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SAVING AND ECONOMIC GROWTH IN THAILAND

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In this paper, we study the long run relationship between saving and economic growth in Thailand using time series data for 1950-96. We distinguish between private saving and total saving in our paper. We find that there is a long run relationship between per capita GDP and total saving but not between private saving and per capita GDP. Our causality tests show that there is no evidence of any causal relationship between the growth of per capita GDP and the growth of total saving or between the growth of per capita GDP and the growth of private saving.

1. Introduction

Thailand has achieved one of the highest rates of economic growth in recent years. However, in recent months, Thailand, along with some other Southeast Asian countries, has been making headlines about a financial crisis of the type experienced by Mexico in 1994. Much of the boom experienced by Thailand was probably fueled by foreign saving in the form of foreign investment. However, in recent years, Thailand has been experiencing a rise in both its private saving rate and total saving rate. It is important, therefore, to study the relationship between saving and economic growth in Thailand. If it is true that domestic saving has a significant effect on economic growth, then the economic crisis ensuing in Thailand may not lead to the crisis of the proportion experienced by Mexico. Also, a number of models emphasize the role of savings in growth. These models include the Solow-Swan model and the Ramsay model. While in the Solow-Swan model, the saving rate is exogenous, in the Ramsay model, the saving rate can be derived from the parameters reflecting preferences and tastes.

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This study explores the relationship between saving and per capita GDP in Thailand using time series data. Annual data from the *International Financial Statistics* of the International Monetary Fund (1998) for 1950-1996 are used. Following previous studies, total saving is derived by subtracting private consumption and government consumption from gross domestic product. Private saving is defined as total saving minus government saving. Government saving is simply defined as government revenue minus government expenditure. All variables are deflated by the implicit GDP deflator so that we deal only with real variables. Figures 1 and 2 plot the private saving and total saving as percentages of GDP, respectively. Total saving has exceeded private saving only in recent years. In other words, Thailand has been running budget deficits during most of the period under study.

The plan of the rest of the paper is as follows. Section 2 describes the time series methodology used in the paper. Section 3 looks at the empirical results. Section 4 draws some conclusions from the analysis in section 3.

2. Econometric Methodology

We use recent advances in time series econometrics to study the relationship between saving and GDP in Thailand. First, we study the unit root properties of the variables. We use the augmented Dickey-Fuller (ADF) (see Dickey and Fuller, 1979 and 1981) test that estimates the following equation:

$$\Delta y_t = c_1 + \omega y_{t-1} + c_2 t + \sum_{i=1}^{\rho} d_i \Delta y_{t-i} + \nu_t. \tag{1}$$

In (1), $\{y_t\}$ is the relevant time series, Δ is a first-difference operator, t is a linear trend and ν_t is the error term. The above equation can also be estimated without including a trend term (by deleting the term $c_2 t$ in the above equation). The null hypothesis of the existence of a unit root is H_0: $\omega = 0$.

Once we establish the order of integration of the variables, we use multivariate cointegration tests, particularly a Johansen (1991)

Figure 1.
Private Saving as a Percentage of GDP in Thailand, 1950-96.

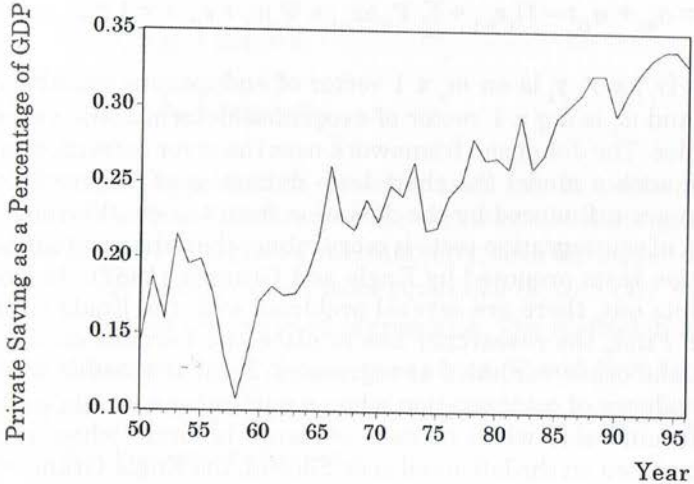
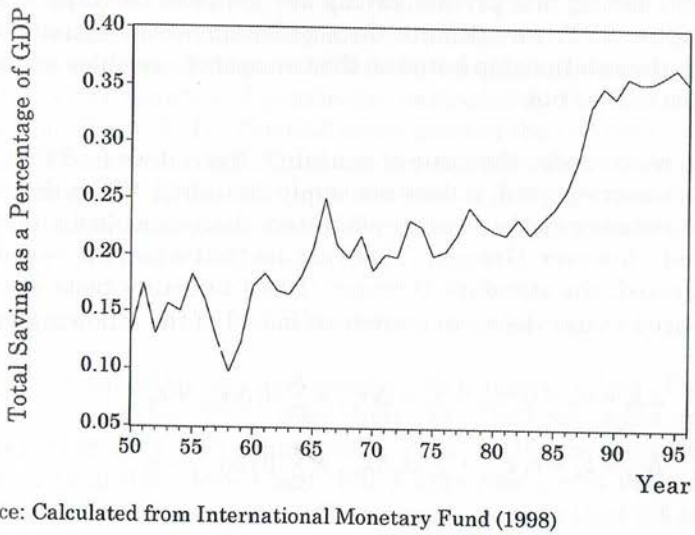


Figure 2.
Total Saving as a Percentage of GDP in Thailand, 1950-96.



Source: Calculated from International Monetary Fund (1998) framework of cointegration tests. The general form of the vector error correction model is given by:

$$(2) \quad \Delta y_t = a_{0y} + a_{1y}t - \Pi_y z_{t-1} + \sum_{i=1}^{p-1} \Gamma_{iy}\Delta z_{t-i} + \Psi_y w_t + e_t, \;\; t = 1,2,.......n$$

where $z_t = (y_t', x_t')'$, y_t is an m_y x 1 vector of endogenous variables I(1) variables and w_t is a q x 1 vector of exogenous/deterministic variables I(0) variables. The Johansen framework uses the error correction model because in such a model the short-term dynamics of the variables in the system are influenced by the deviation from the equilibrium. This framework of cointegration tests is more robust than the residual-based cointegration tests proposed by Engle and Granger (1987). As Enders (1995) points out, there are several problems with the Engle-Granger procedure. First, the researcher has to place one variable on the left-hand side and other variables as regressors. So, it is possible that one can find evidence of cointegration when a particular variable is placed on the left-hand side while no such evidence is found when another variable is placed on the left-hand side. Second, the Engle-Granger procedure is a two-step procedure. The first step is to generate the error series. The second step is to use these errors to estimate a regression. Thus, any error in the first step is carried over to the second step.

If total saving and private saving are found to be cointegrated with per capita GDP, we estimate the coefficients of the equations to see whether the relationship between the two sets of variables are positive (as expected) or not.

Next, we consider the issue of causality. Even if we find that the variables are cointegrated, it does not imply causality. When the variables are stationary or they are cointegrated, then causality tests can be conducted. However, Granger (1988) argues that when the variables are cointegrated, the standard Granger (1969) causality tests are not valid. We need to use the error correction model of the following form

$$(3) \quad \Delta x_t = a_0 + a_1 z_{t-1} + \sum_{i=1}^{g} c_i \Delta x_{t-i} + \sum_{j=1}^{h} d_j \Delta y_{t-j} + \varepsilon_t$$

$$(4) \quad \Delta y_t = b_0 + b_1 z'_{t-1} + \sum_{i=1}^{m} \alpha_i \Delta x_{t-i} + \sum_{j=1}^{n} \beta_j \Delta y_{t-j} + \upsilon_t .$$

In (3) and (4), z_{t-1} and z'_{t-1} are lagged error terms of the following cointegrating equations, respectively

(5) $$y_t = g_0 + g_1 x_t + z_t$$

(6) $$x_t = h_0 + h_1 y_t + z'_t \,.$$

Granger suggests that causality tests can be performed on the levels or on the first differences if the variables are cointegrated. If the variables are not cointegrated but stationary, then the lagged error terms z_{t-1} and z'_{t-1} are to be dropped from equations (3) and (4). Regressions (3) and (4) are the unrestricted regressions. The restricted regressions can be run by dropping $\sum_{j=1}^{h} d_j \, \Delta y_{t-j}$ terms from (3) and $\sum_{i=1}^{m} \alpha_i \, \Delta x_{t-i}$ from (4). In addition, z_{t-1} and z'_{t-1} do not enter the restricted regressions. The F statistic is calculated as follows:

(7) $$F = (n-k-1)\frac{(ESSR - ESSU)}{q(ESSU)}$$

where $ESSR$ is the error sum of squares in the restricted regression, $ESSU$ is the error sum of squares in the unrestricted regression, $n–k–1$ is the number of degrees of freedom in the unrestricted regression and q is the number of parameter restrictions. The statistic is distributed as $F(q, n–k–1)$. The null hypothesis in the Granger causality test is one of non-causality. Thus, the rejection of the null hypothesis implies causality. If the calculated F statistic is higher than critical value (table value), we reject the null hypothesis of no causality.

3. Empirical Results

All variables are expressed in logarithmic forms. The variables are private saving (PVS), total saving (TS) and per capita gross domestic product (PCGDP). The results of the ADF unit root tests for the variables in their levels and first differences are in table 1. The first difference is indicated by Δ. The results indicate that TS and PCGDP are non-stationary in their levels but stationary in their first differences. However, PVS is stationary in its level. The number of lags was selected using the Akaike Information Criterion (AIC). The results mean that we can proceed with cointegration tests for TS and PCGDP but not for PVS and PCGDP. The results of the cointegration tests are in table 2. The number of lags is 2 determined by using the Akaike Information Criterion (AIC). Both Eigenvalue and Trace tests indicate that there is one cointegrating vector. The coefficients of this vector are in table 3. The vector indicates that there exists a long run positive relationship between the two variables.

Table 1 - Augmented Dickey-Fuller Tests

Variable	Test Statistic	Variable	Test Statistic
PVS	−3.8649(1)	ΔPVS	−5.3430*(0)
TS	−2.5551(4)	ΔTS	−5.6235*(2)
PCGDP	−1.0917(1)	ΔPCGDP	−4.4537(0)

Note: Lags in parentheses are determined using the Akaike Information Criteriton (AIC). The number of observations is kept constant at various lags. The critical value at the 5 percent level for variables (with trends) in their levels is −3.5189. The critical values for variables with and without trends in their first differences are −3.5247 and −2.9339, respectively.
* Indicates no trend.

Table 2 - Cointegration Tests

Maximal Eigenvalue Tests

Null	Alternative	Test Statistic	Critical Value*
r = 0	r = 1	27.0756**	14.8800
r <= 1	r = 2	2.3294	8.0700

Table 2 (cont.)

Trace Tests			
r = 0	r >= 1	29.7995**	17.8600
r <= 1	r = 2	2.7239	8.0700

Note: The cointegration tests are for TS and PCGDP. The lag order is two and was determined by using the Akaike Information Criterion (AIC).
* Critical values are for the 95 percent quantile.
** Significant at the 5 percent level.

Table 3 - Long Run Cointegrating Vector

PCGDP	TS
−1.000	1.7115

Note: The coefficients are normalized on PCGDP.

Next, we conduct pairwise Granger causality tests using the procedure outlined in the previous section. These tests are conducted on the first differences of the variables. Since all three variables are in logarithmic forms, the first differences give the growth rates of the variables. While the augmented Granger causality tests (in which the lagged error terms of the regressions in levels enter the equations) are conducted for the growth rates of PCGDP and TS, they are not appropriate for the growth rates of PCGDP and PVS (since PVS was found to be integrated of order zero). Thus, we conduct non-augmented Granger causality tests for these two variables. As pointed out earlier, Granger (1988) shows that if the variables are not cointegrated, augmented Granger causality tests are not valid. The results of causality for lags of one, two, and three are in tables 4, 5, and 6, respectively. The lag orders were also determined by using the AIC criterion but in no case these exceeded 3.

Table 4 - Granger Causality Tests for Lag One

Cause	Effect	Test Stat.
ΔPVS	ΔPCGDP	1.7646
ΔPCGDP	ΔPVS	0.0496
ΔTS	ΔPCGDP	1.5722
ΔPCGDP	ΔTS	2.1441

The table value is 4.076 at the 5 percent level of significance.

Table 5 - Granger Causality Tests for Lag Two

Cause	Effect	Test Stat.
ΔPVS	ΔPCGDP	0.8327
ΔPCGDP	ΔPVS	0.4247
ΔTS	ΔPCGDP	0.4285
ΔPCGDP	ΔTS	1.7804

The table value is 3.248 at the 5 percent level of significance.

Table 6 - Granger Causality Tests for Lag Three

Cause	Effect	Test Stat.
ΔPVS	ΔPCGDP	2.3945
ΔPCGDP	ΔPVS	2.2296
ΔTS	ΔPCGDP	0.2485
ΔGDP	ΔTS	1.6090

The table value is 2.856 at the 5 percent level of significance.

The results indicate that there is no evidence of causality in any direction between the growth rates of PCGDP and TS. The same applies for the growth rates of PCGDP and PVS. Thus, while we find evidence of a long-run relationship between total saving and per capita GDP, we do not find any causal relationship between the growth of per capita GDP and the growth of total saving. The same holds for the growth of per capita GDP and the growth of private saving. However, these results are not inconsistent with each other. Granger causality tests with the growth rates of the variables test for short-run relationship while cointegration tests are tests for long-run relationship.

4. Conclusions

This paper looks at the relationship between saving and economic growth in Thailand for the period 1950-96 using modern time series analysis. In doing so, we distinguish between total saving and total private saving. First, we analyze the unit root properties of the variables. We find that while (total) private saving is integrated of order zero, total saving and per capita GDP are integrated of order one. Next, we conduct generalized Johansen cointegration tests to see whether the total saving and per capita GDP have a long run relationship. The tests indicate that there is a long run relationship between total saving and per capita GDP and that the relationship between the two is positive. Since the variables are in logarithmic form, the first differences give us the growth rates. We perform augmented Granger causality tests for the growth rates of total saving and per capita GDP since per capita GDP and total saving are cointegrated. For the growth rates of private saving and GDP, we conduct the regular Granger causality tests. The causality tests show no indication of any causality in any direction for the two pairs of variables. Since the growth of saving is not found to be causing the growth of per capita GDP, Thailand may be vulnerable to changes in the level of foreign saving in the country.

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