Measuring Capital Mobility in the Asia Pacific Rim

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3. Measuring Capital Mobility in the Asia Pacific Rim

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Introduction

Two decades ago, Feldstein and Horioka (1980) proposed a study of the saving-investment nexus that initiated a major controversy on the extent and implications of international finance. They found high correlation between savings and investments in OECD countries (including the US and Japan), which apparently implied a low degree of global capital mobility. Surprisingly, the disputable findings were confirmed by many other subsequent studies[1]. Such event challenges the conventional wisdom which characterises the post-Bretton Woods floating-rate era as one that is experiencing a seeming increase in capital mobility (Obstfeld and Taylor, 2001), following the abandonment of fixed exchange rate regimes and the removal of capital controls since 1970s. In addition, the accelerated pace of globalisation and financial market deregulations as well as the revolutionary changes in information and communication technologies have further demonstrated an increasingly integrated world economy. Capital and trade flows expand remarkably and economic growth began its most rapid spurt in history worldwide. In other words, the Feldstein-Horioka criterion (FCH hereafter) contradicts the fact that capital movements across countries are getting mobile, as the global capital market has become more integrated and thus creating a puzzle[2] in modern economics.

This study revisits the issue in an effort to examine the extent of capital mobility, focusing on ten Asia Pacific nations of different level of economic development and financial openness, during the past three decades. Countries included in the analysis are the two economic giant: the US and Japan; the NIE-4[3]: Hong Kong, Singapore, South Korea and Taiwan; and the ASEAN-4[4]: Indonesia, Malaysia, Philippines and Thailand. To perform a robust analysis, advances in econometric such as the unit root test, cointegration procedure, unrestricted VAR causality, and dynamic OLS (DOLS) are deployed. These empirical tools are capable of demonstrating the dynamic channel of the saving-investment nexus and our estimations take account of the non-stationarity of the time series data to avoid the inferential biases due to non-stationary variables under investigation.

The investigation of capital mobility in the Asia Pacific rim is of interest for a number of reasons. For analysts, assumptions on the level of capital mobility have profound implications for their modelling strategy. For policy makers, the degree of capital mobility has an important bearing on the short-run effects of stabilisation policies. For academicians, evaluation of the Feldstein-Horioka puzzle by employing different empirical specification enhances the application of modern econometrics methods.

Our study differs from the previous works in at least three significant ways. First, this paper offers an up-to date study of the saving-investment relationship based on the evidence from both developed and developing countries. Empirical research of capital mobility in developing countries has been meagre while previous studies mostly focused on the OECD and European community. Second, we counter the problem of country size by studying ten countries, which are different in the size of capital markets and production capacities. Our findings indicate that the heftiness of FHC in measuring capital mobility is more subjected to econometric specifications rather than country size alone. Third, the endogeneity problem of the saving-investment model is confronted by adopting the dynamic OLS (DOLS) estimation. As suggested in Inder (1995) and Hussein (1998), the inclusion of lags and leads of the first difference of savings in DOLS eliminates the effect of endogeneity, while the lags of the first difference of investment corrects for the impact of the remaining autocorrelation of the residual term in the model.

Review of the Saving-Investment Puzzle

The FHC has gained numerous attentions in both theoretical and empirical works. However, anomalous results were reported without convincing conclusion, leaving the 'Feldstein-Horioka Puzzle' even more controversial[2]. In many settings, arguments were reflecting on the statistical method used rather than on any inherent deficiency in the saving-investment relationship. Obstfeld and Rogoff (2000) reveal their concern, arguing that most explanations (on the FH puzzle) tend to be clever but empirically inadequate, and more troublesome still, tend to fix one puzzle at the expense of creating others.

Conventionally, the FHC has been subjected to several theoretical criticisms including the country size and the endogeneity of saving and investment. A small country would take the world interest rate as given while changes in savings and investment of a large country will affect world interest rates (see Obstfeld, 1986; Summers, 1988; Frankel, 1992). An increase in savings of large economies would lower the world's interest rates and, increase the investments in that country. Consequently, saving-investment will be correlated but it would be erroneous to conclude that this implies low capital mobility. In addition, Dooley, *et al.* (1987) documented that any economic variable in addition to the cost of capital that influence the investment rate will probably be correlated with the national saving rate. If factors that determine investment happen to be uncorrelated with national savings, then there will be no endogeneity problem. But since the difference between national savings and investment is identically equal to current account, the lack of correlation would imply that the factor in question has an identical effect on the current account as on investment. Moreover, the current account targeting policies would have resulted in association of savings and investment (e.g. Bayoumi, 1990; Bayoumi and MacDonald, 1995). If there is trade deficit induced by increase in investment, government may react by expenditure cuts or raising taxes, and if current account targeting is successful, it could provide a strong saving-investment correlation. The high saving-investment correlation, however, has nothing to do with capital mobility.

Empirically, the assessments of the saving-investment nexus have focused more on time series data than cross-sectional data. Several studies have argued that the use of time-averaged data in cross-sectional regression analysis tends to bias the results against capital mobility. Gundlach and Sinn (1992) claim that the average value obtained from a cross-section of countries might be the result of divergent individual observations. Countries may contribute to a high β (the saving retention coefficient) either because they have imposed capital controls or because they are simply large. Moreover, advances in time series estimation lead to the application of cointegration procedure and error correction modelling that allow for the investigation of long run equilibria and short run dynamics of saving-investment. If there is cointegration between the two aggregates, capital flows are immobile. Otherwise, capital is regarded as highly mobile across countries. Authors such as Gulley (1992), Bodman (1995), Lemmen and Eijffinger (1995) and Rubio (1998), among others applied the cointegration procedure on saving-investment nexus and support the hypothesis of capital mobility. By contrast, a few articles show that current account balances tend to be mean-reverting, implying that saving and investment are in fact cointegrated with a unit coefficient (e.g. Gundlach and Sinn, 1992, Jansen, 1996; Coakley, 1996). However, this could be also a reflection of the external solvency constraint requiring the current account to be stationary in order for the external debt to be bounded.

Recent studies have extended their analyses to the panel approach. Notably, panel data comprises information from both cross-sectional and time series dimension that provides great flexibility for researchers in modelling differences in behaviour across individuals. Specifically, Ho (2002) pointed out that the low power of univariate tests against persistent alternatives, which is typical for sample sizes that occur in practice, has motivated the use of panel data analysis. Applying a panel regression on 21 OECD countries, Krol (1996) easily rejected the FH puzzle. Jansen (2000) re-examined the same panel set and argued that Krol's conclusion is due to the presence of Luxembourg in the panel set. Coiteux and Oliver (2000) reconciled Krol with FHC by addressing the FH's finding as a long proportion while revealing a much higher degree of capital mobility in the short run. Alternatively, Athanasios and Romain (1998) measure the world capital mobility by subjecting their analyses to a panel of 103 countries, comprising the OECD countries, middle- and low-income countries. Taking consider the business cycle effects and country-specific fixed effects, they found that the saving retention coefficient of OECD panel alone is on average, higher than that of developing countries as a whole. Such occurrence is explained by the increased size sample of more diverse countries. Athanasios and Romain also argued that official capital transactions may cause a low correlation of saving-investment even if capital markets are not well integrated, as for LCDs. Indeed, the sources of capital flows in LCDs are often linked to the financial aid, debt repayments and financial outflows. Ho (2002) then applies fully modified and dynamic OLS estimators to a panel of 12 OECD countries and found no evidence of cointegration between savings-investment, suggesting that international capital mobility is at least high in the long run. Lately, in a comprehensive study, Banerjee and Zanghieri (2003) reconcile the FH puzzle by exploring both the current account dynamics and the saving-investment nexus. Nonetheless, their findings are neither impeccable, having the results of heterogeneous panel-based tests inconsistent with those of time series-based tests (e.g. unit root and cointegration). In brief, disagreements persist in the panel analyses, which are sensitive to the country grouping and the panel size. Hence, the FH puzzle remains.

Theoretical Framework

Following Frankel (1992) and Lemmen and Eijffinger (1995), the FHC can be algebraically linked to three interest parity conditions: the covered interest rate parity (CIP), the ex ante uncovered interest rate parity (UIP) and the ex ante real interest rate parity (RIP). These interest rate parities rely on the co-movement of domestic and foreign prices (*i.e.,* interest rates) and are characterised as the price approach. The FHC, however, relies on the co-movement of domestic quantities and is characterised as the quantity approach. Table 3.1 summarises the cumulative working assumptions to be fulfilled for each condition to hold.

The CIP states that for countries to be financially integrated in the absence of capital controls, default risks and transaction costs, covered interest arbitrage equates the forward premium or discount on foreign exchange to the nominal interest rate differential between comparable domestic and foreign currency assets. UIP, the hypothesis of perfect asset substitution, measure the financial integration in the sense of zero country premium (CIP holds) and zero exchange risk premium. The exchange risk premium captures the information of forward exchange rate as an unbiased predictor of the future spot rate and hence, an extent of 'efficient market hypothesis'. RIP, on the other hand, will hold if the domestic and foreign real interest rates are equalised. It requires the assumptions of CIP (zero country premium) and UIP (zero exchange risk premium) plus zero expected real exchange rate change.

CIP and UIP conditions coincide with two important theoretical aspects of financial integration, *i.e.* the ability and willingness to move financial assets across countries in response to expected difference in exchange-adjusted returns. Two assets are substitutable if investors are willing to change relative shares of their portfolio in response to a change in expected relative returns. Whether asset stocks actually change depends on the ability of investors to adjust their portfolios. The CIP examines the ability; whereas the UIP examines the ability and willingness of capital movements. Subsequently, the RIP examines the perfect financial and non-financial assets movements across countries including the goods and services or, production factors such as labour and physical capital. In other words, preceding studies that showed real interest rate inequality could be due to the failure of the UIP and the PPP or imperfect integration of goods markets but not imperfect integration of financial markets.

The FHC examines capital mobility through the saving-investment nexus. Under perfect capital mobility hypothesis, domestic savings and domestic investments should not share a common movement but vary independently across countries. There are two important assumptions underlying the saving-investment model. First, the investment rate depends linearly on the expected real interest rates and the stochastic error term (μ_i) that capture all other determinants of the investments is uncorrelated with the savings ratio; second, the savings ratio is not affected by the expected real foreign interest rate and uncorrelated with the deviation of RIP. Since the FHC requires two additional assumptions to the RIP condition, it is thereby the strongest criterion for measuring capital mobility.

Data and Methodology

Unit Root and Cointegration Procedure

It is essential for one to first examine the stationarity of the time series properties and determine their order of integration before any further investigation of relationships among variables. For this purpose, we rely on the standard Augmented Dickey Fuller (ADF), Philips-Perron (PP) and the KPSS unit root tests. If any series is identified to have a unit root, then the series are found to be non-stationary. If so, data transformation such as taking first differences of the series to detrend the regression will be necessary. If a series must be differenced d times before it becomes stationary, then it is said to be integrated of order d, denoted *I(d)* and it is unusual in practice for economic series to be integrated of an order greater than two. If two time series are stationary after first difference, they are said to be integrated of order 1 or *I(1)*.

Notably, the Johansen-Juselius (JJ hereafter) cointegration procedure requires that variables are *I(1)* but not *I*(2). It is, however, possible to have a mixture of different order series when there are three or more series under consideration (see Granger and Lee, 1990; Charemza and Deadman, 1992; Masih and Masih, 1999). More particular, the Johansen procedure requires variables not to be *I(2)* but can admit both *I(1)* only or a mixture of *I(1)* and *I(0)* processes in the system, providing that the dependent variable is *I(0)* while at least two explanatory variables are integrated of *I(1)*, if the necessary condition for stationarity of the error term is to be met.

Cointegration refers to the possibility that non-stationary variables may have a linear combination that is stationary, which implies a long run equilibrium relationship between variables. Cointegrated variables move together over time so that any short run deviation from the long-term trend will be corrected. In recent studies, the JJ cointegration procedure is preferred over the two-step Engle-Granger (1987) cointegration procedure. The arguments of deficiencies and lacking of robustness were pointing to the Engle-Granger approach, which relies on ordinary least squares (OLS) analysis[5] as noted in Banerjee, *et al.* (1988), MacDonald and Taylor (1993), Masih and Masih (1997), among others. The test for number of cointegrating vectors in the JJ procedure can be conducted using two likelihood ratio (LR) test statistics namely the trace statistic and maximum eigenvalue statistic as shown below:

$$L_{trace\,(r)} = -T \sum \ln (1 - \lambda_i) \quad (1)$$

$$L_{max\,(r,\, r+1)} = -T \ln (1 - \lambda_{r+1}) \quad (2)$$

where λ_i is the estimated eigenvalues and T is the number of valid observations. The null hypothesis of trace statistic tests that the number of distinct cointegrating vector is less than or equal to r against a general alternative in which it gives result of at most r cointegrating vectors. The latter λ-max statistic tests the null hypothesis that there is r cointegrating vector(s) against the alternative of r+1 cointegrating vectors. The saving-investment cointegration regression can be specified as follows:

$$(I / Y)_{t+k,i} = \alpha + \beta (S / Y)_{t+k,i} + \varepsilon_{t+k,i} \quad (3)$$

where I / Y is the domestic investment ratio, S / Y is the domestic savings ratio, β is the saving retention coefficient and $\varepsilon_{t+k,I}$ is the error term.

Causality Tests

If cointegration is detected, Granger-causality within Vector Error Correction Model (VECM) will be conducted to avoid the problem of mis-specification. Otherwise if there is no cointegration, the causality channel will then be carried out through the restriction Wald tests within the unrestricted VAR. VECM analyses the short run relationship, indicating the short run adjustment to long run equilibrium and the direction of causal effect from one variable to another. A valid error-correction representation of (3) may be specified in the following way:

$$\Delta(I/Y)_{t+k,i} = \alpha + \beta\Delta(S/Y)_{t+k,i} + \gamma[(I/Y)_{t+k-1,i} - \delta(S/Y)_{t+k-1,i}] + \eta_{t+k,i} \quad (4)$$

where β is the impact multiplier, γ is the error correction coefficient, δ is the long run multiplier and $[(I/Y)_{t+k-1,i} - \delta(S/Y)_{t+k-1,i}]$ is the error correction term.

Dynamic OLS

Stock and Watson (1993) have proposed a more robust parametric approach of extracting the long run coefficient, particularly for small sample size (like ours). While estimating the long-run equilibrium via dynamic OLS (DOLS), the Stock-Watson method corrects for possible simultaneity bias among the regressors. The potential of simultaneity bias and small sample bias among the regressors is dealt with the inclusion of lagged and led values of the change in the regressors. The Stock-Watson DOLS is similar to the methods proposed by Phillips and Hansen (1990) and Phillips and Loretan (1991), but is practically much more convenient to implement and estimate. A valid Stock-Watson DOLS representation may be specified in the following way:

$$I_t = B'X_t + \sum_{j=-k}^{j=k} \eta_j \Delta S_{t-j} + \sum_{j=-l}^{j=l} \lambda_j \Delta I_{t-j} + \xi_t \quad (5)$$

where $B = [c, \alpha, \beta]'$, $X = [1, \; S_t, \; I_t]$ while I_t and S_t represent the domestic investment ratio and domestic savings ratio respectively. The DOLS procedure of estimating the saving-investment long run parameters basically involves regressing any *I(1)* variables on other *I(1)* variables, any *I(0)* variables and leads and lags of the first difference of any *I(1)* variables. These estimates will facilitate inferences made for the long run. In our case, the DOLS equations are estimated including up to $j = \pm 3$ leads and lags for first difference of savings to eliminate the effect of endogeneity. For first difference of investments, the estimation includes up to $j = -3$ lags to correct for the impact of remaining autocorrelation of the residual term.

Data Description

Our analyses occupy the annual ratio of gross domestic savings (GDS/GDP) and ratio of gross domestic investments (GDI/GDP) concerning the United States and Japan, NIE-4 and ASEAN-4, spanning from 1971 to 1999[6]. Gross domestic savings comprises the private and government savings, which can be estimated by subtracting both the private and government consumption expenditure from gross domestic product. Gross domestic investment then takes account of the fixed capital formation and changes in the capital stock. All raw data are sourced from IFS, SEACEN Financial Statistics and the respective central banks. Annual frequency data are chosen for the analysis due to the fact that higher frequency data are not available for most of the developing countries. Indeed, annual data generally convey more information and avoid the contamination of seasonal elements (see Bayoumi and Macdonald, 1995). It is also well known that cointegration analyses are sensitive to seasonal elements in the data. Detail description of the data can be further referred to the Appendix Table.

Results Discussion

Correlation analysis

Figure 3.1 demonstrates the scatter and regression plots of saving-investment ratios over the past three decades. For most East Asian countries, the domestic investments tend to be drifting far apart from the domestic savings, implying a low correlation between the two variables. This pattern appears to suggest high capital mobility within the Pacific Rim. Nonetheless, Japan seems to have their saving-investment closely correlated while the US data yields a positive steep regression slope, which may suggest a highly dependent savings and investments. These figures seem to support the puzzling findings by earlier studies: capital flows in the highly developed and open countries such as the US and Japan are subsequently less mobile when compared to the developing East Asia countries.

Unit Root and Cointegration Analysis

The application of cointegration requires savings and investments ratios to be non-stationary. All series are first transformed into natural logarithm form before being subjected to the unit root tests of stationarity. The computed Augmented Dickey Fuller (ADF) and Philips-Perron (PP) statistics indicate that the null hypothesis of a unit root cannot be rejected for all the series in level (Table 3.2). For series in first difference, many cases in the ADF test still fail to reject the null hypothesis of unit root at standard significant levels. This finding implies that some series are not stationary even after first differencing, perhaps suggesting that the series are integrated at a higher order (e.g. *I(2)*). On the other hand, the non-parametric PP test has rejected the hypothesis of unit root for all series except the investment rates of Hong Kong, implying that most series are integrated of order one or *I(1)*.

It is widely acknowledged that the standard ADF and PP tests are not very informative on how to distinguish between a unit root and near unit root case and they are known to be of low power in small sample size such as ours. The ADF test, in particular experiences the loss of power when the autoregressive parameter is close to unity. The PP test, on the other hand, has poor size properties, i.e. it is biased towards the rejection of the null hypothesis when the series follows a MA process, as highlighted by Schwert (1989). The power of these two tests to distinguish between trend stationary and difference stationary processes has been further questioned by Schwert (1987) and De Jong *et al.* (1989). Therefore, the alternative KPSS test proposed by Kwaitkoski *et al*. (1992) can be used in a complementary way to confirm on the *I(1)* specification. KPSS procedure assumes the univariate series can be decomposed into the sum of a deterministic trend, random walk and stationary *I(0)* disturbance and is based on a Lagrange Multiplier score testing principle. This test reverses the null and the alternative hypothesis. A finding favourable to a unit root in this case requires strong evidence against the null hypothesis of stationarity. As reported in Table 3.3, the null hypothesis is rejected in favour of the unit root hypothesis for all cases, wherein the computed statistics are larger than the asymptotic critical values. These KPSS results have further confirmed that all series are stationary after first difference and no variable is *I(2)*. We thus relied on the KPSS tests to arrive at the conclusion that both domestic savings and investments are of the *I(1)* process for all the sample countries. Hence, the series are expedient in a cointegration analysis.

Although the JJ procedure is a multivariate approach, it is also widely used in two-dimensional cases (such as ours) to test for the unique cointegrating vector in the system (Table 3.4), which may exist between the saving-investment ratios. Both the trace and maximum eigenvalue tests indicate no evidence of cointegrating vector(s) at 5% significant level, suggesting the absence of long run common stochastic trend between domestic savings and domestic investments for all studied countries. The absence of long run comovements of domestic investments and domestic savings leads us to conclude that there is no reason to expect that higher domestic savings in any particular country will reflect a higher domestic investments in that country. In addition, the difference between saving-investment is identically equal to current account balance. The lack of cointegration would imply that savings in each country react to cross country differences in rates of return on capital while a country's level of investment is financed by the world capital market through a current account deficit. This can only happen if the financial markets are open and allow for free capital flows. Thus, the above evidences indicate that capital movements are highly mobile among the region during the sample period.

Unrestricted VAR analysis

Table 3.5 presents the results of restricted Wald tests within the unrestricted VAR. The findings have informed us about the causal channels between domestic savings and domestic investments. Most countries (except Indonesia and Japan) fail to reject the null hypothesis of perfect capital mobility (βs=0) at conventional significance levels. This indicates an inactive temporal causality chain of savings to investments, suggesting that domestic savings are not being utilized in a significant proportion to finance domestic investment even in the short run. By contrast, when the restriction of unique coefficient is imposed (βs=1), all countries strongly reject the null hypothesis of perfect capital immobility. To this end, the findings are in agreement with the cointegration results and further support the presence of a high regional capital mobility (although it is not perfectly mobile).

DOLS and Long run Equilibria

Long run parameters for variables in levels, with approximate asymptotic standard errors appear in Table 3.6, taking account of the endogeneity of national savings-investments. For most countries, domestic savings fail to be the significant explanatory variables for domestic investments, even when allowing for simultaneity bias in DOLS. All saving retention coefficients (βs) are statistically significant at vary confidence levels, and seven out of ten have reported below 0.5, suggesting a considerable degree of capital mobility in the Asia Pacific Rim. Indeed, near perfect capital mobility is detected in the case of Singapore (0.05). Overall, the long run capital mobility is more apparent for NIEs while capital flows in ASEAN countries seem to be more restricted (especially Indonesia and Thailand). Despite the fact that ASEAN members have aggressively taken parts in international trades, their financial controls and interest rates ceilings were only removed gradually since mid-1980s. By contrast, most NIEs (except South Korea) have experienced the interest rates and capital accounts liberalisation since late 1970s. Moreover, Hong Kong and Singapore have both been the Asia financial centre for the past two decades. As for the US and Japan, their long run saving retention coefficients are in the moderate range (0.56 and 0.45) but seems to be much lower than those of previous studies. Our empirical evidences have, to some extent, not supported the argument that country size (or production capacity) encounters for the proficiency of FHC.

Concluding Remarks and Policy Implication

The analyses based on cointegration tests, unrestricted VAR and DOLS have provided sufficient evidence that capital movements have been highly mobile in the Pacific Rim during our study period. This finding is in contrast to that of FH but is in line with recent studies that found massive influx of capital flows from developed countries into developing countries, especially to the East Asian countries (see Hussein, 1998 and Gabriele *et al.*, 2000). We attribute the result of our finding to the endogeneity of savings in the saving-investment relationship.

On one hand, high capital mobility allows small economies such as the ASEAN countries that have a relatively smaller domestic market and insufficient capital (savings), to rely on foreign investments and court funds from the capital-surplus countries to generate capital formation, productive capacity and national wealth. On the other hand, it enables investors from capital-surplus countries (US, Japan and NIEs) to diversify and minimise their portfolio investment risk and achieve higher risk-adjusted rates of return, leading to a much more efficient allocation of resources. In turn, higher return rates encourage more savings and investments that stimulate greater economic growth.

Nevertheless, growing capital mobility across countries is often associated with costly financial problems. The size and speed of international capital movements can very quickly overwhelm the domestic authorities and narrow their policy options, building up pressure on the domestic price and monetary instruments hence causing the macroeconomics imbalance and distortion of the financial system. It is hard to govern capital inflows and to maintain exchange rate stability when international currency and financial markets are dominated by speculative and herding behaviour. Problems become worse when asymmetric information takes place in the immature Asia Pacific financial markets. Asymmetric information implies information gap in financial transactions (e.g. between loan officer and borrower) that contribute to financial problems including moral hazard[7] and adverse selection. Such asymmetric behaviour, at minimum, can lead to inefficiencies; while in extremes will lead to costly financial crises such as the recent Asia crisis (Eichengreen *et al.*, 1999).

The non-cointegrated saving-investment nexus has as well implied that unit roots present in the government saving gaps, which support neither the current account targeting nor the Ricardian Equivalence. Current account balances are thus not mean-reverting to the equilibria level and government could remain insolvent even in the long run. This has indeed reflected the raison d'être of recent Asia crisis. Prior to 1997, a surge of capital inflows increases current account deficits to an unsustainable level. It then causes an appreciation of real exchange rate in the receiving country, which further leads the tradable sector of the economy to become less competitive in the global market. The unsustainability of the current account deficit as well as the appreciation of real exchange rate causes the receiving country to become more vulnerable to foreign shocks. Indeed, the financial crisis demonstrated that different countries in the region were affected differently according to the level of development in the capital market. The badly affected countries are Indonesia, Malaysia, Philippines, Thailand and South Korea. Singapore, Hong Kong, Taiwan and Japan who have relatively matured capital markets were less affected by the crisis.

In conclusion, countries can only take advantage of a greater mobility of capital once they have developed a somewhat advanced domestic financial market (Edwards, 2001). Despite building up strong economic fundamentals, developing Asia countries need to strengthen their domestic financial system before their financial markets are opened internationally. Laws, rules and regulations governing the operations of equity market should be strengthened. Investors ought to be protected and the market should not be manipulated by unscrupulous market players. In addition, closer regional co-operation and governance of international capital flows are essential to provide a collective defence mechanism against systemic failures and monetary instability.

Notes:

1. These include the studies in both cross-sectional and time series. Examples are Penati and Dooley (1984), Dooley, Frankel and Mathieson (1987), Summers (1988), Argimon and Roldan (1994), Taylor (1996), Jansen, (1996), Coakley (1996), Oh *et al.* (1999), among others.
2. Obstfeld and Rogoff, (2000) in their recent survey, remarked the 'Feldstein-Horioka Puzzle' as one of the six puzzles in international macroeconomics in conjunction with the McCallums' home bias in trade puzzle, the French-Poterba equity home bias puzzle, the Backus-Kehoe-Kydland consumption correlation puzzle, the PPP puzzle and the Exchange Rate Disconnect Puzzle.
3. NIE-4 corresponds to the four Newly Industrialised Economies in Asia.
4. ASEAN, which refers to the Association of Southeast Asian Nations, has five original members, Indonesia, Malaysia, Philippines, Singapore and Thailand. However in our context, we characterise Singapore as one of the NIE-4 according to the level of financial development and the size of the capital market.
5. More detail, Masih and Masih (1997) added that the Johansen-Juselius procedure assumes all variables to be endogenous while the Engle-Granger procedure is sensitive to the choice of dependent variables. The JJ procedure does not priori assume the existence of at most a single cointegrating vector; instead it explicitly tests for a number of cointegrating relationships. Also, the JJ procedure avoids the arbitrary choice of the dependent variables in the Engle-Granger approach and is insensitive to the variable being normalised when it comes to extracting the residual from the cointegrating vector. Furthermore, the JJ procedure is established on a unified framework for estimating and testing cointegrating relations within the vector error correction modelling (VECM) formulation. Finally, the JJ procedure provides the appropriate statistics and the point of distribution to test a hypothesis for the number of cointegrating vectors and also tests any restriction upon the coefficients of the vectors.
6. For Malaysia, which imposed capital control and fixed exchange rate since 2 September 1998, the study period only covers 1971-1997.
7. The role of moral hazard in the onset of the Asian crisis has been stressed by a number of authors, namely Krugman (1998) and Sarno and Taylor (1999). According to them, before the financial crisis, Asia's leading national banks were excessively borrowing from abroad and lending excessively at home. These capitals have flowed to lots of risky and dubious profitable projects, which later put the investors/ bankers into large debts and even bankruptcy when the currency crisis occurred.

Table 3.1 Cumulative Assumptions of Interest Parities and FHC

Interest Parities and FHC	Assumptions	
CIP		
$i_t - i_t^* = f_t^{t+k} - s_t$	$i_t - i_t^* - (f_t^{t+k} - s_t) = 0$	Zero country premium
UIP		
$i_t - i_t^* = E_{t(}s_{t+k} - s_{t)}$	$i_t - i_t^* = f_t^{t+k} - s_t$	Zero country premium
	$E_t(s_{t+k} - s_t) = f_t^{t+k}$	Forward exchange rate is an unbiased predictor of expected future spot exchange rate
RIP		
$E_t(r_{t+k}) = E_t(r^*_{t+k})$	$i_t - i_t^* = f_t^{t+k} - s_t$	Zero country premium
	$E_t(s_{t+k} - s_t) = f_t^{t+k}$	Forward exchange rate is an unbiased predictor of expected future spot exchange rate
	$E_t(s_{t+k} - P_{t+k} + P^*_{t+k}) = s_t - P_t + P^*_t$	Zero expected real exchange rate change
FHC		
$(I/Y)_{i,\, t+k} = \alpha + \beta(S/Y)_{i,\, t+k} + \varepsilon_{i,\, t+k}$		
	$(I/Y)_{t+k,\, i} = -\varnothing E_t(r_{i,\ t+k}) + \mu_i$ and	
	$i_t - i_t^* = f_t^{t+k} - s_t$ $E_t(s_{t+k} - s_t) = f_t^{t+k}$ $E_t(s_{t+k} - P_{t+k} + P^*_{t+k}) = s_t - P_t + P^*_t$	} $Cov\ (E_t(r_{i,\ t+k}) - E_t(r^*_{i,\ t+k}), (S/Y)_{I,\, t+k}) = 0$
	$Cov\ (\mu_i, (S/Y)_{i,\, t+k}) = 0$	
	$Cov\ (E_t(r^*_{i,\ t+k}), (S/Y)_{i,\, t+k}) = 0$	

Symbols:

i_t	= domestic nominal interest rate at time t on a k period bond held between time t and t+k
f_t^{t+k}	= forward exchange rate agreed at time t for the delivery of foreign currency at time t+k
s_t	= spot exchange rate at time t
$f_t^{t+k} - s_t$	= forward premium (+ve) or discount (-ve) on foreign currency at time t
$E_t(s_{t+k})$	= expected spot exchange rate at time t +k
$E_t(s_{t+k} - s_t)$	= expected spot exchange rate change of the domestic currency vis-à-vis the foreign currency between time t+k

P_t	= domestic price level at time t
$E_t(r_{t+k})$	= expected domestic real interest rate at time t on a k-period bond held between time t and t+k
E_t	= conditional expectations operator based upon the information available at time t, i.e., $E(. \mid I_t)$
μ_i	= a stochastic error term that captures all other determinants (besides interest rates) of the investment ratio uncorrelated with $E_t(r_{i,\ t+k})$ and $S_{i,\ t+k} / Y_{i,\ t+k}$
I	= gross domestic investment
S	= gross domestic savings
Y	= gross domestic product
k	= holding period of the underlying debt period
*	= foreign variable
i	= domestic country i

Notes:
All variables (except interest rates) are expressed in natural logarithms, represented by the lower case letters. Take for instance that the exact CIP is expressed as $F_t^{t+k} / S_t = (1+ I_t)/ (1+ I^*_t)$. By taking natural logarithms of both sides, noting that $f_t^{t+k} = \ln (F_t^{t+k})$; $s_t = \ln (S_t)$; $\ln (1+ I_t) = i$, and $\ln (1+ I^*_t) = i^*$, the logarithm approximation of CIP will be: $i_t - i_t^* = f_t^{t+k} - s_t$

Table 3.2 ADF and PP Unit Root Tests of Saving-Investment Rates, 1971-1999

	ADF				PP			
	Level		1st Difference		Level		1st Difference	
	No Trend	Trend	No Trend	Trend	No Trend	Trend	No Trend	Trend
Savings								
IND	-2.10[1]	-1.73[1]	-2.96[1]*	-4.20[1]*	-2.16[1]	-1.36[1]	-5.63[1]*	-7.16[1]*
MAL	-2.37[1]	-2.16[1]	-3.70[2]*	-3.68[2]*	-2.27[1]	-3.15[1]	-6.81[1]*	-6.66[1]*
PHI	0.07[1]	-2.32[1]	-4.20[1]*	-4.51[1]*	0.03[1]	-2.30[1]	-4.65[1]*	-5.26[1]*
TH	-1.32[1]	-3.11[1]	-3.52[2]*	-3.45[2]*	-1.15[1]	-3.09[1]	-7.28[1]*	-7.14[1]*
HK	-2.19[1]	-2.14[1]	-4.19[1]*	-4.22[1]*	-2.39[1]	-2.33[1]	-4.21[1]*	-4.23[1]*
SIN	-2.27[1]	-2.77[1]	-3.89[2]*	-3.83[2]*	-2.61[1]	-2.75[1]	-7.74[1]*	-7.63[1]*
SK	-1.78[2]	-2.24[2]	-2.59[4]	-2.59[4]	-2.82[1]	-3.25[1]	-4.74[1]*	-4.69[1]*
TW	-1.61[1]	-2.15[1]	-2.39[4]	-2.41[4]	-1.74[1]	-2.24[1]	-4.81[1]*	-4.78[1]*
JAP	-2.40[1]	-2.47[1]	-3.06[3]*	-3.12[3]	-2.25[1]	-3.41[1]	-8.38[1]*	-8.31[1]*
US	-1.17[1]	-2.67[1]	-3.72[2]*	-3.68[2]*	-1.17[1]	-2.73[1]	-6.23[1]*	-6.18[1]*
Investments								
IND	-1.94[1]	-0.23[1]	-2.03[1]	-2.71[1]	-1.93[1]	0.14[1]	-5.33[1]*	-5.97[1]*
MAL	-1.81[1]	-0.79[1]	-2.20[1]	-2.36[1]	-2.01[1]	-1.28[1]	-3.35[1]*	-3.63[1]*
PHI	-1.49[2]	-2.26[2]	-2.49[2]	-2.39[2]	-1.79[1]	-2.19[1]	-3.52[1]*	-3.55[1]*
TH	-1.17[1]	-0.11[1]	-3.76[1]*	-4.30[1]*	-1.43[1]	-0.52[1]	-3.84[1]*	-4.33[1]*
HK	-2.28[1]	-2.85[1]	-2.67[1]	-2.67[1]	-1.87[1]	-1.81[1]	-2.87[1]*	-2.68[1]
SIN	-1.55[1]	-1.85[1]	-2.54[1]	-2.47[1]	-1.67[1]	-1.99[1]	-4.52[1]*	-4.43[1]*
SK	-1.85[2]	-1.54[2]	-1.32[3]	-1.52[3]	-2.19[1]	-2.11[1]	-4.41[1]*	-4.68[1]*
TW	-1.79[1]	-2.12[1]	-4.44[1]*	-4.36[1]*	-1.95[1]	-2.29[1]	-4.47[1]*	-4.39[1]*
JAP	-1.16[1]	-3.12[1]	-3.22[2]*	-3.18[2]	-1.16[1]	-3.25[1]	-7.34[1]*	-7.19[1]*
US	-1.20[4]	-2.08[4]	-2.28[6]	-2.13[6]	-2.82[1]	-3.34[1]	-6.40[1]*	-6.31[1]*

Notes: Asterisk (*) denotes significant at 5% level. 5% critical values for no trend and trend are –2.86 and –3.41 respectively. The optimal lag structure is determined using the Akaike Information Criteria (AIC) and are provided in the parentheses. All sample periods (except Malaysia) cover from 1971-1999, accounting for 29 observations. The following notations apply in all the forthcoming tables: IND = Indonesia, MAL = Malaysia, PHI = Philippines, SIN = Singapore, TH = Thailand, HK = Hong Kong, SK = South Korea, TW = Taiwan, JAP = Japan and US = United States.

Table 3.3 KPSS Unit Root Tests of Saving-Investment Rates, 1971-1999

	Level		First Difference		Conclusion
	μ	τ	μ	τ	
Savings					
IND	0.802[1]*	0.333[1]*	0.455[2]	0.060[2]	I(1)
MAL	0.720[1]*	0.147[1]*	0.122[5]	0.118[5]	I(1)
PHI	0.818[2]*	0.221[2]*	0.350[1]	0.059[1]	I(1)
TH	1.349[1]*	0.155[1]*	0.074[1]	0.074[1]	I(1)
HK	0.465[8]*	0.158[8]*	0.100[2]	0.041[2]	I(1)
SIN	1.064[1]*	0.153[1]*	0.098[1]	0.052[1]	I(1)
SK	0.493[5]*	0.181[15]*	0.073[1]	0.035[1]	I(1)
TW	0.481[1]*	0.256[1]*	0.137[1]	0.043[1]	I(1)
JAP	0.920[1]*	0.152[1]*	0.106[2]	0.078[2]	I(1)
US	0.792[2]*	0.159[2]*	0.056[1]	0.061[1]	I(1)
Investments					
IND	1.046[1]*	0.247[1]*	0.434[2]	0.105[2]	I(1)
MAL	0.639[1]*	0.152[1]*	0.226[3]	0.080[3]	I(1)
PHI	0.734[1]*	0.222[1]*	0.113[1]	0.081[1]	I(1)
TH	0.693[1]*	0.211[1]*	0.229[6]	0.127[6]	I(1)
HK	0.463[1]*	0.241[1]*	0.082[3]	0.070[3]	I(1)
SIN	0.531[1]*	0.221[1]*	0.064[2]	0.062[2]	I(1)
SK	0.766[1]*	0.150[1]*	0.219[4]	0.111[4]	I(1)
TW	0.560[1]*	0.146[1]*	0.060[1]	0.061[1]	I(1)
JAP	0.926[1]*	0.184[1]*	0.072[2]	0.071[2]	I(1)
US	0.729[1]*	0.152[1]*	0.072[2]	0.064[2]	I(1)

Notes: Asterisk (*) denotes significant at 5% level obtain from Kwiatkowski *et al*. (1992). The null hypothesis of KPSS unit root tests is that the series contain no unit root (stationary) against the alternative hypothesis of a unit root (non-stationary). The μ and τ are the models with constants and a time trend respectively. Optimal lag lengths are provided in parentheses. All sample periods (except Malaysia) covers from 1971-1999, accounting for 29 observations.

Table 3.4 Johansen-Juselius's Cointegration Tests of Saving-Investment

	Null	Alternative	λ-Max	Trace	Critical Value (95%)	
Model	Ho	H_1			λ-Max	Trace
IND (K=3)	r = 0	r = 1	14.30	21.75	19.22	25.77
	r ≤ 1	r = 2	7.44	7.44	12.39	12.39
MAL (K=3)	r = 0	r = 1	7.04	11.23	19.22	25.77
	r ≤ 1	r = 2	4.18	4.18	12.39	12.39
PHI (K=3)	r = 0	r = 1	11.94	18.59	19.22	25.77
	r ≤ 1	r = 2	6.65	6.65	12.39	12.39
TH (K=3)	r = 0	r = 1	9.22	12.59	19.22	25.77
	r ≤ 1	r = 2	3.37	3.37	12.39	12.39
HK (K=2)	r = 0	r = 1	11.14	15.95	19.22	25.77
	r ≤ 1	r = 2	4.80	4.80	12.39	12.39
SIN (K=1)	r = 0	r = 1	18.89	22.55	19.22	25.77
	r ≤ 1	r = 2	3.66	3.66	12.39	12.39
SK (K=3)	r = 0	r = 1	8.47	13.16	19.22	25.77
	r ≤ 1	r = 2	4.69	4.69	12.39	12.39
TW (K=2)	r = 0	r = 1	9.53	15.02	19.22	25.77
	r ≤ 1	r = 2	5.49	5.49	12.39	12.39
JAP (K=2)	r = 0	r = 1	15.75	23.53	19.22	25.77
	r ≤ 1	r = 2	7.79	7.79	12.39	12.39
US (K=1)	r = 0	r = 1	7.89	11.11	19.22	25.77
	r ≤ 1	r = 2	3.22	3.22	12.39	12.39

Notes: (K=n) represents the optimal lag lengths selected according to the AIC criteria. No cointegration is detected for saving-investment relationships of all 10 countries.

Table 3.5 Restriction Test of Saving-Investment within Unrestricted VAR

Model	Dependent Variable	Perfect Mobility Hypothesis (β=0) Independent Variable ΔI χ^2	Perfect Mobility Hypothesis (β=0) Independent Variable ΔS χ^2	Perfect Immobility Hypothesis (β=1) Independent Variable ΔI χ^2	Perfect Immobility Hypothesis (β=1) Independent Variable ΔS χ^2
IND (k=3)	ΔI	-	5.48[0.02]*	-	4.44[0.04]*
	ΔS	0.38[0.54]	-	7.75[0.01]*	-
MAL (k=3)	ΔS	-	2.21[0.14]	-	23.65[0.00]*
	ΔI	2.74[0.10]	-	9.89[0.00]*	-
PHI (k=3)	ΔI	-	0.22[0.64]	-	59.61[0.00]*
	ΔS	0.08[0.78]	-	132.40[0.00]*	-
TH (k=3)	ΔI	-	0.40[0.53]	-	13.12[0.00]*
	ΔS	1.29[0.26]	-	12.13[0.00]*	-
HK (k=2)	ΔI	-	2.96[0.09]	-	48.31[0.00]*
	ΔS	0.00[0.98]	-	50.49[0.00]*	-
SIN (k=1)	ΔI	-	0.07[0.80]	-	379.03[0.00]*
	ΔS	2.82[0.09]	-	47.02[0.00]*	-
SK (k=3)	ΔI	-	1.02[0.31]	-	479.26[0.00]*
	ΔS	3.31[0.07]	-	17.23[0.00]*	-
TW (k=2)	ΔI	-	2.35[0.13]	-	74.90[0.00]*
	ΔS	1.33[0.25]	-	479.26[0.00]*	-
JAP (k=2)	ΔI	-	7.64[0.01]*	-	33.36[0.00]*
	ΔS	1.61[0.21]	-	6.39[0.01]*	-
US (k=1)	ΔI	-	1.19[0.28]	-	15.18[0.00]*
	ΔS	0.01[0.93]	-	38.19[0.00]*	-

Notes: Asterisk (*) denotes 5% significant level while P-values are presented in parentheses [ ]. (K=n) represents the optimal lag lengths selected according to the AIC criteria. The joint-significance of the lagged values of the independent variables is tested using the Wald test and Chi-square (χ^2) statistics.

Table 3.6 DOLS Long Run Parameter Estimations

Country	β	SSR	Adj R^2
IND	0.76 (0.21) ***	0.09	0.81
MAL	0.50 (0.24) **	0.69	0.14
PHI	0.34 (0.11) ***	0.22	0.78
TH	0.69 (0.15) ***	0.40	0.45
HK	0.20 (0.35) *	0.05	0.60
SIN	0.05 (0.18) *	0.02	0.19
SK	0.32 (0.14) **	0.16	0.24
TW	0.14 (0.34) *	0.03	0.63
JAP	0.45 (0.25) *	0.02	0.50
US	0.56 (0.10) ***	0.03	0.74

Notes: Asterisk *, ** and *** denote 10%, 5% and 1% significance level respectively. Standard errors are presented in parentheses ( ), while SSR represents the sum of squared residuals. The DOLS equations are estimated including up to $j = \pm 3$ leads and lags for first difference of savings and up to $j = -3$ lags for the first difference of investments. The results presented refer to a parsimonious version of the more general specification with only the insignificant lead/lag regressors omitted.

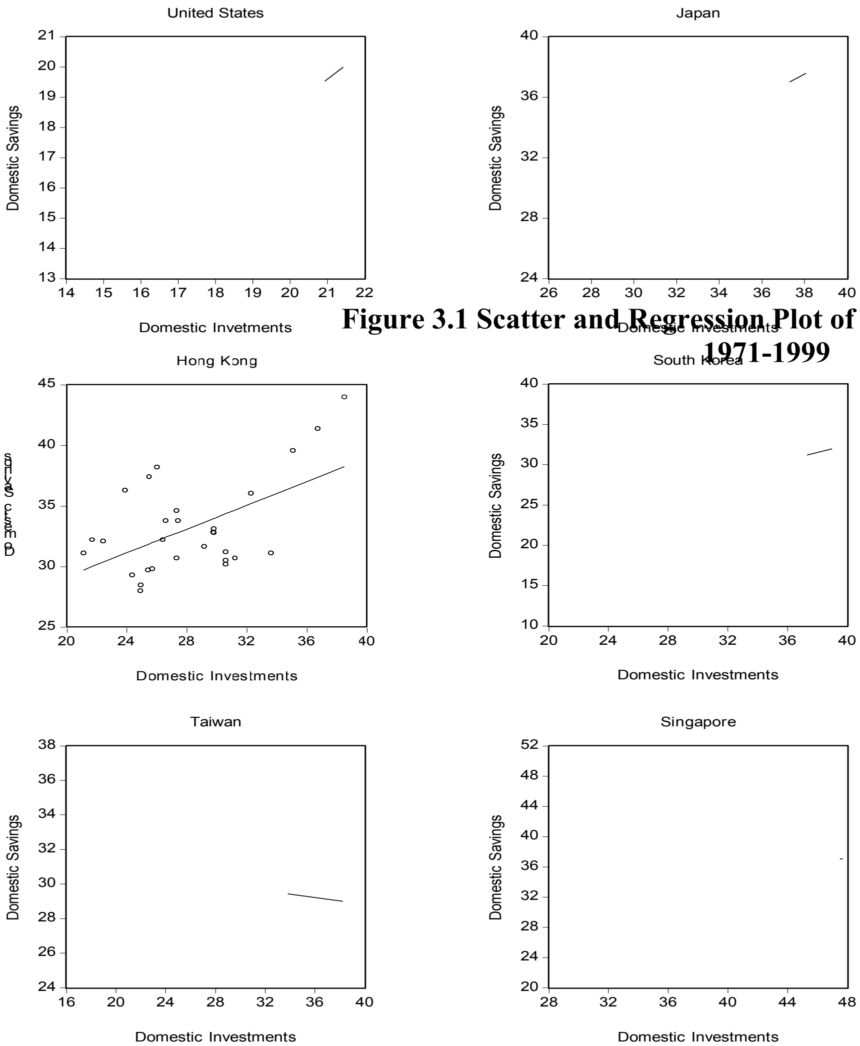

Figure 3.1 Scatter and Regression Plot of Saving-Investment Ratios, 1971-1999

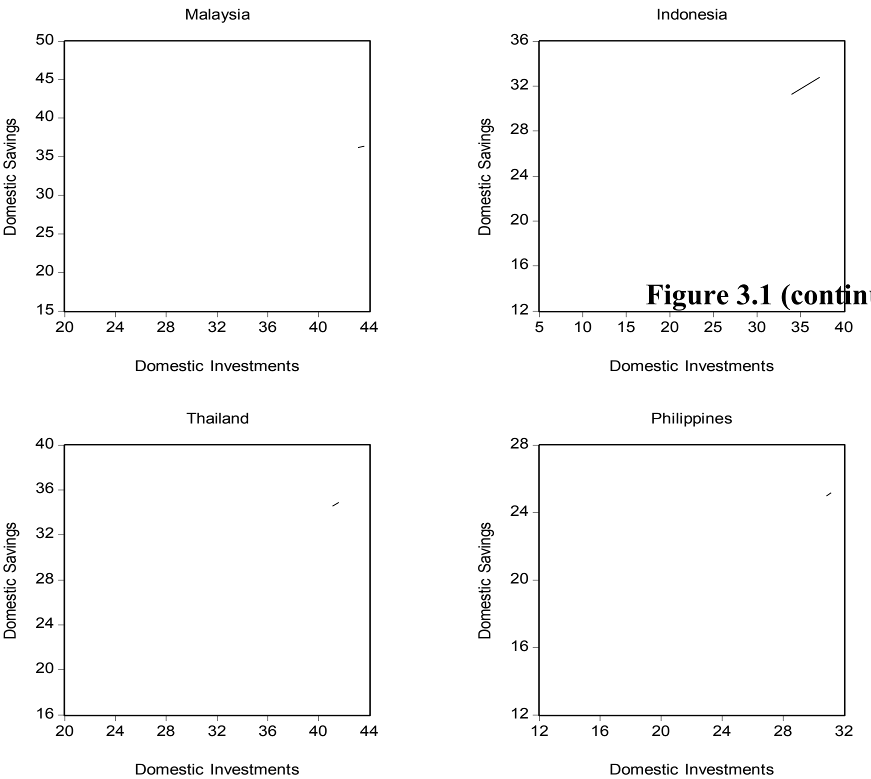

Figure 3.1 (continued...)

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APPENDIX

1.0 Unit Root Tests

The ADF procedure extends the Dickey-Fuller test by allowing a higher order of autoregressive process whereas the PP test is a nonparametric method controlling for serial correlation when testing for a unit root. As these two tests are commonly used in the literature and to conserve space, we do not intend to discuss the details here. Unlike the ADF and PP, the KPSS test assumes the series to be (trend-) stationary under the null hypothesis. The KPSS statistic is based on the residuals from the OLS regression of Y_t on the exogenous variables x_t:

$$Y_t = x_t'\delta + \mu_t \qquad (1)$$

with the LM statistics defined as:

$$LM = \sum_t S(t)^2 / (T^2 f_0) \qquad (2)$$

where f_0 is an estimator of the residual spectrum at frequency zero and $S(t)$ is a cumulative residual function such that $S(t) = \sum_{r=1}^{t} \hat{\mu}_r$, based on the residuals $\hat{\mu}_t = Y_t - x_t'\hat{\delta}(0)$. However, the estimator of δ used in this calculation differs from the estimator for δ used by GLS detrending since it is based on a regression involving the original data, and not on the quasi-differenced data. The reported critical values for the LM test statistic are based upon the asymptotic results presented in Kwiatkowski *et al.* (1992, Table 1, pp. 166).

Country	Raw Data	Derived data	Period	Source
US	Government Consumption & Investment, Household Consumption Expenditure, Consumption of Fixed Capital, Private Gross Fixed Capital Formation, Changes in Inventories, GDP	GDS/GDP, GDI/GDP	1971-1999	IFS
JAP	Gross Saving, Household Consumption Expenditure, Gross Fixed Capital Formation, Changes in Inventories, GDP	GDS/GDP, GDI/GDP	1971-1999	IFS
NIE-4				
HK	Government consumption expenditure, Private consumption expenditure, Gross domestic fixed capital formation, Changes in inventories, GDP	GDS/GDP, GDI/GDP	1971-1999	IFS, Hong Kong Monetary Authority
SNG	Government Consumption Expenditure, Household Consumption Expenditure, Gross Fixed Capital Formation, Changes in Inventories, GDP	GDS/GDP, GDI/GDP	1971-1999	IFS, Monetary Authority of Singapore
SK	Government Consumption Expenditure, Consumption of Fixed Capital, Capital Formation, Changes in Inventories, GDP	GDS/GDP, GDI/GDP	1971-1999	IFS, SEACEN Financial Statistics
TW	Gross national savings, gross domestic investment, GDP	GDS/GDP, GDI/GDP	1971-1999	National Statistics of Taiwan

ASEAN-4				
IND	Government consumption of fixed capital, private consumption, Gross Fixed Capital Formation, Changes in Inventories, GDP	GDS/GDP, GDI/GDP	1971-1999	IFS, SEACEN Financial Statistics
MAL	Government Consumption Expenditure, Household Consumption Expenditure, Gross Fixed Capital Formation, Changes in Inventories, GDP	GDS/GDP, GDI/GDP	1971-1997	IFS, SEACEN Financial Statistics
PHI	Government Consumption Expenditure, Household Consumption Expenditure, Gross Fixed Capital Formation, Changes in Inventories, GDP	GDS/GDP, GDI/GDP	1971-1999	IFS, SEACEN Financial Statistics
THAI	Government Consumption Expenditure, Household Consumption Expenditure, Consumption of Fixed Capital, Gross Fixed Capital Formation, Changes in Inventories, GDP	GDS/GDP, GDI/GDP	1971-1999	IFS, SEACEN Financial Statistics

Country	Raw Data	Derived data	Period	Source
US	**Government Consumption & Investment, Household Consumption Expenditure, Consumption of Fixed Capital, Private Gross Fixed Capital Formation, Changes in Inventories, GDP**	**GDS/GDP, GDI/GDP**	**1971-1999**	**IFS**
JAP	**Gross Saving, Household Consumption Expenditure, Gross Fixed Capital Formation, Changes in Inventories, GDP**	**GDS/GDP, GDI/GDP**	**1971-1999**	**IFS**
NIE-4				
HK	**Government consumption expenditure, Private consumption expenditure, Gross domestic fixed capital formation, Changes in inventories, GDP**	**GDS/GDP, GDI/GDP**	**1971-1999**	**IFS, Hong Kong Monetary Authority**
SNG	**Government Consumption Expenditure, Household Consumption Expenditure, Gross Fixed Capital Formation, Changes in Inventories, GDP**	**GDS/GDP, GDI/GDP**	**1971-1999**	**IFS, Monetary Authority of Singapore**
SK	**Government Consumption Expenditure, Consumption of Fixed Capital, Capital Formation, Changes in Inventories, GDP**	**GDS/GDP, GDI/GDP**	**1971-1999**	**IFS, SEACEN Financial Statistics**
TW	**Gross national savings, gross domestic investment, GDP**	**GDS/GDP, GDI/GDP**	**1971-1999**	**National Statistics of Taiwan**

ASEAN-4				
IND	**Government consumption of fixed capital, private consumption, Gross Fixed Capital Formation, Changes in Inventories, GDP**	**GDS/GDP, GDI/GDP**	**1971-1999**	**IFS, SEACEN Financial Statistics**
MAL	**Government Consumption Expenditure, Household Consumption Expenditure, Gross Fixed Capital Formation, Changes in Inventories, GDP**	**GDS/GDP, GDI/GDP**	**1971-1997**	**IFS, SEACEN Financial Statistics**
PHI	**Government Consumption Expenditure, Household Consumption Expenditure, Gross Fixed Capital Formation, Changes in Inventories, GDP**	**GDS/GDP, GDI/GDP**	**1971-1999**	**IFS, SEACEN Financial Statistics**
THAI	**Government Consumption Expenditure, Household Consumption Expenditure, Consumption of Fixed Capital, Gross Fixed Capital Formation, Changes in Inventories, GDP**	**GDS/GDP, GDI/GDP**	**1971-1999**	**IFS, SEACEN Financial Statistics**

Notes:
IFS refers to the International Financial Statistics published by IMF. SEACEN represents the South East Asian Central Banks Research and Training Central. For details of Taiwanese data, please visits http://www.stat.gov.tw/main.htm