

Japan's Saving, Financial Linkages, and Capital Mobility in East Asia before the 1997-98 Currency Crisis: An Empirical Investigation

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Abstract

I examine financial linkages in East Asia before the 1997-98 crisis by testing long-run and causal relationships between Japan's saving and eight other Asian economies' domestic investment. The results suggest that there is a long-run (cointegrating) relationship between Japan's saving and the domestic investments of four of the five crisis economies and Taiwan. There is also evidence that Japan's saving Granger-causes the domestic investments of five economies. In contrast, no such long-run and causal relationship is found with respect to each country's own domestic saving and investment. The results suggest a presence of financial linkage and high capital mobility in the region prior to 1997-98 and lend support to the literature on the role of financial contagion in the Asian currency crisis.

Keywords: Financial linkages, capital mobility, Asian currency crisis, saving-investment relation, Japan's saving

1. Introduction

Empirical research on the 1997-98 Asian currency crisis has identified financial linkages as an important mechanism through which the crisis spread quickly from one country to another in the region. In particular, Kaminsky and Reinhart (2000) and Van Rijckeghem and Weder (2001) find evidence in favour of a common lender (in this case, the Japanese financial institutions) effect that helps explain the regional contagion.

This paper investigates financial linkages in East Asia prior to the 1997-98 crisis by examining the relationship between Japan's saving and the domestic investments of eight other Asian economies: Hong Kong (HK), Indonesia (ID), South Korea (KR), Malaysia (MY), the Philippines (PH), Singapore (SG), Taiwan (TW), and Thailand (TH). There is a consensus in the literature that "over-borrowing" and speculative investment syndrome in many East Asian economies prior to 1997 was an immediate cause of the crisis. It is also well known that relationship banking was widespread and that Japanese loans were the main source of investment funds in the region. If a long-run relationship between Japan's saving and investments of other Asian countries existed, it would lend support to the literature on the role of financial contagion in the Asian currency crisis. A tight financial nexus between Japan and other East Asia countries can corroborate the "domino" effect that has been suggested in the literature. When a country in the nexus has a crisis, the common lenders will be forced to pull capital out of other countries because there is a need to rebalance their investment portfolios or simply because they think there is also something wrong with other countries. In addition, I run Granger-causality tests to detect the presence and direction of causality between each country's investment and Japan's saving as well as that between domestic investment and saving in each country.

Besides testing for a long-run relationship between Japan's saving and other countries' domestic investment, I check to see if there is a similar relationship between domestic saving and investment in each of the selected countries as a control. This allows us to examine how internationally mobile capital in the region was. The degree of capital mobility may play an important part in propagating crisis in the region.

The results suggest that there is a long-run (cointegrating) relationship between Japan's saving and the domestic investments of four (ID, KR, MY, and PH) of the five crisis economies and Taiwan. No such relationship is found with respect to each economy's own domestic investment and saving. There is also evidence that Japan's saving Granger-causes the domestic investments of five economies. The reverse direction of causality is not supported. Overall, the results indicate that there is a strong financial linkage in East Asia. Japan's saving appears to be an important factor driving investment in other Asian economies, especially those that experienced severe crisis in 1997-98. The absence of a long-run relationship and, to a lesser extent, causal link, between the domestic investment and saving in the other Asian economies implies high international capital mobility in the region prior to the crisis.

Section 2 provides a brief literature review and discusses some analytical issues associated with the topic of financial contagion in the Asian crisis and saving-investment relationships. Section 3 discusses the data. Section 4 presents the econometric methods and results. Section 5 concludes.

2. Brief literature review and analytical issues

Kaminsky and Reinhart (2000) were the first to study empirically the role of financial contagion in currency crises. Grouping many Latin American and East Asian countries into different trade (bilateral and third-party) and financial (common bank lending and portfolio flows) clusters, the authors show that knowing there are crises in a banking cluster contains significant information on the presence of crises elsewhere in the same cluster. The trade clusters are found to under-perform the financial clusters in terms of predictive power. Their results suggest that much of what has been attributed to the role of trade in propagating crises across countries could be due to financial sector linkages. Van Rijckeghem and Weder (2001), using a measure of competition for bank funds, argue that spillovers through bank lending can help explain contagion during the Thai crisis. The empirical results in Chan et al. (2000) suggest that the loan shares of South Korea, Indonesia, Malaysia, and Thailand have a high degree of substitution, which implies that there is a strong financial linkage among these countries.

Some studies emphasizing the role of financial linkages in the Asian crisis attempt to decompose international capital flows into different components such as bank lending and portfolio flows from mutual funds or hedge funds. However, data on actual capital flows are either not easily available or very unreliable. In this paper, I look at the financial link between Japan and other East Asian economies by instead focusing on a simple relationship between saving of the former and the domestic investment of the latter. Besides avoiding the issue of data availability and reliability, another advantage of this approach is that it allows us to examine financial integration from a long-run equilibrium perspective, as opposed to short-run effects associated with volatile portfolio capital flows. In particular, the following specification will be tested:

$$\left(\frac{I}{Y}\right)_{it} = \alpha + \beta \left(\frac{S}{Y}\right)_J, \quad (1)$$

where $(I/Y)_{it}$ is the ratio of gross domestic investment to gross domestic product in country i and $(S/Y)_J$ is Japan's ratio of gross domestic saving to gross domestic product. The existence of a long-run relationship between Japan's saving and the domestic investments of other Asian countries, in the form of a cointegrating relationship between these two variables, would suggest that financial markets were well integrated in East Asia and that financial linkages were a probable channel through which the turmoil spread in 1997-98. Since saving in one country (in this case, Japan) was used to finance investment activities in other countries, this would also imply a high degree of capital mobility.

As a control, I also examine if there is a long-run relationship between domestic saving and investment in each country. Additional regressions are run based on the following specification:

$$\left(\frac{I}{Y}\right)_{it} = \alpha + \beta \left(\frac{S}{Y}\right)_{it}, \quad (2)$$

where country i 's own saving replaces Japan's saving from equation (1).

The second set of regressions, via equation (2), is intimately related to the literature on saving-investment correlations inspired by Feldstein and Horioka (1980). Feldstein and Horioka find that there is high correlation between domestic saving and investment across the OECD countries, thereby suggesting low international capital mobility. Their results, also known as the Feldstein-Horioka puzzle, have been re-examined by many studies, such as Baxter and Crucini (1993) and Bayoumi and Rose (1993). A recent detailed survey of this literature is presented in Coakley et al. (1998).

While most of the studies in the literature focus on OECD countries, very few have looked at the saving-investment relationship in Asian countries. A recent exception is Sinha (2002), in which the author studies the relationship between the domestic saving and investment rates in Japan, Malaysia, Singapore, Sri Lanka, Hong Kong, Pakistan, the Philippines, India, South Korea, Myanmar, and Thailand. Using time-series econometric methods, Sinha shows that domestic saving and investment are cointegrated only for Myanmar and Thailand.

My paper is different from the literature on saving-investment relation and, in the context of Asian countries, from Sinha (2002) in an important way. My main focus is the financial connection between Japan and eight emerging Asian market economies that are considered to have unrestricted capital flows and/or deemed to be affected by the 1997-98 crisis. The auxiliary analysis of domestic saving-investment in the individual Asian economies simply serves as a control. The added benefit, however, is that both analyses in this paper will allow us to examine the degree of international capital mobility in this region.

3. Data and countries

Annual data are collected from the World Bank's World Development Indicators (WDI) 2003 CD-ROM. The Asian countries selected for this study are emerging market economies with reasonably well-functioning and unrestricted capital flows. Other Asian countries such as India, China, or Vietnam have either less-developed capital markets or highly restricted capital flows and therefore are not chosen for this study. Since I am primarily interested in the period prior to the crisis, the year 1996 is chosen as the ending date for all samples. Data for the selected Asian economies and Japan are as follows: Hong Kong (HK, 1965-1996), Indonesia (ID, 1979-1996), Japan (JP, 1960-1996), South Korea (KR, 1960-1996), Malaysia (MY, 1960-1996), the Philippines (PH, 1960-1996), Singapore (SG, 1965-1996), Taiwan (TW, 1960-1996), and Thailand (TH, 1960-1996). Gross fixed capital formation (percent of GDP) and gross domestic savings (percent of GDP) series from the WDI are used to measure investment and saving for each country. The International Monetary Funds (IMF) classifies ID, KR, MY, PH, and TH as crisis economies and HK, SG, and TW as non-crisis economies. (Note 1)

Table 1 presents the average investment and saving rates for Japan and the other eight economies for different sub-periods and for the whole period of 1960-1996. Figure 1 depicts the saving and investment series for all countries. Overall, these Asian countries have very high saving rates, ranging from 21 percent for the Philippines to 35 percent for Singapore. Although Japan did not have the highest saving rate, its economy is many times bigger than that of Singapore. Therefore, Japan is the largest saver among these countries. In addition, due to its low interest rate policy since the mid 1980s and widespread relationship banking in East Asia, Japan had become the biggest lender for other countries in the region. From Figure 1, for the period of 1990-1996, investment exceeded saving in four of the five crisis economies: MY, KR, PH, and TH. The excess investment in these countries was perhaps financed by the excess saving from Japan.

4. Econometric methods and results

4.1 Nonstationarity and Unit Root Tests

To check for nonstationarity in the investment and saving series, I use the augmented Dickey-Fuller (ADF) test, which is based on the following regression:

$$\Delta Y_t = \mu + \beta t + \gamma Y_{t-1} + \sum_{i=1}^k c_i \Delta Y_{t-i} + \varepsilon_t, \quad (3)$$

where Y_t is either the saving rate or investment rate for each country, ε_t is the error term, and the Akaike Information Criterion (AIC) is used to determine the number of lags k . The null hypothesis ($\gamma = 0$) is that the series follows a unit root process, or $I(1)$, and the alternative ($\gamma < 0$) is that the series is stationary around a deterministic trend, or $I(0)$. The test statistics are compared against the critical values in Davidson and Mackinnon (1993). (Note 2)

The Philippines experienced severe political, social, and economic turbulence in the period of 1983-1984. (Note 3) There was a significant drop in the investment and, to a lesser extent, saving of the Philippines around this time (see Figure 1). To account for this shock, I use the Lanne et al.'s (2002) extension of ADF test that admits structural break. (Note 4) 1984 is chosen as the date of the structural break.

Table 2 presents the test statistics of the ADF unit root test for investment (IR) and saving (SR) rates for Japan and the other eight Asian economies. The lag lengths are included in the parentheses next to the test statistics. The null of $I(1)$ cannot be rejected at the 5 percent level in any of the series, except the investment of Singapore (SGI), in which case the null of $I(1)$ is rejected at the 1 percent level of significance. The null of $I(2)$, however, is rejected for all series at the 5 percent level. Therefore, I treat SGI as $I(0)$ and the rest of the series as $I(1)$.

4.2 Cointegration and Granger-Causality Tests

Since all but one series appear to contain a stochastic trend, the question arises as to whether there exist stationary long-run (cointegrating) relationships between them. It is important to take into account long-run information when modeling dynamic interactions between these variables. Johansen & Juselius' (1990) maximum likelihood approach is used to determine if there is cointegration between Japan's saving and each of the other countries' investment or between each country's own investment and saving. The test is based on the following specification:

$$\Delta y_t = \mu + \sum_{j=1}^{p-1} \Gamma_j \Delta y_{t-j} + \Pi y_{t-1} + \Phi D_t + \varepsilon_t, \quad (4)$$

where y is an $n \times 1$ vector. Γ_j ($j = 1, \dots, p-1$) are matrices of coefficients. The matrix Π can be decomposed as $\Pi = \alpha\beta'$ where α and β are $(n \times r)$ matrices. Then $\beta'y_{t-1}$ represents the r cointegrating relations, β is the matrix of

coefficients of the cointegrating vectors, and α is the matrix of adjustment parameters. D_t is a vector containing deterministic variables.

The cointegrating rank is tested using the trace statistic, which tests the null hypothesis that there are at most r cointegrating relations:

$$Trace = -T \sum_{i=r+1}^n \ln(1 - \lambda_i), \quad (5)$$

where λ_i are the $(n-r)$ ordered eigenvalues obtained in the solution of the reduced rank regression problem. I apply the MacKinnon et al. (1999) critical values to the trace statistic. VAR analysis is known to be sensitive to the chosen lag order p in Equation (4). Therefore, to maintain consistency and comparability between regressions using Japan's saving and each economy's own saving and to highlight the difference in the results across economies, an order of 4 lags (in level) is chosen for all the cointegration tests. However, the overall results from cointegration tests with lag lengths chosen by AIC are similar. (Note 5) To account for 1984 structural shock for the case of the Philippines, I use Johansen et al.'s (2000) extension of cointegration test that admits structural breaks in the variables.

Besides examining whether a long-run relationship between Japan's saving and the domestic investment of other Asian countries exists, it is desirable to see if there is a causal link between them. Depending on the results of cointegration tests, different forms of Granger causality tests are then carried out.

To perform causality tests in a cointegrated VAR system, I employ a procedure developed by Toda and Yamamoto (1995) and Dolado and Lutkepohl (1996) (henceforth, TYDL). To apply the procedure, one fits an augmented VAR ($p + d_{max}$) to the data, where d_{max} is the maximum order of integration of the variables in the system:

$$y_t = \delta + \sum_{j=1}^p \Psi_j y_{t-j} + \sum_{j=p+1}^{d_{max}} \Psi_j y_{t-j} + v_t, \quad (6)$$

Then χ^2 or F -tests for linear restrictions based on the Wald principle can be performed on the first p lags of the appropriate elements of the Ψ_j s. Toda and Yamamoto (1995) show that, provided the order of integration of the processes involved in the analysis does not exceed the true lag length of the VAR model, the test statistic of the null hypothesis -- the set of p elements taken from Ψ_j s is zero -- has an asymptotic χ^2 distribution with p degrees of freedom. Following Lutkepohl and Kratzig (2004), I use the F -version of this procedure to test for Granger causality between saving and investment. (Note 6)

For non-cointegrated VAR systems, Granger causality tests are carried out on the VAR in the first differences. However, similar results are obtained when causality tests are based on VAR in levels.

Table 3 presents the results of cointegration tests for Japan's saving and the domestic investments of the other eight countries. The null hypothesis of no cointegration is rejected for ID, KR, MY, PH, and TW at the 5 percent level. (Note 7) In contrast, the results in Table 4 indicate that, at the 5 percent level, no such relationship is found between the domestic investment and saving for each of the eight Asian economies. (Note 8) There is evidence of cointegration in Japan's own saving and investment.

It is interesting that the domestic investments of four of the five crisis countries share a cointegrating relationship with Japan's saving while none shares a long-run relationship with its own saving. The empirical literature on the Asian currency crisis documents heavy dependency of many of the East Asian economies on the Japanese loans for investment capital. For example, on the eve of the crisis initiated in Thailand, 54 percent of Thai liabilities were due to the Japanese commercial banks. While some other economies, such as Hong Kong, Taiwan, and Singapore, also depended heavily on the Japanese commercial bank lending, these economies had good economic fundamentals, better-supervised financial institutions, and more mature and diversified domestic markets. These countries did not run out of international reserves in 1997-98 and did not suffer severe dislocations in their domestic economies either. The crisis economies, on the other hand, had weak economic fundamentals (e.g., large fiscal budget and current account deficits, overvalued currency, and lax banking regulations) and were likely caught up in the over-investment dynamics before 1997. The results presented here suggest that the link between Japan's financial capital and the domestic investment of the crisis economies was stronger (and of a long-term nature) than that between each of the country's own investment and capital.

The absence of a long-run relationship between the domestic saving and investment of the eight Asian economies indicates a high degree of capital mobility in this region. The domestic investments in these countries do not seem to be bounded by their respective savings. The excess of investment over saving, particularly in the 1990s for some countries, was financed by imported capital. Since the domestic investments of some of these countries appear to be financed by Japan's saving and not by their own savings, this also indicates that capital was relatively mobile across these East Asian countries. The presence of a long-run relationship of domestic saving and investment in the case of

Japan, however, does not imply capital immobility, given the size and a relatively low degree of openness of the Japanese economy. One would expect a stronger link between domestic saving and investment in a closed and large economy (Coakley et al., 1998). In addition, Coakley et al. (1998) also argue that domestic saving-investment cointegration for a given economy can be interpreted as evidence of international capital markets imposing an inter-temporal solvency constraint on that particular economy.

The results of Granger-causality between Japan's saving and the domestic investment of the eight Asian economies are given in Table 5. The null of no-causality running from the former to the latter is rejected at the 5 percent level for HK, ID, KR, and PH. It is also marginally rejected for the case of TW. There is, however, no evidence of causality running in the reverse direction, i.e., from the domestic investments of these economies to Japan's saving. Table 6 shows the causality results between the domestic saving and investment of each country. Only in the case of MY then does domestic saving Granger-cause domestic investment. On the other hand, Hong Kong's investment seems to drive its own saving. In the case of Japan, there is evidence of bi-directional causality between its own investment and saving.

Overall, the results from the cointegration and causality tests lend support to the important role of Japan as the common lender, especially for those economies that suffer significant economic setback in the crisis of 1997-98. Starting from the late eighties, the Bank of Japan began a very loose monetary policy, which fueled frenzied investment and led to Japan's asset bubble in the early nineties. When the asset market crashed in 1992, even more liquidity was provided in attempt to rescue its economy. The excess capacity resulting from the low-interest rate policy prevented a significant increase in Japan's domestic investment, even with a significant source of capital made available through high saving rate. In fact, as can be seen from Figure 1, Japan's saving was greater than its investment throughout the period of 1960-1996. The "saving glut" from Japan, coupled with widespread relationship banking, had made Japan the main source of loans for many Asian countries. So when one country in the region had a crisis, the Japanese lenders, in an attempt to rebalance their investment portfolios, were forced to pull capital out of the other countries. This, then, allowed the crisis to spread quickly across countries. The results in this paper are consistent with empirical literature on the financial contagion in the 1997-98 Asian currency crisis (for example, Kaminsky and Reinhart, 2000; Van Rijckeghem and Weder, 2001; Chan and Dang, 2010). (Note 9)

5. Conclusion

In this paper, I investigate financial linkages in East Asia by examining long-run relationship between Japan's saving and the domestic investment of eight other Asian countries prior to the 1997-98 currency crisis. To put this financial connection in a comparable context and to also draw some conclusions about the degree of capital mobility in the region, I also examine the domestic saving-investment relationship in these selected countries. Japan's saving shares a long-term relationship with the investment of four of the five crisis countries. In contrast, no such relationship is found between the domestic investment and saving for each of the eight Asian economies. There is also evidence of cointegration between Taiwan's investment and Japan's saving. The Granger-causality tests further suggest that investment in many of these countries appears to be financed by Japan's saving.

By considering a simple relationship between Japan's saving and investment of some Asian economies, I show that there exist financial linkages in East Asia before 1997-98. The results lend support to the empirical literature on the 1997-98 Asian crisis, which establishes (1) financial (as opposed to trade) contagion and (2) common lender effect as key explanations. In addition, capital mobility seems to be high in the region, with domestic investment not being tied to domestic saving in many countries. The evidence of high capital mobility can explain how quickly the crisis was then propagated across countries.

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Notes

Note 1. This classification is also consistent with other empirical studies on the Asian crisis. See, for example, Kaminsky and Reinhart (2000).

Note 2. Econometric analyses in this paper are carried out using the JMulti (version 4) computer program; it can be downloaded from www.jmulti.de.

Note 3. The political opposition leader Benigno S. Aquino was assassinated in August 1983. The assassination led to a collapse in the confidence of foreign investors and induced significant capital outflows. The Philippines subsequently failed to service its debt. The economy contracted by 7 percent in 1984.

Note 4. I thank the anonymous referee for suggestion to use this test.

Note 5. Given results from VAR can be quite sensitive to different lag lengths, imposing (exogenously) a uniform lag order for all cointegration and causality tests avoid the results being dependent on different lag lengths for different VARs. The set of results for cointegration tests in VAR with AIC lag is available upon request.

Note 6. Lutkepohl and Kratzig (2004) argue that the *F*-version of the test has a better size property.

Note 7. It appears that the null of at most one cointegrating vector is also rejected for ID and TW, thus implying there are two cointegrating vectors in a two-variable system. However, it is well-known that the Johansen test tends to over-reject the null (poor size property) when the sample is small, which is the case for my data. Therefore, I assume that there is at most one cointegrating vector for all VAR systems.

Note 8. Since Singapore's investment series seems to be stationary and Japan's saving seems to be nonstationary, the null of no cointegration between the two series, as expected, is not rejected.

Note 9. In another way to examine financial linkage, Chan and Dang (2010) find evidence suggesting that there are long and short-run causal relationships between the Japanese money supply (M1) and the domestic investment of the Asian crisis economies prior to 1997. We also use M1 of Germany and US and domestic investment of Australia as counterexamples.

Table 1. Average investment and saving, 1960-1996

	Investment					Saving				
	60-69	70-79	80-89	90-96	60-96	60-69	70-79	80-89	90-96	60-96
HK	22	23	26	28	25	26	31	33	33	31
ID	-	22	24	28	25	-	33	32	32	32
JP	32	33	29	30	31	35	35	32	32	34
KR	18	27	30	37	27	9	22	31	36	23
MY	16	23	29	39	26	22	27	30	38	29
PH	16	22	23	22	21	19	25	21	16	21
SG	22	36	40	35	35	15	29	42	47	35
TW	18	26	23	24	22	18	31	33	27	27
TH	19	24	29	40	27	19	22	26	35	25

Table 2. ADF unit root tests for investment & saving

	Sample	IR		SR	
		I(1)	I(2)	I(1)	I(2)
HK	1965-1996	-1.52 (4)	-4.59 (3)	-2.17 (0)	-4.61 (1)
ID	1979-1996	-0.98 (0)	-3.66 (1)	-2.69 (0)	-6.00 (0)
JP	1960-1996	-1.03 (4)	-4.45 (3)	-1.48 (1)	-4.70 (1)
KR	1960-1996	-1.11 (9)	-5.51 (1)	-1.80 (0)	-4.88 (1)
MY	1960-1996	-1.00 (1)	-3.56 (0)	0.55 (2)	-7.38 (1)
PH*	1960-1996	-1.81 (1)	-3.43 (2)	-2.78 (0)	-7.93 (0)
SG	1965-1996	-3.74 (2)	-3.25 (2)	-1.91 (2)	-3.79 (1)
TW	1960-1996	-2.37 (1)	-3.79 (1)	-2.57 (1)	-4.69 (0)
TH	1960-1996	0.12 (4)	-3.55 (3)	-0.57 (0)	-7.74 (0)

Note: Lags (in parenthesis) are determined using the Akaike Information Criterion (AIC). The maximum lag length is 7 for HK and SG, 3 for ID, and 9 for the rest. The critical values at the 1%, 5%, and 10% levels are -3.43, -2.86, and -2.57 respectively.

* Lanne et al.'s (2002) unit root test with structural break is used in the case of the Philippines. The year 1984 is chosen as the break date to account for the political, social, and economic turmoil associated with the assassination of Senator Aquino in 1983. The critical values at the 1%, 5%, and 10% levels are -3.48, -2.88, and -2.58 respectively.

Table 3. Johansen cointegration tests: Japan's saving and other countries' investment

# of Coint. Vector(s)	Trace Statistics	95%	P Value
HK (1965-1996) - VAR(4)			
None	16.78	25.73	0.4397
At most 1	5.12	12.45	0.5866
ID (1979-1996) - VAR(4)			
None	34.19	25.73	0.0028
At most 1	12.98	12.45	0.0403
KR (1960-1996) - VAR(4)			
None	28.50	25.73	0.0208
At most 1	11.76	12.45	0.0660
MY (1960-1996) - VAR(4)			
None	26.48	25.73	0.0397
At most 1	10.64	12.45	0.1016
PH* (1960-1996) - VAR(4)			
None	45.86	36.71	0.0038
At most 1	12.12	18.59	0.3225
SG (1965-1996) - VAR(4)			
None	21.83	25.73	0.1484
At most 1	6.59	12.45	0.3992
TH (1960-1996) - VAR(4)			
None	20.64	25.73	0.1982
At most 1	7.84	12.45	0.2729
TW (1960-1996) - VAR(4)			
None	29.43	25.73	0.0153
At most 1	12.75	12.45	0.0443

Note: (*) Johansen et al. (2000) cointegration test with structural break is used in the case of the Philippines (PH). The year 1984 is chosen as the break date to account for the political, social, and economic turmoil associated with the assassination of Senator Aquino in 1983.

Table 4. Trace statistics of Johansen cointegration tests for individual country's investment and saving

# of Coint. Vector(s)	Trace Statistics	95%	P Value
HK (1965-1996) - VAR(4)			
None	14.04	25.73	0.6587
At most 1	3.17	12.45	0.8467
ID (1979-1996) - VAR(4)			
None	22.82	25.73	0.1145
At most 1	3.25	12.45	0.8370
JP (1960-1996) - VAR(4)			
None	26.72	25.73	0.0369
At most 1	8.19	12.45	0.2433
KR (1960-1996) - VAR(4)			
None	15.76	25.73	0.5194
At most 1	3.09	12.45	0.8560
MY (1960-1996) - VAR(4)			
None	24.09	25.73	0.0807
At most 1	5.84	12.45	0.4912
PH* (1960-1996) - VAR(4)			
None	24.69	36.71	0.4971
At most 1	10.93	18.59	0.4204
SG (1965-1996) - VAR(4)			
None	19.22	25.73	0.2732
At most 1	2.58	12.45	0.9087
TH (1960-1996) - VAR(4)			
None	22.10	25.73	0.1383
At most 1	3.48	12.45	0.8093
TW (1960-1996) - VAR(4)			
None	17.58	25.73	0.3804
At most 1	4.50	12.45	0.6719

Note: (*) Johansen et al. (2000) cointegration test with structural break is used here for the PH. The year 1984 is chosen as the break date to account for the political, social, and economic turmoil associated with the assassination of Senator Aquino in 1983.

Table 5. Granger causality test – F statistics (p-value)

Country	Japan's saving does not Granger-cause domestic investment	Domestic investment does not Granger-cause Japan's saving
HK	4.24 (0.0105)	0.68 (0.5712)
ID*	8.29 (0.0078)	0.09 (0.9637)
KR	2.85 (0.0363)	1.43 (0.2707)
MY	0.88 (0.4827)	1.34 (0.2716)
PH	4.28 (0.0065)	1.71 (0.1698)
SG	0.75 (0.5268)	2.49 (0.0735)
TH	0.49 (0.7410)	1.31 (0.2825)
TW	2.58 (0.0516)	0.19 (0.9413)

Note: (*) The sample size of ID does not permit TYDL Granger-causality test based on VAR(4); therefore, the test is run based on VAR(3).

Table 6. Granger causality test – F statistics (p-value)

Country	Domestic saving does not Granger-cause domestic investment	Domestic investment does not Granger-cause domestic saving
HK	0.27 (0.6060)	3.84 (0.0162)
ID	1.41 (0.2817)	0.53 (0.6718)
JP	3.91 (0.0090)	3.46 (0.0162)
KR	0.86 (0.4658)	2.17 (0.1032)
MY	8.82 (0.0001)	1.76 (0.1656)
PH	0.72 (0.5478)	0.33 (0.8072)
SG	1.51 (0.2267)	2.63 (0.0624)
TH	1.07 (0.3714)	0.89 (0.4542)
TW	1.78 (0.1653)	0.26 (0.8518)

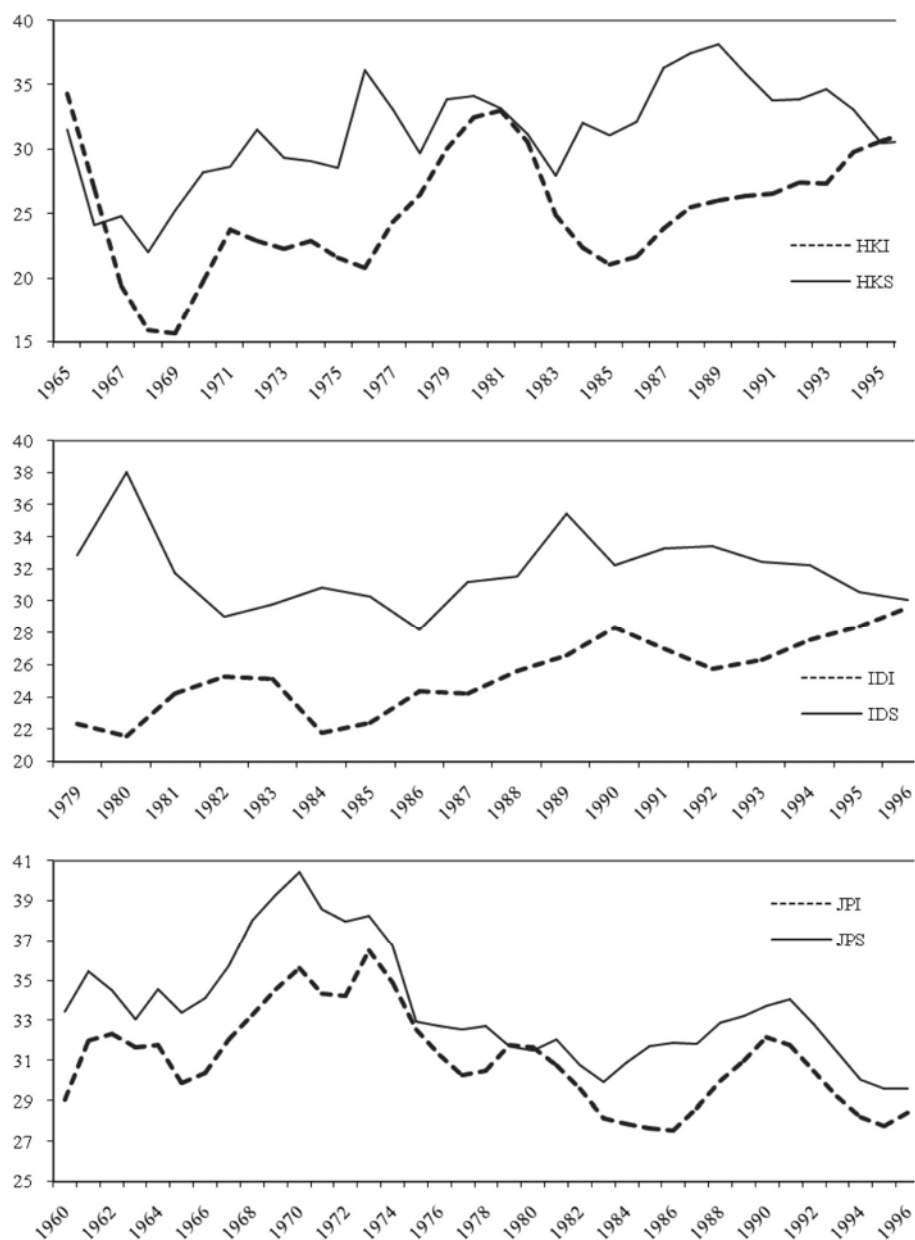


Figure 1. Investment (I) and saving (S) in Hong Kong (HK), Indonesia (ID), Japan (JP), South Korea (KR), Malaysia (MY), the Philippines (PH), Taiwan (TW), and Thailand (TH)

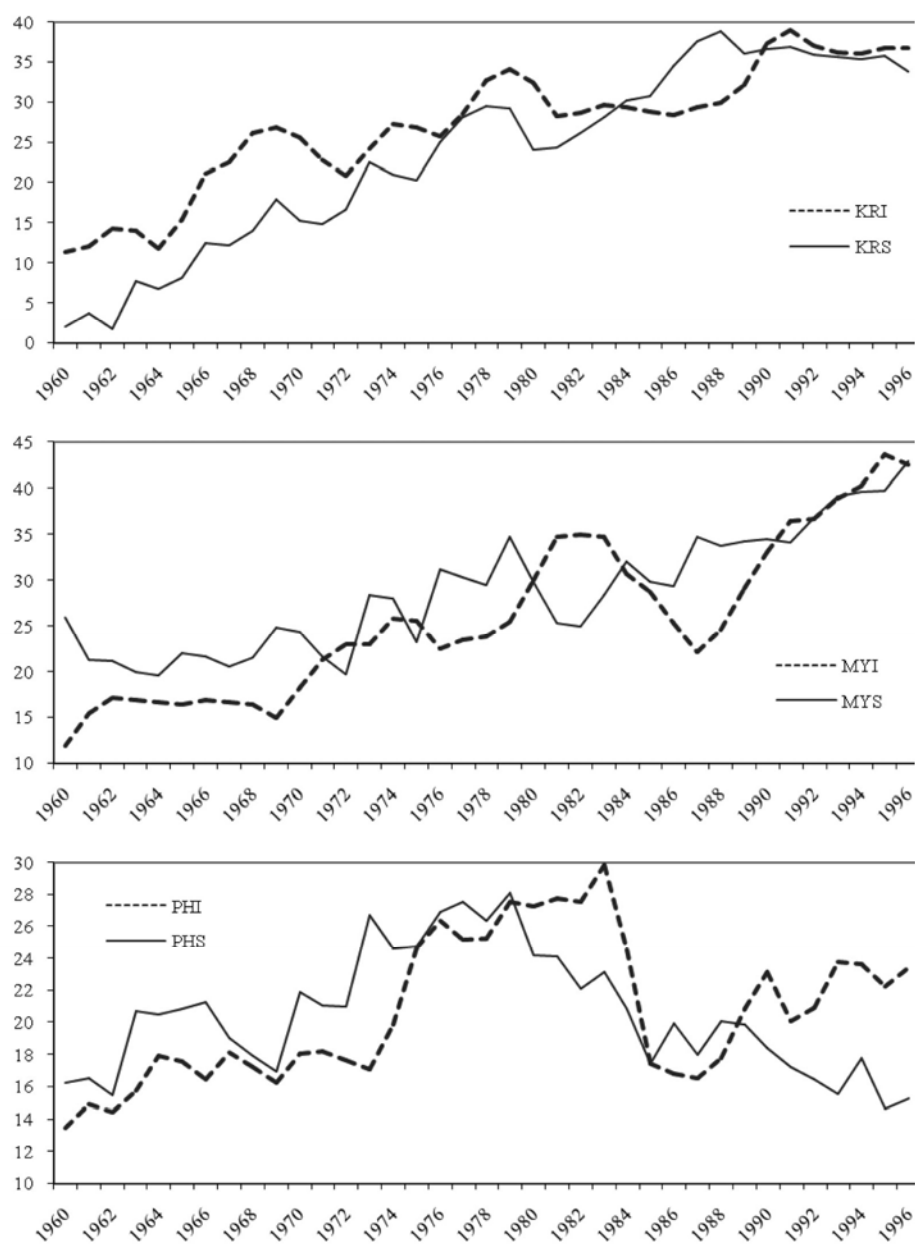


Figure 1. Investment and saving (continued)

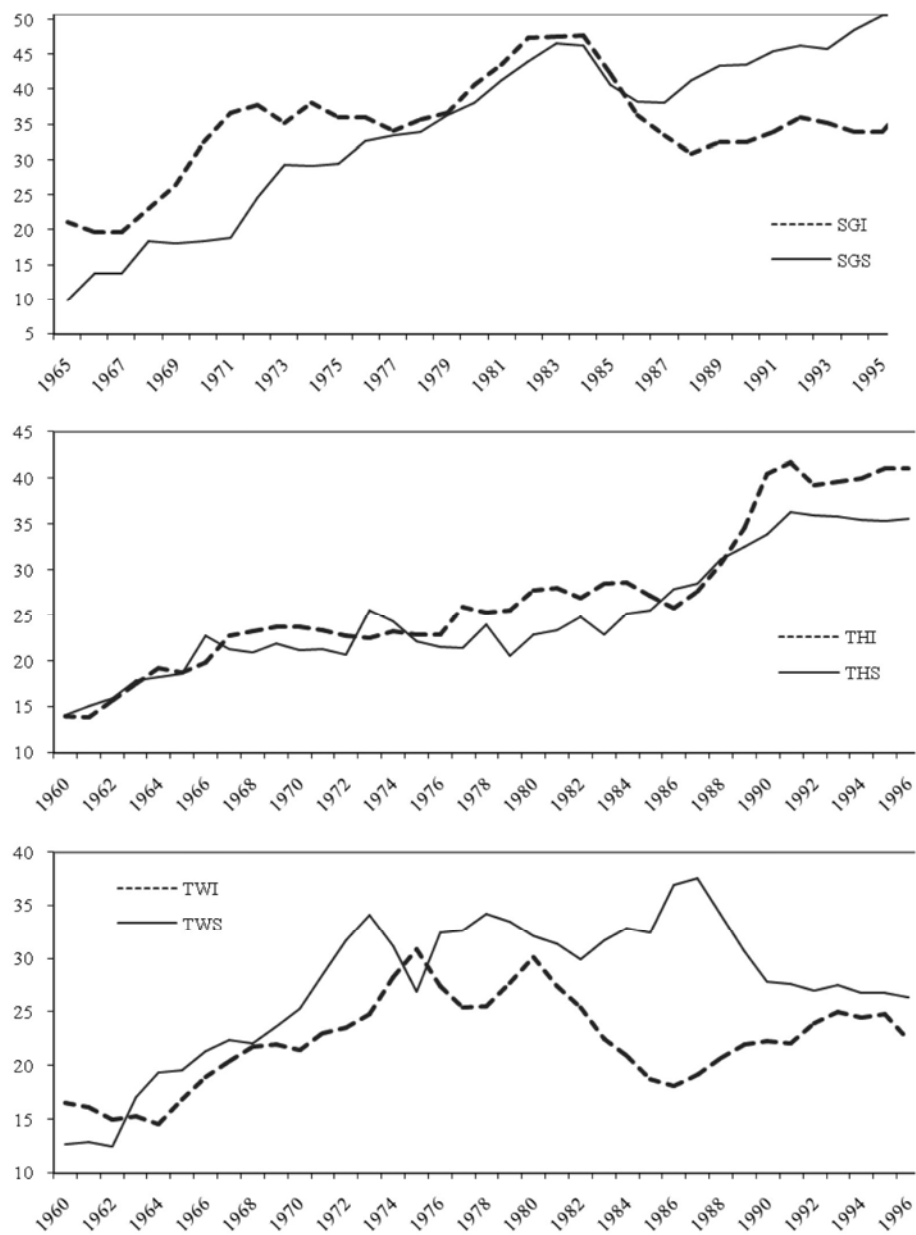


Figure 1. Investment and saving (continued)