treatment of the real per capita private savings variable reflects the data limitations.

⁵ For more details in using this stability analysis approach see Giannaros (1985).

⁶ The 1979-1982 period is used for our structural break analysis since we assume that the August 1977 government policy actions may have influenced the savings behavior with a one year lag.

To measure the real per capita permanent or expected normal disposable income we use the Friend and Taubman's approach and thus it is a three year average $(Y_{t-1} + Y_t + Y_{t+1}/3)$. Real per capita transitory income is expressed in terms of the deviations of expected normal disposable income (permanent) from actual annual disposable income. The income and savings variables are all expressed in 1980 *real per capita* terms. These variables are deflated using the Consumer Price Index (CPI) for Seoul capital area (base year = 1980). The interest rate variable is measured as the average interest rate paid on time and savings deposits by the banking sector.

All the data were collected from the *Economic Statistics Yearbook* (1977, 1983) and the *Monthly Statistical Bulletin* (Jan. 1984), both published by the Bank of Korea, and *The World Bank* (1976, 1983) publication published by The Johns Hopkins University.

The parameters of the equations are estimated using annual time series for the period of 1963-1982. Each equation is specified applying economic rationale and estimated by using a Maximum Likelihood procedure which assumes first order serial correlation in the disturbance term.

III. Empirical Results

A. Structural Break Analysis

One of the major objectives of this study is to test the null hypothesis of no structural break for the period 1979-1982. The null hypothesis of no structural change is rejected if the absolute value of the t-statistic of the interaction variable is larger than the tabulated value. If the null hypothesis is rejected, it is assumed that there is strong evidence of structural break in the real per capita private savings behavior possibly caused by the government policy actions and/or the political instability during the post-1979 period. Therefore, in order to test for structural change we introduced an interaction variable and a dummy distinguishing the two periods (1963-1978, the pre-1979 period; 1979-1982, the post-1979 period.) The well known Chow test for structural stability is also employed for the same purpose. The interaction variable introduced allows the regression line to change slope

from one period to another and its coefficient estimates the difference in the coefficients between the two periods. The dummy (D_t) allows the regression line to change intercept from one period to another. The introduction of the interaction variable and the dummy allows one to separately estimate the coefficient(s) of the two periods and test for structural stability. On an *a priori* basis, the coefficients of the interaction variables and the dummy can be either positive or negative depending on the direction of the slope and intercept of the savings equation during the post-1979 period. Because the dummy has units for the post-1979 period, a positive sign of the coefficient of the interaction variable would mean that slope of savings function increased during the second period.

The regression results presented in Table 1 reveal that both the dummy (D_t) and the interaction variable ($D_t \cdot (Y^P/N)_t$) are systematically highly significant. The statistical significance of the dummy and the interaction variable is also observed even when the lagged savings variable is excluded as an explanatory variable of savings (see Table 2). Therefore, it can be concluded that the null hypothesis of no structural break in the Korea's real per capita private savings model is rejected.⁷ The regression estimates indicate that the slope and the intercept of the regression line changes significantly between the pre-and post-1979 periods. This conclusion is reinforced if one examines equations (2) and (5) in Table 1 and 2, where the interaction variables and dummy are excluded, and compare them to equations (1) and (4). It is evident from the estimations that the summary statistics improve substantially when our equations are modified to take into account the structural change. The estimates of equation (1) in Table 1 provide the following information:

<u>Coefficient of</u>	<u>Constant</u>	<u>$(Y^P/N)_t$</u>
Pre-1979 period	$-26,589.7 = c_0$	$0.1492 = c_2$
Post-1979 period	$-712,914.7 = c_0 + c_1$	$1.0880 = c_2 + c_6$
Change in coefficient	$-686,325.0 = c_1$	$0.9388 = c_6$

It can be observed from the above results that there was a

⁷ The Chow-test for structural stability was also applied confirming that the estimated equations of the savings function coefficients are not stable during the two periods.

Table 1
ESTIMATES OF THE PRIVATE SAVINGS EQUATIONS (1963-1982)

Equation	Constant	D_t	$(\frac{Y^P}{N})_t$	$(\frac{Y^T}{N})_t$	i_t	$(\frac{\Delta CPI_t}{CPI_{t-1}})$	$(\frac{S}{N})_{t-1}$	$D_t (\frac{Y^P}{N})_t$	R^2 (\bar{R}^2)	D.W.	F-Stat.
1	-26,589.7 (3.04)*	-686,325 (2.46)*	0.1492 (4.59)*	-0.2347 (0.65)		91.6362 (0.27)	0.3881 (2.16)*	0.9388 (2.27)*	0.94 (0.91)	1.94	28.00*
2	-25,430.4 (1.01)		0.1408 (2.18)*	0.1455 (0.50)		798.472 (1.25)	0.2064 (0.82)		0.45 (0.30)	1.45	2.41
3	-26,492.1 (3.16)*	-586,634 (2.64)	0.1478 (4.71)*			153.183 (0.48)	0.4423 (2.81)*	0.7875 (2.43)*	0.94 (0.91)	1.91	29.54*
4	-24,749.9 (1.25)	-710,097 (2.69)*	0.1487 (3.93)*	-0.2635 (0.76)	-44.4103 (0.07)		0.3709* (2.21)*	0.9742 (2.50)*	0.93 (0.90)	1.96	28.72*
5	-8,776.4 (0.22)		0.1349 (2.05)**	0.0034 (0.01)	-484.800 (0.36)		0.1331 (0.54)		0.46 (0.32)	1.53	2.57
6	-24,758.1 (1.29)	-608,891 (2.77)*	0.1484 (4.05)*		-28,3829 (0.04)		0.4187 (2.72)*	0.8197 (2.56)*	0.94 (0.91)	1.94	28.98*
7	-26,016.9 (3.18)*	-710,859 (2.80)*	0.1501 (4.79)*	-0.2623 (0.78)			0.3683 (2.32)*	0.9750 (2.60)*	0.93 (0.91)	1.96	28.60*
8	-25,423.2 (3.22)*	-609,665 (2.89)*	0.1491 (4.90)*				0.4173 (2.87)*	0.8207 (2.66)*	0.94 (0.92)	1.94	43.42*

Values in parentheses are the estimated absolute t-values.

* Significant at the 0.05 level.

** Significant at the 0.10 level.

All equations are estimated by using the Maximum Likelihood procedure assuming first order serial correlation in the disturbance term.

Table 2
ESTIMATES OF THE PRIVATE SAVINGS EQUATIONS (1963-1982)

Equation Number	Constant	D_t	$(\frac{Y^P}{N})_t$	$(\frac{Y^T}{N})_t$	i_t	$(i_t - \frac{\Delta CPI_t}{CPI_{t-1}})$	$D_t \cdot (\frac{Y^P}{N})_t$	R^2 (R^2)	D.W.	F-Stat.
1	-35,022.4 (2.99)*	-736,494 (2.93)*	0.2100 (7.13)*	-0.3938 (1.27)		-171.3610 (0.41)	1.0104 (2.76)*	0.84 (0.78)	1.72	10.53*
2	-38,818.0 (1.28)		0.1893 (3.07)*	0.1711 (0.62)		607.6240 (1.12)		0.40 (0.29)	1.22	3.34*
3	-35726.8 (2.75)*	-565,421 (2.57)*	0.2171 (6.81)*			-40.1437 (0.09)	0.7548 (2.40)*	0.79 (0.73)	1.49	11.11*
4	-46,802.2 (1.85)**	-711,704 (2.95)*	0.2209 (6.48)*	-0.3498 (1.16)	390,279 (0.45)		0.9724 (2.78)*	0.83 (0.77)	1.67	9.71*
5	-20,308.0 (0.52)		0.1663 (3.10)*	0.0498 (0.17)	-316.175 (0.25)			0.40 (0.28)	1.38	3.28*
6	-47,858.7 (1.80)**	-580,758 (2.69)*	0.2263 (6.30)*		457,537 (0.50)		0.7756 (2.51)*	0.79 (0.73)	1.49	11.22*
7	-36,657.8 (3.31)*	-699,761 (3.00)*	0.2132 (7.48)*	-0.3600 (1.23)			0.9568 (2.82)*	0.83 (0.78)	1.68	14.58*
8	-36,042.1 (2.96)*	-560,041 (2.71)*	0.2175 (7.09)*				0.7473 (2.52)*	0.78 (0.74)	1.48	18.24*

Values in parentheses are the estimated absolute t-values.

* Significant at the 0.05 level.

** Significant at the 0.10 level.

All equations are estimated by using the Maximum Likelihood procedure assuming first order serial correlation in the disturbance term.

downward change in the intercept of the regression line (from -26,589.7 during the first period down to -712,914.7) and an increase in the regression line's slope between the two periods. The above values show a substantial increase in the coefficient of the real per capita permanent disposable income during the post-1979 period, pointing towards an upward rotation in the regression line. In the pre-1979 period a unit increase (decrease) in the real per capita permanent disposable income caused 0.15 increase (decrease) in the real per capita private savings versus a 1.09 increase (decrease) during the post-1979 period, *ceteris paribus*.⁸ Therefore, these results imply that the real per capita private savings increases (or decreases) at a faster rate during the post-1979 period as real per capita permanent disposable income increases (decreases). The same conclusions can be reached when the estimated equations are expressed without the interest rate variables and/or real per capita transitory income variables.⁹

B. Effect of Income and Interest Rates

An analysis of the econometric results presented in Table 1 and Table 2 allows to make the following comments regarding the impact of income and interest rates on the real per capita private savings. In all equations estimated the real per capita permanent disposable income $(Y^P/N)_t$ is statistically significant at the 5% level and carries the expected positive sign. This significant positive linkage was also observed by Gupta whereas Williamson, using a very small sample, observed a neutral effect.¹⁰ On the other hand, our estimates reveal that the real per capita transitory income is consistently insignificant in explaining real per capita private savings. This finding conforms with the results obtained by Williamson and Gupta. Finally, the introduction of either the nominal or real interest rate into our basic equations does not

⁸ This large coefficient should not be interpreted as the marginal propensity to save (MPS). In the context of our equation, the MPS out of real per capita normal disposable income is equal to the coefficient of the real per capita permanent disposable income plus the coefficient of the real per capita transitory income. For more details see Friend and Taubman, p. 120.

⁹ Estimations of alternative specifications using the "absolute income hypothesis" showed the same basic results but are not presented here for space considerations.

¹⁰ Yoo, in testing the significance of the role of money supply on savings and investment, also observes a positive and significant effect of both income and money on savings.

seem to improve the quality of our estimations. In fact, in all estimated equations neither the nominal nor real interest rate is statistically significant in explaining the real per capita private savings behavior. This neutrality effect of interest rates on savings seems to contradict the implied assumptions of the IMF policy recommendations to the government. The IMF recommended a policy of higher savings deposits interest rates to encourage increased savings which imply a positive linkage. The results of this study allow one to question that assumption. In fact, if fixed investment is negatively related to interest rates, higher interest rates may suppress fixed capital investment and economic growth.

IV. Concluding Remarks

Some have suggested that the savings behavior has changed during the post-1979 period and that an increase in interest rates (as suggested by the IMF) will stimulate domestic savings and decrease the foreign debt. A number of empirical studies have studied the Korean private savings behavior but to our knowledge none has attempted to determine if a structural change has recently taken place.

In an attempt to further examine the important issue of savings behavior, this study concentrates on testing empirically the influence of interest rates, real per capita permanent disposable income, and real per capita transitory income on real per capita private savings. Moreover, it also concentrates on testing for structural break during the post-1979 period.

The overall results and analysis of the estimated real per capita savings models allow for the following summary remarks to be made regarding the propositions tested:

1. The coefficient stability analysis indicates that structural change took place around 1979 in the private savings behavior. This conforms with our *a priori* expectations. The implication here is that the governmental policy actions and the political instability may have had a positive effect on savings.
2. The real per capita permanent disposable income is positively related to the real per capita private savings. The evidence indicates that this relationship strengthened

during the post-1979 period. Thus, as the economy entered a major recession in 1980 savings dropped at a faster pace than if the same recession had taken place during the pre-1979 period. This could be explained by the increased economic volatility as a result of the political instability which may have increased uncertainty about future economic events. The IMF's concern about lower savings seems to be attributed to this change in savings behavior rather than low interest rates.

3. In contrast to the IMF assumption, interest rates are not significantly correlated with the real per capita private savings behavior. Therefore, an increase in the rate of interest may not influence savings but, in fact, may discourage fixed investment. Thus, the empirical analysis does not support the common held belief that the governmental policy action on interest rates has a positive and significant impact on the real per capita private savings behavior. Given the empirical results, it is important for the government policy makers to place their efforts in encouraging and promoting a more modern and efficient financial system and in promoting the development of the capital markets. In addition, policy actions that insure savings deposits and decrease uncertainty should be considered by the government. These actions are likely to improve the market efficiency and increase private domestic savings that will allow the financing of fixed investment and suppress the need for borrowing from abroad.

Our results are subject to a number of constraints that should be taken into account before one attains a strong conviction in the above conclusions. For example, given the data limitations, ideal measures of the interest rate, income and savings variables are not obtained. Hopefully, the conclusion reached here will stimulate further research and discussion in resolving these issues.

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