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AN EMPIRICAL STUDY ON THE ASEAN ECONOMIES**

Tan Hui Boon
Department of Economics
Faculty of Economics and Management
Universiti Putra Malaysia
Serdang 43400 Selangor Malaysia
Tel: 603 – 9486101
Fax: 603 – 9486188
Email: tanhb@econ.upm.edu.my
Web Site: <http://www.econ.upm.edu.my/report/ecn0003.pdf>

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Tan Hui Boon

tanhb@econ.upm.edu.my

Department of Economics
Faculty of Economics and Management
Universiti Putra Malaysia
Serdang 43400 Selangor Malaysia

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SAVINGS, INVESTMENT AND CAPITAL FLOWS: AN EMPIRICAL STUDY ON THE ASEAN ECONOMIES

ABSTRACT

The relationship between savings and investment is a crucial indicator of international capital mobility and it has important implications on the development of the ASEAN economies. This paper examines the dynamic savings-investment relationship and the degree of international capital mobility in the region based on the time-series approach of cointegration and vector error-correction modeling (VECM). The savings and investment variables for the five ASEAN economies, namely, Indonesia, Malaysia, the Philippines, Singapore and Thailand, possessed a general upward trend during the sample period of 1968-1997. The trend, however, reverted for the case of Thailand in 1997 when the country was hit by the financial crisis. The absence of short-run causality running from savings to investment, as indicated by the estimated results of this study, implies a high degree of short-run international capital mobility in the region. The upward trend of investment in the region during the boom period of 1988-1996 is supported by the net foreign capital inflow, especially for the case of Malaysia, the Philippines and Thailand. For Singapore, the savings rate rose to match its investment rate in the mid-1980s, and it is now a net capital exporter since 1986.

Introduction

The relationship between savings and investment rates and its implication on international capital mobility are of interest to open macroeconomics for several reasons. For example, the extent of economic development of a small open country could exceed its domestic savings depends on how readily the country is accessible to international capital markets. The extent to which public deficits crowd out domestic investment also depends on the degree of international capital mobility. The reduction in national welfare due to a temporary negative shock (for example, the earthquake in Istanbul, Turkey in August 1999) will be much less pronounced if the economy can borrow resources from abroad in order to go through the period of adjustment.

The correlation between savings and investment was first introduced as a quantity-based criterion to assess international capital mobility by Feldstein and Horioka (1980). According to them, domestic savings, in a world of perfectly mobile capital, would seek out the highest returns in the highly integrated capital markets and should be independent of domestic investment demand. By the same token, the capital markets around the world would cater for domestic investment needs independent of domestic savings supply. Thus, they hypothesized that the stronger the positive correlation between savings and investment, the less mobile is the international capital or, in other words, international capital markets are not well integrated.

Although the existence of the high correlation has been confirmed, the Feldstein-Horioka conclusion that they are due to a low degree of international capital mobility has been challenged by a number of authors. Alternative explanations for the correlation fall into two camps; some paper constructed theoretical models in which there is perfect capital mobility, but where investment and savings are correlated due to the nature of the disturbances affecting the economy, for example population growth and productivity shocks (See , Obstfeld,1986 and Summers, 1988). Several other paper, on the other hand, argued that the positive correlation might be due to current account targeting by the government (See Bayoumi, 1990; Artis and Bayoumi, 1991; McClure,1994; Levy, 1995). In their view, governments impose constraints on cross-border capital flows whenever the deficit (or surplus) in the current account exceeds a predetermined level. Governments can also affect the current account by adjusting the savings and investment rates of the public sector to off set the private savings-investment gap.

Despite of the above challenges, two recent papers, Dekle (1996), Helliwell and McKitrick (1998), provide empirical evidences that are consistent with the hypothesis of Feldstein and Horioka. Under a near-perfect capital mobility environment across the Japanese regions, as in the study of Dekle, and across the Canada provinces, as in the study of Helliwell and McKitrick, the estimated savings-investment coefficients are insignificantly different from zero. From the above findings, we could confirm a perfect capital mobility when savings and investment are not correlated. However, we could not conclude that capital is not mobile when savings and investment are correlated.

Another important point in testing the savings-investment relationship is the assumption of small countries. According to Obstfeld (1986) the hypothesis proposed by Feldstein and Horioka only works on small open economies. For a large open economy like United States, domestic savings and investment might move together even if the international capital market functioned perfectly. This is due to the fact that a large economy could affect the world real interest rate.

For a country large enough to affect world financial market conditions, a fall in domestic savings might drive up both the domestic and world interest rates, and crowd out investment everywhere in the world. It would be erroneous to draw a conclusion that a high savings-investment correlation implies low capital mobility for this case.

Since the savings-investment relationship is closely tied to the pattern of capital flow, the empirical study on the relationship among the ASEAN developing economies should provide important information on the evolution of the regional capital markets, as well as the development of the economies. This paper augments the literature by investigating the short and long-run dynamic relationships between savings and investment of the five small open ASEAN economies, namely Indonesia, Malaysia, Philippines, Singapore and Thailand¹ by using the time-series approach of cointegration and Granger-causality in the framework of vector error-correction model (VECM). Most of studies in the literature evaluated international capital mobility by estimating the savings-investment correlation based on cross-sectional data, and they focussed mainly on the OECD countries.

¹ Due to the data deficiency, other ASEAN countries are not included in this study.

The advantages of using the time-series approach are, first, the long- and short-run dynamics relationships between these variables could be discriminated; second, the Granger-causality analysis not only indicating the linkages between the variables, but also the direction of the causal effect from one variable to another. This analysis thus provides more information than the estimated savings-investment correlation. In this analysis, capital is considered as not mobile across national borders if there is a short-run causal effect running from savings to investment in an economy.

The analysis in this paper is divided into two parts. First, we conduct a long-run analysis on the savings-investment relationship based on the multivariate cointegration test, and second, we examine the short-run dynamics of the relationship via vector error-correction modeling (VECM). The estimated short-run savings-investment causal relationships are then employed to analyze the international capital flow in the region.

Savings, Investment and International Capital Flow

As noted, analysis of the savings-investment relationship is closely tied to the degree of international capital mobility, thus it is useful to review some definitions and notations of national account identity. To simplify, we may define gross national product (*GNP*) as the sum of goods and services produced, which, with imports *M*, may be allocated to private consumption *C*, public consumption *G*, investment *I* and exports *X*, so that $GNP + M = C + I + G + X$. By rearranging, GNP is given by

$$GNP \equiv C + I + G + NX \quad (1)$$

where $NX = X - N$ is the net exports. If the country's net credit (debt) position vis-a vis the rest of the world is *B* (or *-B*), and these claims (or debts) earn (or pay) interest at a world interest rate *r*, then gross domestic product (GDP) is GNP plus (or minus) this net factor income from (or to) the rest of the world

$$GDP \equiv Y = GNP + rB = C + I + G + NX + rB. \quad (2)$$

It is then very clear that the net balance on the current account CA satisfies

$$CA \equiv NX + rB = (Y - C - G) - I = S - I \quad (3)$$

where $S = Y - C - G$ is gross domestic savings, which equals the sum of private savings ($S_{priv} = Y - T - C$) and public savings ($S_{pub} = T - G$). This study focuses on the patterns of savings (S) and investment (I), and the basic identity of $CA = S - I$.

Data and Methodology

This study employed the annually data spanning from 1968 to 1997 of gross domestic savings (GDS) and gross domestic investment (GDI) of the five ASEAN countries collected from various issues of the central bank reports of the countries and the International Financial Statistics published by IMF. The gross domestic savings comprises the personal and corporate savings from the private sector and the government savings, and is an important source of funding for gross domestic investment.

The long-run relationship between these variables is investigated by the Johansen-Juselius (1990) multivariate cointegration method. The short-run relationship, on the other hand, is analyzed by using Granger-causality within the vector error-correction model (VECM). Before conducting the cointegration analysis The order of integration of each series is determined by both the Augmented Dickey-Fuller (ADF) unit root tests. The maximum likelihood multivariate cointegration test is then utilized to determine the number of linearly independent cointegrating vectors in the system. The approach is set up as a vector autoregression (VAR) of non-stationary time series:

$$\Delta X_t = \Pi X_{t-1} + \sum_{i=1}^{k-1} \Gamma_i \Delta X_{t-i} + \mu + \Theta t + \varepsilon_t \quad (4)$$

where

$$\Pi = -\left(\mathbf{I} - \sum_{i=1}^k \Pi_i\right) \text{ and } \Gamma_i = -\left(\mathbf{I} - \sum_{j=1}^i \Pi_j\right) \text{ for } i=1, \dots, k-1.$$

X_t is a vector of p variables, μ are the intercepts, t are deterministic trends and ε_t is a vector of Gaussian random variables. The coefficient matrix Π , is also referred to as the long-run impact matrix, contains information about the stationarity of the variables and the long-run relationship amongst them. The rank(r) of the matrix determines the number of cointegrating vectors in the system. If Π is of full rank, or $r = p$, then all variables in X_t are themselves stationary with no common stochastic trend or long-run relationship exists amongst them. On the other hand, if Π is a null matrix, or $r = 0$, then cointegration is also not present but variables in X_t are non-stationary. In the latter case, Equation (4) is equivalent to the usual VAR model in first differences. For the case when $0 < r < p$, then there are r linear combinations of variables in X_t that are stationary. This is an indication that the variables are cointegrated in the long run with r cointegrating vectors. The Π matrix can be factored as $\Pi = \alpha\beta^T$, where the α matrix contains the adjustment coefficients and the β matrix contains the cointegrating vectors. Johansen and Juselius approach uses two likelihood ratio statistics, the trace and the maximum eigenvalue statistics, to test for the possible number of cointegrating vectors in the system. Critical values for these statistics are tabulated in Osterwald-Lenum (1992). The optimal lag structure of the system is determined by minimizing the Akaike's FPE criteria.

If cointegration is detected, then the Granger-causality must be conducted in vector error-correction model (VECM) to avoid problem of misspecification (see Granger 1988). Otherwise, the analyses may be conducted as a standard vector autoregressive (VAR) model. VECM is a special case of VAR that imposes cointegration on its variables. The testing of causality in the environment of VECM can be represented by the following example:

$$\begin{aligned}
X_t = \begin{pmatrix} \Delta x_{1t} \\ \Delta x_{2t} \\ \vdots \\ \Delta x_{nt} \end{pmatrix} &= \begin{pmatrix} \mathbf{a}_1 \\ \mathbf{a}_2 \\ \vdots \\ \mathbf{a}_n \end{pmatrix} + \begin{pmatrix} \mathbf{b}_{11}(L) & \mathbf{b}_{12}(L) & \cdots & \mathbf{b}_{1n}(L) \\ \mathbf{b}_{21}(L) & \mathbf{b}_{22}(L) & \cdots & \mathbf{b}_{2n}(L) \\ \vdots & \vdots & \ddots & \vdots \\ \mathbf{b}_{n1}(L) & \mathbf{b}_{n2}(L) & \cdots & \mathbf{b}_{nn}(L) \end{pmatrix} \begin{pmatrix} \Delta x_{1t} \\ \Delta x_{2t} \\ \vdots \\ \Delta x_{nt} \end{pmatrix} \\
&+ \begin{pmatrix} \mathbf{g}_1 z_{1,t-1} \\ \mathbf{g}_2 z_{2,t-1} \\ \vdots \\ \mathbf{g}_n z_{n,t-1} \end{pmatrix} + \begin{pmatrix} \Phi(L) & 0 & \cdots & 0 \\ 0 & \Phi(L) & 0 & \cdots & 0 \\ \vdots & \vdots & \ddots & \vdots & \vdots \\ 0 & \cdots & 0 & \Phi(L) \end{pmatrix} \begin{pmatrix} \mathbf{e}_{1,t} \\ \mathbf{e}_{2,t} \\ \vdots \\ \mathbf{e}_{n,t} \end{pmatrix}
\end{aligned} \tag{5}$$

where X_t is an $(n \times 1)$ vector of variables in the system, \mathbf{a} 's represent a vector of constant terms, \mathbf{b} 's are estimable parameters, Δ is a difference operator, L is a lag operator, $\mathbf{b}(L)$ and $\Phi(L)$ are finite polynomials in the lag operator, z_{t-1} 's are error-correction terms, and \mathbf{e}_t 's are disturbances.

In the analysis of cointegration, if two variables are cointegrated, the finding of no-causality in either direction is ruled out. However, although cointegration indicates presence or absence of Granger-causality, it does not indicate the direction of causality between variables. This direction of the Granger causality can only be detected through the vector error-correction model (VECM) derived from the long-run cointegrating vectors. In addition to indicating the direction of causality amongst variables, the VECM also allows us to distinguish between short-run and long-run Granger-causality. The F -test of the explanatory variables (in first differences) indicates the "short-run" causal effects, whereas the "long-run" causal relationship is implied through the significance or otherwise of the t -test of the lagged error-correction terms which contains the long-run information.

Empirical Results and Discussions

Before conducting the multivariate cointegration test, the order of integration of each variable is determined by means of augmented Dickey Fuller (ADF) unit root test. The estimated results reported in Table 1 indicate that the savings and investment variables for all the economies are integrated of second order, or they are I(2). The Johansen-Juselius multivariate cointegration test is then performed

on a VAR system of two variables for each country. The estimated results are reported in Table 2. The maximum eigenvalue statistics (λ_{\max}) show that only the null hypothesis of no cointegrating vector ($r = 0$) is rejected for all the five cases, implying that the variables are cointegrated with one cointegrating vector. The variables are said to share a long-run co-movement, which is bounded by their long-run equilibrium relationship.

Since the variables are cointegrated, the Granger-causality test is conducted in the environment of VECM. The test results are reported in Table 3. The significance of F -statistic for the lag values of the independent variable indicates the presence of a unidirectional short-run causal effect running from the independent variable to the dependent variable. The estimated results, however, show no short-run causal effect running from savings to investment for all the cases except Singapore. The causal effect is running from investment to savings for the case of Indonesia and Thailand, instead. For the case of Malaysia and the Philippines, there is no causal relationship between savings and investment at all.

The absence of short-run causality running from savings to investment implies a high degree of short-run international capital mobility in the region. This means that the upward trend of investment in the region, especially Malaysia, the Philippines and Thailand, during the boom period of 1988-1996 (See Figure 1 – 5) was contributed partially by the net foreign capital inflow. The inflow is therefore crucial for the development of these ASEAN economies. For Singapore, the saving is always surplus to the investment since 1986, indicating a net capital outflow from the country.

Conclusion

The mobility of savings, both the domestic and foreign, is an important prerequisite for capital accumulation and national development. In underdeveloped and developing economies, a vicious cycle of poverty (low-income, low savings, low investment and in turn, low income, ...) will repeats itself endlessly unless it is broken by the accessibility to foreign capital.

Figure 1-5 present the savings and investment behaviors of the five ASEAN economies over the sample periods of 1968-1997. In these figures, both savings and investment exhibit a general upward trend. The trend was steeper during the period of 1988-96 – the fast-growing regime of the ASEAN economies. The estimated results of this study provide empirical evidences that

the rapid economic growth, which had prolonged for about 8 years, was sustained by productive activities transformed effectively from the increased domestic resources and the mobilized international resources in the forms of foreign capital inflow and foreign direct investment. The increase in investment enhanced aggregate output and national income, which in turn induce further savings. This intuition is consistent with the empirical results that show a causal effect running from investment to savings.

The savings and investment variables, however, possess a long-run cointegration relationship, and tend to move together in the long run. This corroborates an important assumption in international macroeconomics that countries obey the intertemporal budget constraint. Although the saving rate of this region is considered to be among the highest in the world, it is recognized that it will have to be raised further to narrow the savings-investment gap in the long-run, in particular Malaysia and Thailand, and, to a lesser degree, the Philippines and Indonesia (See Figure 1-5).

The importance of increasing the rate of domestic savings in the long run raises the question of which policy instruments have been crucial in promoting high saving rates. For the case of Singapore, the surplus in savings-investment gap is attributed to the increase in both the public and private savings. The public saving is expanded through the government budget surplus, statutory board's operating surplus² and the government-linked companies (GLCs) operating surplus. The private saving, on the other hand, is heavily contributed by the Central Provident Fund (CPF), which is forced-saving scheme primarily aimed at providing for retirement needs. The voluntary private saving is mobilized through commercial banks, finance companies, insurance companies and the capital market. The major determinants of voluntary private savings include households permanent income, economic growth, interest rates, financial development, demographic factors, taxation, inflation and some external factors such as exchange rates and current account balance - an unexpected expansion of domestic credits through capital inflows eases the liquidity constraint, thus tending to decrease the saving ratio (See Hong ; 1997).

² Statutory boards are separate entities from the government ministries which perform certain public sector functions, such as the provision of telecommunication services and utilities.

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Table 1
The Augmented Dickey-Fuller (ADF) Unit Root Test
(Sample period: 1968 to 1997)

Variables	Levels	First Differences	Second Differences
Indonesia:			
Investment	-1.4365(2)	-2.7529(3)	-4.6163(2)*
Saving	-3.0032(0)	-2.3844(3)	-4.1473(3)*
Malaysia:			
Investment	-1.7532(0)	-3.1906(1)	-3.7093(2)*
Saving	-1.5168(2)	-1.1603(4)	-4.1583(4)*
Singapore:			
Investment	-3.2332(0)	-3.1259(1)	-4.8379(1)*
Saving	-2.7719(2)	-3.1074(2)	-4.7176(2)*
Philippines:			
Investment	-1.6971(0)	-2.7251(2)	-3.8835(2)*
Saving	-2.1121(0)	-0.9393(2)	-3.6496(2)*
Thailand:			
Investment	-2.1183(0)	-3.0452(2)	-4.9640(1)*
Saving	-2.1591(0)	-1.8322(3)	-3.8006(3)*

Notes: The null hypothesis is that the series contains a unit root. The critical value for rejection is -3.41 for models with a linear trend at 5% significance level. This value is provided by the SHAZAM output based on Mackinnon (1991). The optimal lag lengths in parentheses are determined based on the Final Prediction Error (FPE) criterion.

Table 2
Johansen Multivariate Cointegration Test
(Sample Period: 1968-1997)

Variables: Investment, Saving		
Null Hypothesis $H_0: r = p$	Maximum Eigenvalue λ_{\max}	Critical Value 95%
Indonesia (k=5)		
$r = 0$	30.67**	25.32
$r \leq 1$	4.84	12.25
Malaysia (k=5)		
$r = 0$	26.42*	25.32
$r \leq 1$	8.23	12.25
Singapore (k=5)		
$r = 0$	41.29**	25.32
$r \leq 1$	10.21	12.25
Philippines (k=6)		
$r = 0$	33.13**	25.32
$r \leq 1$	11.51	12.25
Thailand (k=5)		
$r = 0$	27.13*	25.32
$r \leq 1$	4.87	12.25

Notes: r indicates the number of cointegrating vectors. (*), (**) indicates rejection at the 95% and 99% critical values. The optimum lag-structure (k) is determined by minimizing the Akaike AIC criterion.

Table 3
Granger Causality Tests based on Vector Error-Correction Model
(Sample Period: 1968-1997)

Dependent variable	Independent variables		
	Δ Investment <i>F</i> -statistic (significance level)	Δ Saving	ECT_{t-1} <i>t</i> -statistic
Indonesia (k=5)			
Δ Investment	3.3078 (0.0416)**	1.7318 (0.2019)	-2.3336*
Δ Saving	3.5091 (0.0347)**	0.9311 (0.4946)	-0.2117
Malaysia (k=5)			
Δ Investment	1.0472 (0.4347)	1.0356 (0.4402)	-0.0554
Δ Saving	1.8092 (0.1855)	4.3292 (0.0175)**	3.3427*
Singapore (k=5)			
Δ Investment	3.8055 (0.0269)***	4.8466 (0.0117)**	-5.5437
Δ Saving	1.4297 (0.2826)	2.3406 (0.1056)	-2.5327
Philippines (k=6)			
Δ Investment	1.3554 (0.3270)	1.1943 (0.3890)	-0.1825
Δ Saving	2.3699 (0.1180) (0.1181)	2.3241 (0.1232)	3.1740*
Thailand (k=5)			
Δ Investment	0.8931 (0.5157)	0.3575 (0.8677)	-1.6219
Δ Saving	8.1564 (0.0015)***	0.4425 (0.0424)**	-4.1567*

Notes: ECT_{t-1} is the error correction term. The optimum lag for each system is selected based on the FPE criterion. (*), (**), and (***) denote rejection of H_0 at 10%, 5% and 1% significance levels respectively. H_0 : No causality.

Figure 1
Investment-saving Gap: Indonesia

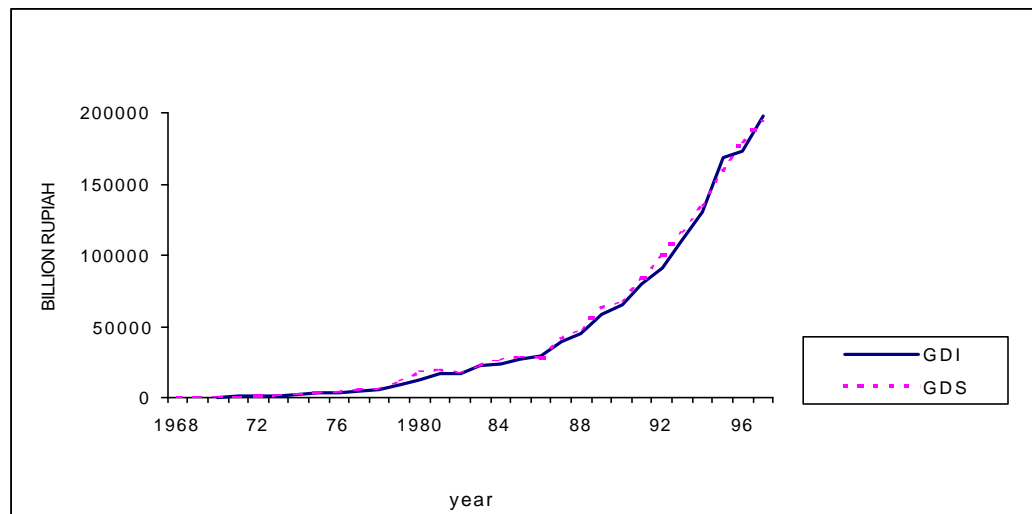


Figure 2
Investment-saving Gap: Malaysia

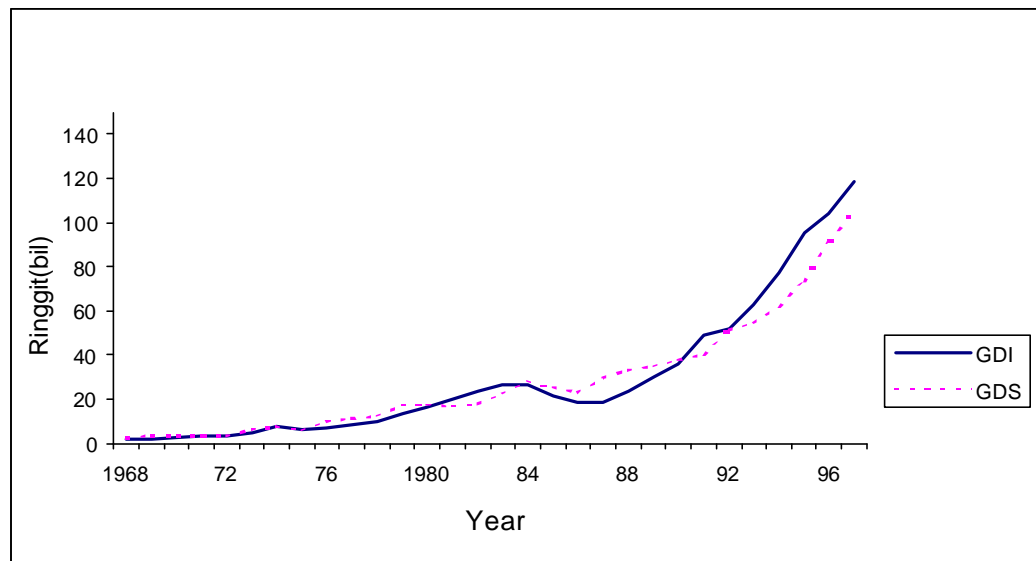


Figure 3
Investment-saving Gap: Singapore

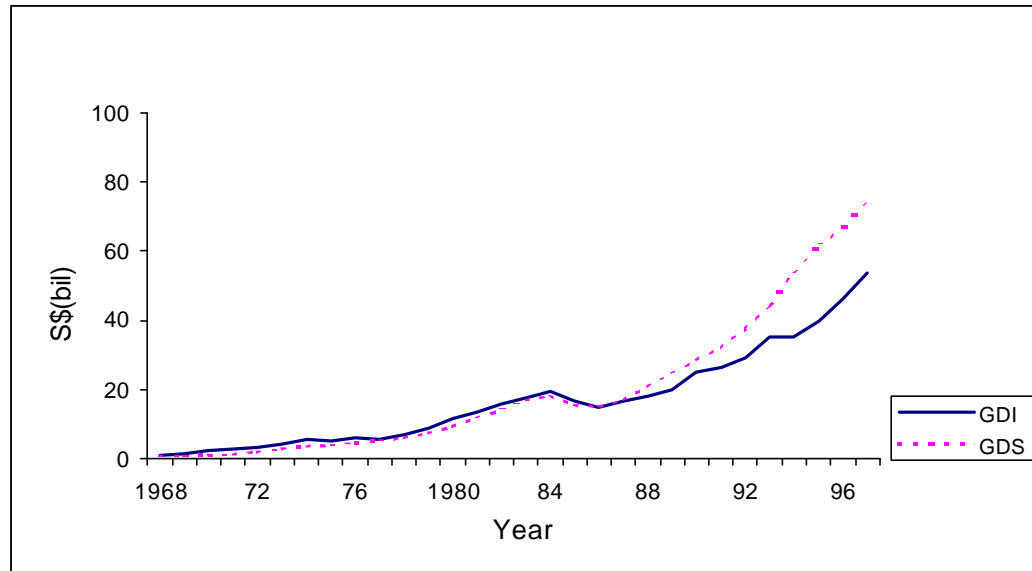


Figure 4

Investment-saving Gap: Philippines

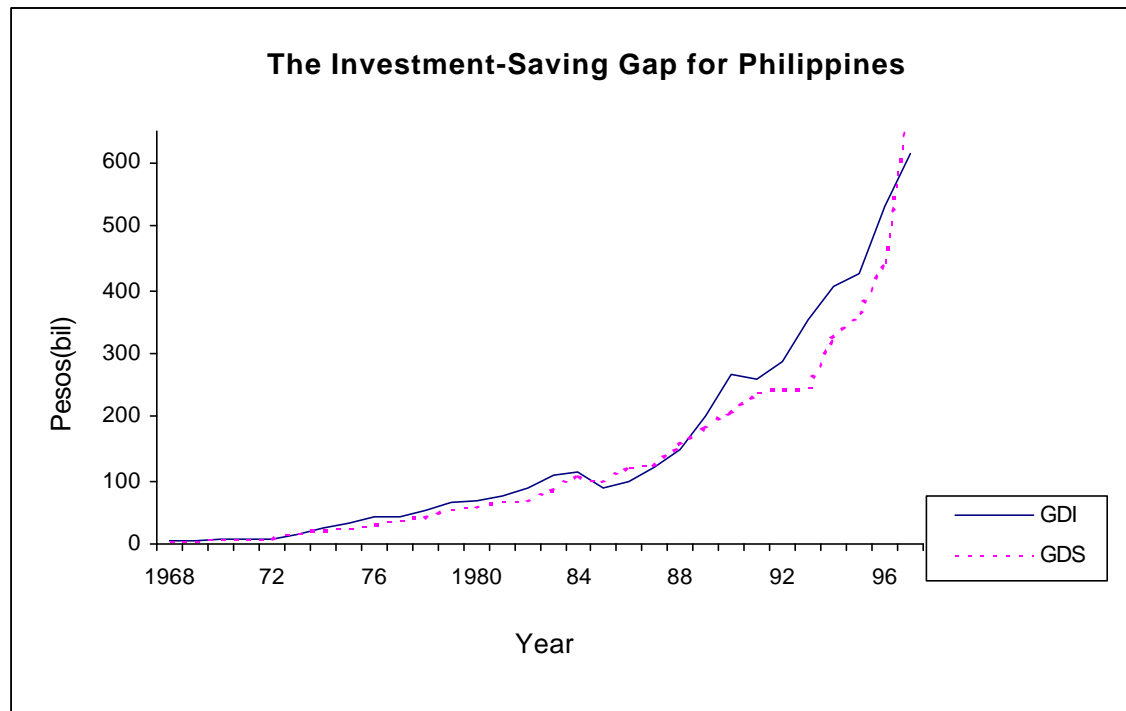


Figure 5
20

Investment-saving Gap: Thailand

