Solvency and the Currency Crisis in Asia:
Evidence for the Four ASIAN Countries

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ABSTRACT

The study deals with the Asian currency crises, in which the causes and consequences of the crisis are analysed. The two hypotheses which, are often viewed as competing, fundamental and panic and herd behaviour, are also examined. The first hypothesis states that fundamental imbalances triggered the Asian currency and financial crisis in 1997. The crisis occurred because the economies had deteriorating current accounts, a slowdown in growth rates and short-term debt approaching a dangerous level, while the second hypothesis states that sudden shifts in market expectations and confidence were the cause of the initial financial turmoil. When the crisis erupted it caused panic in domestic and foreign investors.

A major focus of the study is to evaluate these two approaches and to examine whether there was evidence of insolvency prior to the crisis. A solvency index as originally popularised by Cohen (1991) is then calculated for each country. An econometric analysis of the trade sector is undertaken in which the Engle-Granger two-step procedure is employed, and the short-run dynamics are described by the Error Correction Mechanism (ECM). The Johansen Maximum Likelihood test is also employed as a comparison to the Engle-Granger Two-Step model. Subsequently the price elasticities obtained from the export demand model together with the GDP supply elasticity are used to calculate the index.
From the results, it appears that all countries were solvent prior to the crisis in which the percentage of actual debt service paid (in 1997) was greater than the percentage that needs to be paid to be solvent. This suggests that a further external credit could have solved the problem, as it was a matter of short-term liquidity difficulties and panic, rather than insolvency.
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CHAPTER ONE
INTRODUCTION

1.1 Overview

The last century marked a major transition in economic ideology from the tenets of command to free market economies, which has been climaxed with further progress towards liberalization and global integration of national economies. As expected, the landscape for business and finance has been underlined by gradual transformation from domestic to international markets, with major challenges arising in the demands for economic management.

The evolution of challenges in economic management varies from simple proactive change in strategy to national crises, and in the extreme, regional crises that affected the entire world economy. Corsetti, Pesenti and Roubini (1999) offer very illuminating views on the Asian crisis, which precipitated significant changes in real exchange rates in the South East Asian region, which also caused deterioration in the trade balances of the United States and Western Europe by about $40-50 billion.

The crisis, whose implications engulfed the world economy, has its origins in the months of financial turbulence that triggered speculative activities in the foreign exchange market. The landscape began to change when Thailand was came under pressure to float the baht on 2nd July 1997 when it become apparent that rolling over its short-term debt had done nothing to mitigate the depletion of net foreign exchange reserves. The alarm sounded through out the region as Thailand experienced
unprecedented currency turmoil, with the baht losing a third of its value, which also triggered retaliatory devaluation in the Philippines, Malaysia and Indonesia.

These events marked a turning point for the East Asian countries that had been admired for their rapid progress towards industrialisation, which underpinned rapid economic growth and, consequently, high living standard of their populations. The acceleration of economic progress in the region had also elevated these countries to role models for many other developing countries that had made very little progress, despite many years of reform and adjustment supported by the IMF and World Bank.

The economic meltdown in South east Asia could not have been predicted because countries such as Malaysia, Thailand, and Indonesia had shown a spectacular record of economic growth supported by macroeconomic stability, characterised by low inflation rates, high saving rates and a strong export growth. The possible occurrence of a foreign exchange problem in Asia was therefore a complete anathema as their economies were considered to be fundamentally sound. Specifically, from the 1960’s all the way through to the mid 1990s, East Asia countries experienced an average growth rate of GDP per capita at 4.6% as shown in table 1.1, below.

Table 1.1: Real GDP/capita and Growth rate of Real GDP/capita

<table>
<thead>
<tr>
<th>Country/year</th>
<th>Real GDP/capita ($1990 international)</th>
<th>Percent a year</th>
</tr>
</thead>
<tbody>
<tr>
<td>Malaysia</td>
<td>1696</td>
<td>3167</td>
</tr>
<tr>
<td>Philippines</td>
<td>1293</td>
<td>1956</td>
</tr>
<tr>
<td>Indonesia</td>
<td>874</td>
<td>1538</td>
</tr>
<tr>
<td>Thailand</td>
<td>848</td>
<td>1750</td>
</tr>
<tr>
<td>Singapore</td>
<td>2038</td>
<td>5412</td>
</tr>
</tbody>
</table>

Within a year, the dramatic downturn in the economies of the region following the floatation of the Thai baht in early July 1997, had transformed the world’s fastest growing economies into distressed economies. Rising curiosity into the factors that precipitated the East Asian problems, has led to a consensus that they were “the victims of their own success” [see among others Kocchar, Loungani and Stone (1988)].

A common feature of these countries is that the spectacular record of economic performance throughout the 1990s was not promptly accompanied by policies suitable for the management of economies with a high export-oriented and investment-led growth. First, since Japan had become less profitable while Europe experienced sluggish economic growth, the resulting search for investment opportunities was reflected in massive capital inflows since the beginning of 1990s. Between 1990 and 1996, the share of capital inflows to GDP in Asia averaged about 10 percent compared to 4 percent in the late 1980s (see IMF: 1997 and also table 2.1). This build up of excess liquidity (especially foreign funds) resulted in lower rates of interest, which set the stage for a classic boom-bust cycle.

The trends and implications of foreign capital inflows only helped to magnify internal anomalies the countries were already experiencing. According to the World Economic Outlook by IMF (1997), these economies were already overheating as a result of large external deficit, inflated property and stock market values. This was aggravated by the weak financial systems, weak management and poor control of risks, lax enforcement of prudential rules and inadequate supervision in the banking and financial system. These factors combined to put pressure on the quality of banks’ loan portfolio, while
poor corporate governance and the political uncertainties that ensued exacerbated the crisis of confidence, which resulted in foreign creditors declining to roll over short-term loans.

The monetary policy regimes prevalent in these countries, which relied on existence of an exchange rate peg, generally, made it difficult to defend against speculative attack, particularly as the financial system remained weak. Upward revision in interest rate, which might have been required to shore up the exchange rate, could not be carried out while authorities remained obsessed with the promotion of enterprise lending at low interest rates.

Exchange rate anchors also caused distortions in the financial system. The exchange rate peg gave an implicit guarantee for stability in the currency value, irrespective of changing fundamentals, a factor that stimulated a rising appetite for more borrowing in foreign currencies. Under these circumstances, a guarantee of convertibility was limited to the availability of international reserves, which were already on the decline. This compelled the countries to borrow fresh foreign resources abroad, a factor, which led to the accumulation of short term, speculative capital inflows.

The gravity of the scenario has been explained by fundamental weaknesses that prevailed in the export sector in the mid 1990s following the appreciation of the U.S dollar against the yen, and the devaluation of the China yuan in 1994, which resulted in a major trade shock to the region. The establishment of the North America Free Trade Agreement also led to the loss of some markets, while the decline in the price
of main exports of these countries, i.e. semiconductors and an increase in world oil prices in 1996, aggravated the problems.

The worsening export situation resulted in a yawning current account deficit which remained unsustainable against the background of capital flight (see table 1.2).

Table 1.2: The Four Asian Countries' Current Account Deficit

<table>
<thead>
<tr>
<th></th>
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<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Malaysia</td>
<td>-10.0</td>
<td>-4.9</td>
<td>-5.8</td>
</tr>
<tr>
<td>Indonesia</td>
<td>-3.3</td>
<td>-3.3</td>
<td>-2.9</td>
</tr>
<tr>
<td>Philippines</td>
<td>-4.4</td>
<td>-4.7</td>
<td>-4.5</td>
</tr>
<tr>
<td>Thailand</td>
<td>-8.0</td>
<td>-7.9</td>
<td>-3.9</td>
</tr>
</tbody>
</table>

Source: IMF (1997)

Putting everything together, the weakness of the financial system, the growing short-term external debt, the appreciation of real exchange rate, the size of the external current account deficit all exerted a strong pressure on the foreign exchange market, and finally, these countries' exchange rates collapsed. The depreciation of the currency during the period from 1 July 1997 to 16 February 1998 is presented in table 1.3.
Table 1.3: Depreciation of Currency  
(July 1, 1997 – February 16, 1998)

<table>
<thead>
<tr>
<th>Country</th>
<th>Depreciation of the currency vis a vis the dollar</th>
<th>Changes in the share price Index</th>
<th>Changes in interest rate</th>
</tr>
</thead>
<tbody>
<tr>
<td>Malaysia</td>
<td>55.43</td>
<td>-58.41</td>
<td>373.00</td>
</tr>
<tr>
<td>Indonesia</td>
<td>231.00</td>
<td>-81.74</td>
<td>2398.00</td>
</tr>
<tr>
<td>Philippines</td>
<td>51.37</td>
<td>-49.17</td>
<td>0.00</td>
</tr>
<tr>
<td>Thailand</td>
<td>87.09</td>
<td>-48.37</td>
<td>-25.00</td>
</tr>
</tbody>
</table>

Source: IMF (1998)

1.2 Objectives of the Study

From the above overview, the Asian crisis may be attributed to current account deficits, which brings up the issue of sustainability. To assess current account sustainability, the notion of solvency is usually used, which sometimes adopts traditional measures such as debt/GDP, dcbt/export, etc. However, these measures do not take into account, the dynamics of economic activity and shifts in major fundamentals, i.e. growth rate and interest rates.

The aim of this study is therefore to develop solvency models for the four ASEAN countries on the basis of which a solvency index can be calculated. To be able to do this, the price elasticities of exports demand are needed, as well as the price elasticity of GDP. Thus, the foreign and GDP supply models are also developed.
To accomplish these objectives, this thesis will aim at a number of goals, chief among them will be the task of giving a general view of the Asian crisis, examination of the background to the crisis, the causes and consequences. The thesis will also identify and examine the relevant theoretical literature, as well as the application of the empirical literature to the various approaches used to evaluate the potential indicators of currency crises. This thesis will also develop a foreign trade model and estimate the income and price elasticities for the four Asian countries.

1.3 Methodology

Although a descriptive approach is used, this study emphasises a time series econometric application, which evaluates the foreign trade of the four Asian countries. All variables influencing exports and imports demands are used in the estimation. There is difficulty, though, in operationalising such a model because the data used is time series data, which creates the problem of non-stationarity. This problem is tackled by using the co-integration analysis in which, although variables are non-stationary there is a linear relationship among them, ensuring that the regression is not spurious. Appropriately, therefore, the Engle-Granger two-step procedure is employed as well as the Johansen Maximum Likelihood model as a basis of comparison with the Engle-Granger Model.
1.4 Organisation of the Study

Chapter 1 provides the analytical background of the study. In addition, an overview of the Asian crises is presented.

Chapter 2 presents in general the background of the crisis in which the causes and consequences of the crisis are discussed. The two main views explaining the crisis are also discussed. The first view is the ‘fundamental approach’; while the second view is the ‘self-fulfilling or herd-behaviour’ approach. This analysis is mostly descriptive and supported by tables and figures.

The literature review, which consists of previous studies on the issue, is discussed in chapter 3. This includes theoretical and empirical studies. Specifically, the theoretical studies discuss the first generation, the second generation and also the ‘twin crises’. For the empirical literature, a review of recent studies is given.

Chapter 4 discusses the macroeconomic fundamental for the four Asian countries prior to the crisis. The foreign debt accumulation is also analysed.

A foreign trade model for the four Asian countries is presented in chapter 5. The Engle-Granger two-step Procedures and the Johansen Maximum Likelihood approach are employed to estimate the price and income elasticities of export and import demand of each country. A review on foreign trade estimation, of cointegration analysis and the error correction mechanism are also presented.
In chapter 6, solvency indices are estimated for the four Asian countries prior to the crises, to determine whether they were solvent.

Chapter 7 presents the main conclusion, based on the empirical findings, and policy implications. Areas for further research are also outlined.
CHAPTER TWO

BACKGROUND TO THE ASIAN CRISIS

2.1 Introduction

The economic backslide that began with the devaluation of the Thai Baht remains today the nucleus of the financial crisis that erupted in South East Asia in early July 1997. As pointed out by Radelet and Sachs (1998a), since the debt crisis of 1982, the Asian crisis has been described as the sharpest financial crisis to hit the developing countries.

According to McNeill and Bockman (1998), it was the most serious financial and economic crisis in the world since the Second World War. It is also renowned as the largest financial bailout in history with financial packages totalling of US$114.2 billion provided to three countries; Indonesia, South Korea and Thailand. A characteristic feature of the crisis is that it spread through several other economies in Asia thereby dampening investor sentiment toward the emerging market while the spill-over effects reverberated throughout the global financial market.

This chapter examines available evidence on currency crises followed by a discussion of the causes of the Asian crises in Section 2.2. Section 2.3 enumerates the factors that precipitated the contagion. Section 2.4 discusses the economic and social implication of the crisis followed by the Malaysian case prior to the crisis in section 2.5. The impact of the crisis on Malaysia is discussed in section 2.6. Section
2.7 presents the recent economics performance of the four Asian countries that were at the centre of the crisis. A summary is provided in section 2.8.

2.2 Causes of the Crisis

The sudden reversal of capital flows is identified as the fundamental starting point for events that developed into the Asian crisis. During the preceding period, especially from the early to mid 1990s, most of the Asian economies had experienced the unusually successful performance associated with the rapid growth of net capital inflows to the countries. For example, net private capital flows into South Korea, Indonesia, Thailand, Philippines and Malaysia were recorded at US$97.1 billion in 1996 compared to only US$37.9 billion in 1994. However, in the second half of 1997, these inflows was reversed with net private capital flows turning to -US$11.9 billion; a turnaround of US$109 billion² which was equivalent to approximately 10 percent of the pre-crisis GDP of these countries.

As a substantial portion of the capital was structured with very short-term maturities, it was able to leave the region so quickly. Most of this swing occurred in commercial bank lending, followed by short-term portfolio flows, whilst foreign direct investment (FDI) remained constant. Portfolio flows turned out to be negative in 1997 with an outflow of more than US$ 10 billion. Almost concurrently, international bank credit, which had reached the highest levels among private flows, with about US$ 50 billion both in 1995 and 1996, was dramatically reversed in 1997 with an estimated outflow of US$ 20 billion. As the scale of lending grew rapidly, together with shorter maturity, these economies became more vulnerable to a loss of confidence. In mid
1997, Indonesia and Malaysia had about 60% of their claims maturing in less than a year's time. Specifically, at the onset of the crisis, the ratio of short-term debt to international reserves ranged from 0.6 for Malaysia to 2.1 for South Korea. This was a characteristic feature of the countries' heavy dependency on foreign creditors to roll over existing short-term credit at a time when exports were stagnating. Accordingly, the surge in capital outflows is a very important factor in the evolution of the Asian crisis.

Besides this aspect, there are several other hypotheses that have been advanced to explain the origin of the crisis. The two hypotheses which, are often viewed as competing, are fundamental and herd behaviour and panic. The first hypothesis states that it was the fundamental imbalances that triggered the Asian crisis in 1997. The crisis is believed to have occurred when the economies had a deteriorating current account, a slow down in growth rate and acceleration of short-term debt to dangerous level. The second hypothesis states that the sudden shifts in market expectations and confidence were the cause of the initial financial turmoil. The basis if this theory is that when the crisis erupted, it tended to provoke financial panic among investors to withdraw from the region, a process which was aggravated by demands for repatriation of short-term capital as well.

As stated by the 'fundamentalist' hypothesis, the cause of the Asian crisis can be explained by the growing current account deficits. This view is challenged by the fact that the current account deficit is not a problem as long as it is sustainable. Sustainability, in this case, is explained by the notion of solvency and uses indicators such as debt/GDP or debt/export to measure the debtor's ability to repay. These
measures are considered weak because they do not take into account the dynamic aspect of the solvency issue, which includes growth trends in the economy, and the dynamics of interest rates.

The view of Radelet and Sachs (1998a, 1998b) is that creditor panic was the principal cause of the crisis. According to them the changes in international factor or domestic development could not substantiate the Asian crisis, while the weak fundamentals of the Asian economies at both macroeconomic and microeconomic level were not strong enough to prevent the crisis from erupting.

Krugman (1997) stated that the Asian crises were mainly related to a burst of a financial bubble in a context of low and declining returns to investment. The short-term bursting of the ensuing bubble appeared in a framework of low and declining capital returns.

Krugman (1998a, 1998b), Dornbusch (1998), Corsetti et al. (1999) and IMF pointed out that the weaknesses in the financial systems, as well as governance and poor economic policies, were the main causes. Bhagwati (1998), Stiglitz (1998a, 1998b) believe that capital account liberalisation was the main cause as the opening to volatile short-term debt international capital flows induced a panic-self-fulfilling crisis to occur. 'Market failures' i.e. moral hazard which occurred when the party that assessed the level of risk of a given transaction received the gains from, but did not bear the full costs of, the risks taken, was the main concern.
Wade (1998) and Wade and Veneroso (1998) also pointed out that capital liberalisation was the root cause of the crisis. But they did not stress moral hazard. While Lim (1999) agreed that capital openness as a root cause of the crisis, he finds policy erroneous because of persistent macro economic weaknesses, chief among them overvaluation of currencies and high current account deficit.

As stated by Radelet and Sachs (1999), the weaknesses in the Asian economies, corruption-cum moral hazard, and the initial devaluation were the main cause of the crisis that were pointed out by most observers. But as time passed by, the weaknesses in international financial market are much more widely recognised. In fact, Paul Krugman also has changed his view on the causes of the crisis. Initially Krugman (1998), stated that the cause were problems within the Asian economies, together with corruption and moral hazard which led to over-investment and boom-bust cycle. However (Krugman, 1999) argues that the blame should be on financial panic and overly liberalisation in international and domestic financial system rather than the factors above.

### 2.2.1 Fundamentals

A rising number of researchers, however, attribute the crisis to weaknesses within the Asian economies. The starting point is that Asian countries experienced an average real gross domestic product (GDP) growth rate in excess of 9% during 1992-1995. Indonesia, Thailand, and Malaysia particularly experienced average growth rate above 7 percent during this period. Although the Philippines has experienced the lowest
growth among these countries, the country experienced accelerated growth in the mid 1990's with average growth rising to above 5% by 1995-1996. (See figure 4.1).

One of the factors that had attracted foreign investment to these countries was rapid economic growth that was outward-oriented. These economies also experienced remarkable macroeconomic stability, with modest inflation rates, at least by the standard of developing countries. Thailand was exceptional at the country experienced government surpluses between 1988/1996, although the Philippines continued to incur a persistent general government deficit.

There were sizeable current account deficits especially in Malaysia and Thailand, but these were the outcome of the shortfalls of private saving in relation to private investment, and not necessarily public sector dis-saving. These deficits were not a matter of policy concern because the monetary policy stance appears to have been set appropriately (IMF 1997). It is also argued that the private saving shortfalls were associated not with low savings but extraordinarily high investment levels associated with high growth performance and the projected foreign exchange earning potential.

As pointed out in the World economic Outlook (1997), these successes brought mixed results. Absorption of the capital inflows posed challenges, i.e. in terms of their productive deployment and their sensible intermediation through financial systems that were not well developed or sophisticated enough. The potential variability of the inflows also imposed challenges for macroeconomic policy, and exchange rate management in particular. It was therefore incumbent upon the macroeconomic policies and the soundness of financial systems to deal with the difficulties.
There was also a stark contrast in term of inflows of funds because foreign direct investment (FDI) dominated net private inflows in countries such as China and Vietnam while the short-term inflows were substantial for countries such as Indonesia, Malaysia and the Philippines. In the case of Thailand, the short-term inflows became increasingly dominant rising to the equivalent of 7-10% of GDP each year during 1994-1996. (See table 2.1). The worsening scenario is evident from the fact that Malaysia’s short-term capital was 4-4.5% of GDP while its foreign direct investment (FDI) was at 5% of GDP during 1995-1996.
Table 2.1: Capital Flows for the Four Asian Countries  
(Percent of GDP)

<table>
<thead>
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<tr>
<td>Malaysia</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Net private capital flows</td>
<td>11.2</td>
<td>15.1</td>
<td>17.4</td>
<td>1.5</td>
<td>8.8</td>
<td>9.6</td>
<td>4.7</td>
</tr>
<tr>
<td>Net direct investment</td>
<td>8.3</td>
<td>8.9</td>
<td>7.8</td>
<td>5.7</td>
<td>4.8</td>
<td>5.1</td>
<td>5.3</td>
</tr>
<tr>
<td>Net portfolio investment</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>Other net investment</td>
<td>2.9</td>
<td>6.2</td>
<td>9.7</td>
<td>-4.2</td>
<td>4.1</td>
<td>4.5</td>
<td>-0.6</td>
</tr>
<tr>
<td>Net Official flows</td>
<td>0.4</td>
<td>-0.1</td>
<td>-0.6</td>
<td>0.2</td>
<td>-0.1</td>
<td>-0.1</td>
<td>-0.1</td>
</tr>
<tr>
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<td>-17.7</td>
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<td>2.0</td>
<td>-2.5</td>
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<tr>
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<td></td>
<td></td>
<td></td>
<td></td>
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</tr>
<tr>
<td>Net private capital flows</td>
<td>4.6</td>
<td>2.5</td>
<td>3.1</td>
<td>3.9</td>
<td>6.2</td>
<td>6.3</td>
<td>1.6</td>
</tr>
<tr>
<td>Net direct investment</td>
<td>1.2</td>
<td>1.2</td>
<td>1.2</td>
<td>1.4</td>
<td>2.3</td>
<td>2.8</td>
<td>2.0</td>
</tr>
<tr>
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<td>-</td>
<td>-</td>
<td>1.1</td>
<td>0.6</td>
<td>0.7</td>
<td>0.8</td>
<td>-0.4</td>
</tr>
<tr>
<td>Other net investment</td>
<td>3.5</td>
<td>1.4</td>
<td>0.7</td>
<td>1.9</td>
<td>3.1</td>
<td>2.7</td>
<td>0.1</td>
</tr>
<tr>
<td>Net Official flows</td>
<td>1.1</td>
<td>1.1</td>
<td>0.9</td>
<td>0.1</td>
<td>-0.2</td>
<td>-0.7</td>
<td>1.0</td>
</tr>
<tr>
<td>Change in reserves</td>
<td>-2.4</td>
<td>-3.0</td>
<td>-1.3</td>
<td>0.4</td>
<td>-0.7</td>
<td>-2.3</td>
<td>1.8</td>
</tr>
<tr>
<td>Thailand</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
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<td></td>
</tr>
<tr>
<td>Net private capital flows</td>
<td>10.7</td>
<td>8.7</td>
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<td>8.6</td>
<td>12.7</td>
<td>9.3</td>
<td>-10.9</td>
</tr>
<tr>
<td>Net direct investment</td>
<td>1.5</td>
<td>1.4</td>
<td>1.1</td>
<td>0.7</td>
<td>0.7</td>
<td>0.9</td>
<td>1.3</td>
</tr>
<tr>
<td>Net portfolio investment</td>
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<td>-0.5</td>
<td>3.2</td>
<td>0.9</td>
<td>1.9</td>
<td>0.6</td>
<td>0.4</td>
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<tr>
<td>Other net investment</td>
<td>9.2</td>
<td>6.8</td>
<td>4.1</td>
<td>7.0</td>
<td>10.0</td>
<td>7.7</td>
<td>-12.6</td>
</tr>
<tr>
<td>Net Official flows</td>
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<td>0.1</td>
<td>0.2</td>
<td>0.1</td>
<td>0.7</td>
<td>0.7</td>
<td>4.9</td>
</tr>
<tr>
<td>Change in reserves</td>
<td>-4.3</td>
<td>-2.8</td>
<td>-3.2</td>
<td>-3.0</td>
<td>-4.4</td>
<td>-1.2</td>
<td>9.7</td>
</tr>
</tbody>
</table>

1 other net investment may include some official flows

2 A minus sign indicates an increase
### Table 2.1: continued

<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
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</tr>
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<tbody>
<tr>
<td>Philippines</td>
<td></td>
<td></td>
<td></td>
<td></td>
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<td></td>
</tr>
<tr>
<td>Net private capital flows¹</td>
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<td>2.0</td>
<td>2.6</td>
<td>5.0</td>
<td>4.6</td>
<td>9.8</td>
<td>0.5</td>
</tr>
<tr>
<td>Net direct investment</td>
<td>1.2</td>
<td>1.3</td>
<td>1.6</td>
<td>2.0</td>
<td>1.8</td>
<td>1.6</td>
<td>1.4</td>
</tr>
<tr>
<td>Net portfolio investment</td>
<td>0.3</td>
<td>0.1</td>
<td>-0.1</td>
<td>0.4</td>
<td>0.3</td>
<td>-0.2</td>
<td>-5.3</td>
</tr>
<tr>
<td>Other net investment</td>
<td>0.2</td>
<td>0.6</td>
<td>1.1</td>
<td>2.5</td>
<td>2.4</td>
<td>8.5</td>
<td>4.5</td>
</tr>
<tr>
<td>Net Official flows</td>
<td>3.3</td>
<td>1.9</td>
<td>2.3</td>
<td>0.8</td>
<td>1.4</td>
<td>0.2</td>
<td>0.8</td>
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<tr>
<td>Change in reserves²</td>
<td>-2.3</td>
<td>-1.5</td>
<td>-1.1</td>
<td>-1.9</td>
<td>-0.9</td>
<td>-4.8</td>
<td>2.1</td>
</tr>
</tbody>
</table>

¹ Other net investment may include some official flows
² A minus sign indicates an increase

Source: IMF (1997)

A large proportion of short-term flows came from the international bank lending, with European and Japanese banks being particularly active in the emerging market economies of Asia (see table 2.2)

### Table 2.2: International Bank Lending to East Asia

(In billion of US Dollars)

<table>
<thead>
<tr>
<th>Country</th>
<th>Malaysia</th>
<th>Indonesia</th>
<th>Thailand</th>
<th>Philippines</th>
</tr>
</thead>
<tbody>
<tr>
<td>US banks</td>
<td>2.3</td>
<td>5.3</td>
<td>5.0</td>
<td>3.9</td>
</tr>
<tr>
<td>Japanese Banks</td>
<td>8.2</td>
<td>22.0</td>
<td>37.5</td>
<td>1.6</td>
</tr>
<tr>
<td>European Union banks</td>
<td>9.2</td>
<td>21.0</td>
<td>19.2</td>
<td>6.3</td>
</tr>
<tr>
<td>Total Int'l Lending</td>
<td>22.2</td>
<td>55.5</td>
<td>70.2</td>
<td>13.3</td>
</tr>
</tbody>
</table>

Source: IMF (1997)
It was also argued that the macroeconomic performance of the South East Asia economies during the early to mid 1990s concealed various elements of overheating, which triggered questions about sustainability of the exchange rate policy. For instance, in Malaysia and Thailand there were signals of higher inflation in output prices, and substantial and growing external current account deficits - which indicated that the growth of domestic demand was putting pressing on external liquidity. Also the inflation rate that prevailed during 1993-1996 was somewhat higher than the weighted average of trading partners’ inflation rates, therefore signalling erosion of external competitiveness.

The exchange rate problem can be traced to the early 1990s when most government of Asian countries kept the exchange rate fixed, and expressed every hope that such policies would be sustained. This encouraged short-term capital inflows, as investors did not expect losses from exchange rate movements. In addition, the price of tradable goods and services were kept relatively fixed while the prices of non-tradable goods and services rose as a result of the investment boom. Consequently, the real exchange rate began to gradually appreciate as no adjustments were made to cater for domestic inflation. Radelet and Sachs (1999), estimate the overvaluation to be in the range of 20% in Thailand, Malaysia and Indonesia.

The trigger to financial panic was increased when governments of the Asian countries ran down their foreign exchange reserves to defend pegged currencies, which, according to Radelet and Sachs (1999) first gave undue over confidence to investors; second, allowed an overvaluation in real term and third, set the stage for financial panic.⁶
Financial Sector and Other Structural Weaknesses

The problem of low quality investment is attributed to financial sector and other structural weaknesses in these countries. Inadequate regulation and supervision and also weaknesses in governance at a general and fundamental level are believed to have permitted misallocation of credit and inflated asset prices. As stated by Kocchar, Loungani and Stone, "the reforms in the area of regulatory frameworks and institutions failed to keep pace with the changes of global capital flows and in general they were not in line with international accepted best practices."7

Although financial reforms were introduced during the 1980s and 1990s the enforcement of regulation of the financial sector did not keep pace; a significant proportion of credit was being allocated to unproductive or speculative investment. A study by Kaminsky and Reinhart (1996) found that for the period 1970-1995, financial liberalisation followed by a private lending boom played a significant role in raising the probability of a banking crisis. Thus problems in the banking system can be used as an indicator to predict currency crises.

External Economic Environment

The changes that emerged in the external economic environment of the economies concerned are one of the factors that led to the build-up to the recent crisis. In the early to mid 1990s there was a decline in asset yield in the industrial economies, which contributed to the rise in capital inflows to emerging markets. The weak economic performance in most of industrial countries led to accommodative monetary
policies, abundant liquidity, and low interest rates, which caused an increase in the stock markets. The declined in assets yield in industrial countries made the emerging markets an increasingly attractive investment opportunity. In addition, a sharp narrowing of yield spreads indicated an increased preference among asset holders for emerging market investments.

Besides the factors mentioned above, the movements in exchange rate among the major currencies have also been another significant external factor, with a crucial effects on the international competitiveness of four Asian countries. These countries gained competitiveness as their currencies depreciated in trade-weighted terms when the dollar weakened during 1994 and early 1995. But beginning in mid 1995, the dollar had recovered most markedly against the yen, and these countries suffered substantial losses in competitiveness. As results of these swings in competitiveness, both the current account and capital account of the balance of payments were affected.

These countries also experienced a marked slowing down in the growth of their export markets as shown in figure 2.1, thus causing a sharp slowing down of export revenues in most East Asian Economies. A slower export growth may have created concerns on the part of creditors about future growth prospects and ability of Asian firms to continue to service their debts. Moreover, the establishment of North America Free Trade Area (NAFTA) increased the affected countries export competition particularly from China and possibly from Mexico.
2.2.2 Creditors Panic/Herd Behaviour

It has been argued that the crisis was caused by self-fulfilling panic of creditors and investors. Although the Asian countries were vulnerable due to problems such as weak financial system, the slowing down of export growth, the overvaluation of the real exchange rate, these were not strong enough to cause the crisis to erupt. As stated by Radelet and Sachs, it must come from the investors’ incentive to pull out their money, as they believe other investors were also doing the same thing. Self-fulfilling panic can occur when the level of short-term foreign liabilities relative to a short-term foreign asset is high. Every creditor then knows that he should withdraw capital ahead of other creditors. Creditors know that the last short-term creditor to withdraw funds will not be repaid on time, as the available short-term assets cannot cover all of the
short-term liabilities. Accordingly there are several pieces of evidence in favour of the panic interpretation in Asia, both direct and indirect.\textsuperscript{11}

There is also considerable debate on factors that are responsible for the spread of causes across countries. Once again the question arises of whether the weakness of the economic fundamentals in afflicted countries justify the transmission of crisis or is it the panic and herding behaviour of investors in fear of financial losses? Radelet and Sachs (1998a, 1998b) argued that the region is regarded as a single entity and therefore many international lenders expected other countries in the region to experience the same problem as Thailand. As stated by Radelet and Sachs (1998b) ‘herd behaviour is the action of creditors which is based on the actions of other creditors, and not on the basis of the debtors' fundamental behaviour as perceived by the individual investor’.\textsuperscript{12} Here, contagion is driven by the irrational behaviour of international lenders. While Corsetti et.al (1999) pointed out that the reason for the spread was a natural inseparability, derived from trade links and financial links between the countries, and the retaliatory economics of competitive devaluation.

2.3 Contagion

As stated by Radelet and Sachs (1998), one of the features of the Asian crisis was the speed and the extent to which the crisis spread from Thailand to other countries. For the last few years, many studies have been carried out to analyse the reasons and causes for financial crisis to spread across countries.\textsuperscript{13}
Specifically, as stated in the literature, causes of contagion can broadly be categorised into four groups. They are: i) ‘fundamental contagion’, ii) ‘real integration contagion’ iii) ‘herding contagion’ and iv) ‘institutional contagion’. The first two groups are based on real factor in an economy, while the other two are related to financial phenomena.

i) ‘Fundamental contagion’ indicates that the transmission of a crisis occurs if the affected countries have similar economic fundamentals or if they face common external shocks. Once a financial crisis occurred in one country, investors and speculators become more sensitive to the risks in other countries and lessen their exposure in these countries that have similarly weak fundamentals as the country where the crisis originated, hence spreading the crisis across economies.

ii) ‘Real integration contagion’ is the phenomenon in which investors and speculators become more cautious and reduce their exposure in those economies, which are closely integrated either as trading partners or as competitors with a country where a crisis occurred. Although those countries may have sound economic fundamentals, a government of one country might want to devalue its currency to regain competitiveness once a currency collapsed in a closely related country.

iii) ‘Herding contagion’ refers to the behaviour of investor who follow other investors without forming their own expectations or gaining first-hand information that could rationalise the change of their actions. Herding behaviour is rational in the sense that acquiring information that is required for making more informed decision may be costly. It is rational for smaller
investors to follow large investors who have superior information. Herding behaviour can therefore explain how a few large investors and speculators can move markets and how a few individual pessimistic expectations can develop into a vicious cycle of self-fulfilling.

iv) A financial crisis in one country is usually accompanied by a decline in stock market returns. 'Institutional contagion' refers to the behaviour of investors to reduce asset holding in other countries, even if those are initially not affected. Fund managers may lower asset holding in other countries either to balance portfolios and to optimise the overall risk/return ratio, or to raise cash to meet redemption that results from investors withdrawing funds.

As stated by Fratzcher (1998), empirically, many studies link the onset of the crisis with the fundamental contagion. However, there are few studies that attempt to identify sources of other types of contagion. For instance, Frankel and Schmukler (1996) look at the prices and net asset values of country funds for Latin American and they find out that the speed of the Mexican crisis to other Latin American market is based on herding and institutional contagion. By contrast, Calvo and Reinhart (1996) argue that the stock market crash during the Latin America crisis 1994-95 can be explained partly by economic fundamentals and are partly due to high financial integration with Mexico. Eichengreen et.al (1996) show that trade integration and linkages are the explanation for the spread of currency crisis among industrialised countries.

Fratzcher (1998) finds that the transmission of Asian crisis is based on contagion that has nothing to do with the strength of the economic fundamentals of affected
countries. The spread of the crisis across country is explained by high financial integration and close trade integration. Goldstein (1998) pointed out that it is unlikely to be the bilateral trade or investment share with Thailand. Given the size of Thailand, these bilateral relationships are too small to generate such wide-ranging contagion (see table 2.3). Besides, if it were bilateral linkages with Thailand that are predominant for the pattern of contagion, one would expect to see Malaysia, Singapore and Taiwan more affected than Indonesia or South Korea. Accordingly there are two explanations for the spread.

Table 2.3: Bilateral Trade Shares with Thailand (1996)

<table>
<thead>
<tr>
<th>Country</th>
<th>Export to Thailand (as a% of total exports)</th>
</tr>
</thead>
<tbody>
<tr>
<td>South Korea</td>
<td>2.0</td>
</tr>
<tr>
<td>Indonesia</td>
<td>1.8</td>
</tr>
<tr>
<td>Malaysia</td>
<td>4.1</td>
</tr>
<tr>
<td>Philippines</td>
<td>3.8</td>
</tr>
<tr>
<td>Singapore</td>
<td>5.7</td>
</tr>
<tr>
<td>Taiwan</td>
<td>3.1</td>
</tr>
<tr>
<td>Hong Kong</td>
<td>1.0</td>
</tr>
</tbody>
</table>

Source: Goldstein (1998) p.18

The first explanation for the spread is the ‘wake-up call’ hypothesis which says that Thailand acted as a wake-up call for investors to reassess the creditworthiness of Asian borrowers. When they did that reassessment, they found that a few of the Asian economies had weaknesses similar to those in Thailand i.e. large external deficits, appreciating real exchange rates, declining quality of investment, a slow down in
exports and over-expansion in certain key industries. Reassessment of creditworthiness is therefore the explanation for the spread of the crisis.

The second explanation is the dynamics of competitive devaluation. It simply say that when one by one country in a region undergoes a depreciation of its currency, the countries that have not devalued would experience a deterioration in competitiveness and thus their currencies become more susceptible to speculative attacks. Devaluation therefore becomes their only remedial action as well.

Table 2.4: Asian Intra-regional Trade (1996)

<table>
<thead>
<tr>
<th>Country</th>
<th>Export Share (as a % of total exports)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Emerging Asia</td>
</tr>
<tr>
<td>South Korea</td>
<td>37.8</td>
</tr>
<tr>
<td>Indonesia</td>
<td>26.4</td>
</tr>
<tr>
<td>Malaysia</td>
<td>46.8</td>
</tr>
<tr>
<td>Philippines</td>
<td>25.7</td>
</tr>
<tr>
<td>Thailand</td>
<td>36.8</td>
</tr>
<tr>
<td>Hong Kong</td>
<td>47.2</td>
</tr>
</tbody>
</table>

Source: Goldstein (1998) p.20

As can be seen in table 2.4, the Asian emerging economies have important trade links with each other and they also compete in third country markets. This is in line with the ‘real integrated contagion’ theory discussed earlier.
As stated by Lougani, Kochhar and Stone (1998), since the Asian countries tend to compete in the same market, a crisis in one country can affect the macroeconomic fundamentals of other countries through trade or capital market linkages. A devaluation of one currency will have an adverse effect in the international competitiveness of other countries, which may lead to downward pressure on these currencies. Also, these countries also tend to export similar goods to the same destinations. For instance the bulk of exports of the four Asian countries to the U.S can be divided into two product clusters; (i) semiconductors and capital goods industries, (ii) apparel, footwear and household goods (see chart 2.1). Clearly export competition among countries have increased as these countries moved in the direction of increasing their shares of semiconductor goods/capital goods while reducing their shares of apparel, footwear and household goods (source: see Appendix C).
Chart 2.1: Share of Exports Products to the U.S

Product Share (1989)

Type of Goods

Product Share (1997)

Type of Goods
2.4 The Economic and Social Implications of the Crisis

2.4.1 Impact on Economic Growth.

Prior to the crisis, the East Asia countries were not only successful in term of per capita income but also achieved substantial reduction in poverty. As reported by Ranis and Stewart (1998) there was a strong decrease in the proportion of the population that was classified as poor based on their private income. For instance, in Indonesia the proportion dropped from 57 percent in 1970 to 15 percent in 1990. While in Malaysia the figure was 50 percent and 15 percent respectively. Accordingly, the success in poverty reduction was achieved through the outward-oriented growth strategy in which these economies focused on rapidly group labour-intensive exports. Until the first half of the 1990s, most of the countries experienced high national income growth rate, which were around 8 percent. However, this was not long lasting. The crisis that erupted in the mid 1997 reversed the region’s history of high growth. Most countries experienced negative growth rates. For the case of Indonesia, the effect was severe as the country also suffered from political instability and adverse climatic condition. Specifically, the growth estimates for 1998 is given in table 2.5. Based on UNCTAD (1999) estimation, Indonesia was the hardest hit and only the Philippines showed a positive growth. (The recent estimation is given in section 2.7).
Table 2.5: GDP Growth Rates of Asian Four (1998)

<table>
<thead>
<tr>
<th>Country</th>
<th>1998(1)</th>
<th>1998(2)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Malaysia</td>
<td>-6.2</td>
<td>-7.5</td>
</tr>
<tr>
<td>Thailand</td>
<td>-8.0</td>
<td>-8.0</td>
</tr>
<tr>
<td>Philippines</td>
<td>-0.5</td>
<td>+1.0</td>
</tr>
<tr>
<td>Indonesia</td>
<td>-13.7</td>
<td>-15.3</td>
</tr>
</tbody>
</table>

Source: UNCTAD (1999)

2.4.2 Impact on Trade

In 1996 Asia contributed about 26% of world merchandise exports, however for machinery and transport equipment, automotive products, textiles and clothing the share was higher. (See: UNCTAD, 1998). Similarly, Asian countries are also major importers and accounted for about 25% of world merchandise imports in 1996. Specifically, the ASEAN is the third largest group of importers, following European Union and the USA. The compositions of import have mainly been on primary commodity such as fuels, food, ore and metals and agricultural materials. Asia is the second largest exporting and importing region with regard to commercial service trade.

As stated in UNCTAD 1999, the volume and prices of traded good have been affected by the crisis. The import volume for the five Asian economies fell in 1998. Percentage drop in the Philippines, Korea and Indonesia was 13%, 21% and 27% respectively. The import values have dropped even more dramatically. For the first nine months of 1998, Asia imports fell by 16%, while for the five most affected economies import
values fell on average by one-third (see UNCTAD 1999). In 1998, Korea, the Philippines and Thailand experienced positive export volume growth; conversely Indonesia and Malaysia had negative export volume growth. With regard to primary commodity prices, the prices of agricultural raw materials, timber, metal and energy products were affected by the decreased in demand resulting from the crisis.

2.4.3 Social Implication of the Crisis

As previously mentioned, the poverty reduction in Asia was mainly based on high growth rates. In line with this, the most significant impact on poverty levels takes the form of a reduction in private income. This effect takes place through rising unemployment and falling wages. Clearly, since the onset of the crisis, unemployment in the region has increased drastically. For instance, in Thailand the unemployment rate had increased from an annual average rate of 2.2% in 1997 to 6.0% in 1998 (see ILO, 1998). Table 2.6 shows unemployment rates (%) in the pre-crisis period and at the end of 1998.

<table>
<thead>
<tr>
<th>Country</th>
<th>Pre-crisis</th>
<th>Late 1998</th>
</tr>
</thead>
<tbody>
<tr>
<td>Malaysia</td>
<td>2.6 (end 1997)</td>
<td>5.2</td>
</tr>
<tr>
<td>Indonesia</td>
<td>4.9 (August 1997)</td>
<td>15.0</td>
</tr>
<tr>
<td>Thailand</td>
<td>2.2 (Feb 1997)</td>
<td>6.0</td>
</tr>
<tr>
<td>Korea</td>
<td>2.3 (Oct 1997)</td>
<td>8.4 (Sept 1998)</td>
</tr>
<tr>
<td>Singapore</td>
<td>1.8 (end 1997)</td>
<td>4.5 (Sept 1998)</td>
</tr>
</tbody>
</table>

Source: Jones (1998)
Besides unemployment, the increases in price and interest rates also have an impact on living standards. The increase in food price in the wake of the crisis depressed real wages.\(^\text{18}\) Consequently, households would have to spend a higher proportion of their income on food.

2.5 **Malaysia Prior to the Crisis.**

Prior to the crisis in 1997, there were many favourable features of the Malaysian economy. As compared to other economies, Malaysia had a relatively low external debt of US$ 45.2 billion or 42% of GDP as at June 1997. The debt service ratio was only 6.1 percent of exports at the end of 1996. The inflation rate was around 3.8%, unemployment rate for 1996 was only 2.5% and GDP growth averaged 8.7% per annum. Although Malaysia's position was not as bad as other economies, the nervousness of the market over some issues in countries such as Thailand, Indonesia led to the ‘contagion’ effect that caused economic crisis. Nevertheless, prior to the crisis there were some disturbing signs that need attention.

2.5.1 **Economic Growth Above Potential Output**

Since early 1990s, the Malaysian economy has been consistently growing above its potential growth path. The potential output is a measure of the full employment output given existing resources. When actual output drops below potential output, unemployment of resources occurs. Conversely, when actual output exceeds potential output, this causes over employment of resources. The output gap is zero when actual and potential GDP are equal in size. During 1994-1996, the output gap increased as
actual GDP increased faster than potential GDP. As a result inflation increased, particularly in the form of wage increases above productivity gains. Instead of improvements to efficiency, growth during this period was primarily brought about through augmenting inputs – which is not sustainable in the longer term. It is worsened when both capital and labour were imported.

2.5.2 Loss of Efficiency in the Economy

The efficiency in the utilisation of resources in the economy is indicated by the rate of total factor productivity (TFP) and the incremental capital output ratio (ICOR). Based on the TFP growth, it is obvious that it had been decreasing over the years. Basically, the Malaysian growth has been driven primarily by a high rate of capital stock accumulation. Specifically the ICOR rose from 3.0 in 1988 to 6.5 in 1997. The increasing level of ICOR indicate that the use of capital have been increasingly less efficient. With a constant ICOR, the economic growth would have been much higher. The rising ICOR might also suggest that investment used for capital-intensive projects, which need much longer gestation periods, leakage and under-utilised capacity. (For a full discussion on TFP see chapter 4 – section 4.3.1.1)

2.5.3 Rising Current Account Deficit

As previously mentioned, the deficit in the current account is caused by the saving-investment gap. Malaysia experienced a current account deficit due to its high investment rate (see table 2.7). For some of the years, the current account deficit was partially financed by net long-term capital inflows.
Table 2.7: Savings-Investment Gap (RM million)

<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Public gross domestic capital formation</td>
<td>23,760</td>
<td>24,833</td>
<td>27,844</td>
<td>27,970</td>
<td>32,183</td>
</tr>
<tr>
<td>Public savings</td>
<td>27,339</td>
<td>32,733</td>
<td>32,763</td>
<td>39,729</td>
<td>47,204</td>
</tr>
<tr>
<td>Deficit/surplus</td>
<td>3,579</td>
<td>7,900</td>
<td>4,919</td>
<td>11,759</td>
<td>15,021</td>
</tr>
<tr>
<td>Private gross domestic capital formation</td>
<td>38,700</td>
<td>52,070</td>
<td>67,305</td>
<td>75,799</td>
<td>86,499</td>
</tr>
<tr>
<td>Private savings</td>
<td>27,195</td>
<td>29,400</td>
<td>40,561</td>
<td>51,788</td>
<td>58,078</td>
</tr>
<tr>
<td>Deficit/surplus</td>
<td>-11,505</td>
<td>-22,670</td>
<td>-26,744</td>
<td>-24,011</td>
<td>-28,421</td>
</tr>
<tr>
<td>Gross domestic capital formation</td>
<td>62,460</td>
<td>76,903</td>
<td>95,149</td>
<td>103,769</td>
<td>118,682</td>
</tr>
<tr>
<td>(as % of GNP)</td>
<td>39.8</td>
<td>42.5</td>
<td>45.7</td>
<td>43.6</td>
<td>45.1</td>
</tr>
<tr>
<td>Gross national savings</td>
<td>54,534</td>
<td>62,133</td>
<td>73,324</td>
<td>91,517</td>
<td>105,282</td>
</tr>
<tr>
<td>(as % of GNP)</td>
<td>34.7</td>
<td>34.4</td>
<td>33.2</td>
<td>38.5</td>
<td>40.0</td>
</tr>
<tr>
<td>Balance on current account</td>
<td>-7,926</td>
<td>-14,770</td>
<td>-21,825</td>
<td>-12,252</td>
<td>-13,400</td>
</tr>
<tr>
<td>(as % of GNP)</td>
<td>-5.0</td>
<td>-8.2</td>
<td>-10.5</td>
<td>-5.1</td>
<td>-5.1</td>
</tr>
</tbody>
</table>


2.6 Impact of the Crisis on Malaysia

A depreciation of ringgit, enhanced Malaysia’s competitiveness. Malaysia’s real effective exchange\(^{19}\) rate declined starting from July 1997. Consequently, Malaysia’s goods became relatively cheaper and more competitive than its trading partners did. As discussed in previous section, the impact of the crisis can be seen in the trade sector.
2.6.1 Trade Balance

As a result of the currency depreciation, the current account imbalances improved. Exports grew faster than import, as the Ringgit became cheaper, eventually this helped to reduce the size of the current account deficit.\textsuperscript{20}

With respect to exporters, the depreciation of the Ringgit boosted exports of Malaysia's products. The value of exports in 1997 grew by 12.4 percent in Ringgit term but only 0.5 percent in USD term compared to the previous year. In August 1998, export growth grew by 44.5 percent in Ringgit term compared to the same period in 1997.

2.6.2 Primary Commodities

There was little effect on the Ringgit depreciation on rubber prices since they were quoted in Ringgit. The price of rubber (RSS1) increased slightly from 279.3 sen per kg in June 1997 to 287.3 sen per kg in April 1998. This was owing to exporter adjustment as this increment would be negligible in US dollar term. With regard to palm oil, the price had risen significantly from RM1215 per tonne in June 1998 to RM 2366 per tonne in April 1998.
2.6.3 Manufacturing Exports

The manufacturing sector exports contribute about 80 percent of Malaysia's total exports and they are largely from non-resource based industries. Although, the Ringgit depreciated, the private sector did not benefit much from the devalued currency. Most firms were already operating at full capacity and could not increase exports quickly to take advantage of the depreciating Ringgit. As commonly known, there is a time lag before the beneficial effects of the currency depreciation trickle down to the real economy. Besides that, the cost of inputs that go into manufactured exports increased substantially and this offset the benefit of depreciation.

Sectors that heavily depend on imported machinery and material had been hit most by currency depreciation. The cement production for instance, faced a high production costs as it used imported input such as coal, gypsum and other raw material. Based on the exchange rate of RM 4.00 to US$ 1, the increase in cost was about RM 180 million.

2.7 Recent Asian Four's Economic Performance.

All countries are predicted to have positive growth rates in 1999 and 2000 (See report by IDE, 2000). For Malaysia, after experiencing a growth rate of −7.5% in 1998, it began to gain back its momentum toward recovery in 1999. Net exports in January-August of 1999 amounted to RM46.3 billion – showing an increased from RM32.5 billion registered in the same period of previous year. The real term export to the Asian countries and to the United States increased by 11% in 1999.
As for the year 2000, the Malaysian economy is predicted to have recovered on a more solid path. With an increasing world-wide demand for semiconductors and other electronics products, it is predicted that Malaysia will experience a growth rate of 10.5%.

On the other hand, private investment is expected to increase again especially in the electronic industry and is forecast to increase by 10.9% in 2000. For the public investment, it is expected to increase by 4% in 2000, which this comes from investment from infrastructure improvements. Combining together the above factors, the Malaysian economy is forecast to experience a stable growth of 5.6% in 2000. (see table 2.8)

<table>
<thead>
<tr>
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</thead>
<tbody>
<tr>
<td>Malaysia</td>
<td>-7.5</td>
<td>4.5</td>
<td>5.6</td>
</tr>
<tr>
<td>Indonesia</td>
<td>-13.2</td>
<td>0.1</td>
<td>4.5</td>
</tr>
<tr>
<td>Thailand</td>
<td>-10.0</td>
<td>3.7</td>
<td>4.9</td>
</tr>
<tr>
<td>Philippines</td>
<td>-0.5</td>
<td>4.9</td>
<td>4.6</td>
</tr>
</tbody>
</table>

Notes to table: * Actual Figures

Source: IDE (2000)

For Indonesia, 1999 had been a turbulence year for the country as there was a series of political and social events i.e. the presidential election, independence of East Timor, general elections, etc. With this instability conditions, the foreign direct investment have continued to flow out, and the net outflow reached to US$230 million in the first quarter of 1999. The net outflow of foreign direct investments for the whole year is predicted to reach US$1.42 billion. At the same time, the dollar-dominated customs
cleared exports of goods also decreased by 9.5% for the period of January-August 1999. Private consumption was forecast to increase by 2.4% as income rises. In addition, 44% gain in crude oil prices over 1998 boosted government revenues from taxes on oil and other related operations. Therefore government consumption increased by 7.0% in 1999. Combining together all the above factors, Indonesia economic growth was around 0.1% in 1999. As for the year 2000, the Indonesia economy is predicted to be 4.5% as Indonesia investment climate improve as well as the political and social stability. Exports also are expected to rebound from negative growth experienced in 1998. Total investment also is forecast to increase by 5.0%.

For Thailand, the growth rate for 1999 was 3.7%. With the IMF bailout package, which has been in effect since August 1997, Thailand’s macroeconomic management is carried out under the guidance of the IMF. Thailand exports of goods and services are expected to increase by 8.0% compared to 5.5% in 1998 owing to an improvement in exports to Japan and other East Asian countries. For the year 2000, it is expected that Thailand will experience a recovery of 4.9% growth rate.

For the Philippines, it is predicted that the economy will make a rebound from −0.5% growth rate in 1998 to a positive growth rate of 3.1%.
2.8 Summary

In this chapter, the causes of the Asian crisis are analysed. Basically, this can be categorised by internal and external factors: massive capital inflows, macroeconomic mismanagement, financial sector and other structural weaknesses, and external economic factors. However, in term of pinpointing the root of the crisis, there are several views i.e. fundamental, creditors panic, capital liberalisation, etc. Different views suggest different policy response i.e. if capital liberalisation was the main cause then capital control should solve the problem. The issue of contagion is also discussed. Generally there are four types of contagion in the literature. Based on study done by Fratzcher (1998) the Asian crisis can be explained by financial integration as well as trade integration. This chapter also analysed the impact of the crisis, which can be divided into economic and social implications. Clearly, the Asian crisis has seriously affected the region in many ways.
Moral hazard can be identified at the corporate, financial and international level. At the corporate level moral hazard arises when government extends guarantees to promote both public and private investment by eliminating certain risk component. While in the financial sector, moral hazard arises because banks have an implicit bailout guarantee from the government. As banks reap the benefits of high returns but do not necessarily absorbs all the losses in bad times, they are encouraged to take on very high-risk projects. At the international level moral hazard arises when international creditors over-extended credit to Asian countries in the belief that the IMF would bail out any trouble countries. See Krugman (1998a, 1999). Also see Corsetti et.al. (1999a) where they present a systematic articulation of the moral hazard structural view.

For further explanation see Radelet and Sach (1999).

See Kocchar, Lougani and Stone for the key features of the prudential and regulatory framework before the crisis.
Kocchar, Lougani and Stone (1998) show the correlation coefficient between the yen depreciation and real export growth.

The weighted average of export volume growth of partner countries: the weight for each partner country is the share of the indicated country’s exports to that partner in the total exports of the indicated country.

See Ahmad and Loungani (1998) on evidence of the importance of term of trade movement and also changes in oil prices for output fluctuations in Asian economies.

Direct evidence has three main parts; 1) countries that were hit were the one that had high levels of short-term foreign debt relative to short-term foreign assets. 2) countries that were hit have different economic structure and fundamentals. 3) Even the crisis eased up after about one year even though several fundamentals still not improved. Indirect evidence has two main parts; 1) the crisis was unexpected, meaning that it can not be explained by fundamentals. 2) It is hard to explain the depth of the crisis based on fundamentals.

See Radelet and Sachs (1998b).

Many have attempted to analyse the reasons and sources for financial crises to spread across economies, for instance Frankel and Schmukler (1996), Calvo and Reinhart (1996).

See Banerjee (1992) for an example of herding behaviour, also see Calvo (1995).

Goldstein refers to the 'wake-up call' as private creditors and rating agencies fell asleep prior to the crisis as creditors did not have accurate information on the creditworthiness of Asian borrowers, and creditors were awake but expected government (or the IMF) to bail them out in case of trouble.

ASEAN economies consist of Malaysia, Indonesia, Singapore, Thailand, the Philippines, Brunei Darussalam and Vietnam.

For further detail see Robb (1998).

This rate is most important in determining the international competitiveness of a country. It corrects for inflation differential and the market price of the Ringgit weighted by some combination of currencies of Malaysia's trading partners.

With an exchange rate of RM4.00 to US$1 importers have to pay about 37.5 percent more compared to pre-crisis when the exchange rate was RM2.50. This rate was around mid-June 1998.
CHAPTER THREE

REVIEW OF THE LITERATURE

3.1 Introduction

Currency crises have been the subject of an extensive economic literature both theoretical and empirical. In the 1990s the world has seen currencies crises in Europe, Mexico and Asia which have attracted the attention of both academics and policy makers. Researchers tend to undertake new theoretical and empirical analysis in explaining these events. The focus has mainly been on the identification of the causes and symptoms of the crisis and accordingly the consequences and policy responses.

The question most researchers try to answer is whether these events could be predicted through systematic early warning signs or whether they are unpredictable like the stock market crashes. By looking at the previous models, it is hoped that the causes of currency crisis can be well understood. Specifically this chapter reviews the existing work on currency crises. In section 3.2 the theoretical literature is presented in which the first, second generation models are discussed as well as the ‘twin crises’. Section 3.3 presents recent work on currency crises followed by the empirical literature in section 3.4. Finally, summary is provided in section 3.5.
3.2 Theoretical Literature

The theoretical literature on balance of payment crises has been well developed following Krugman's seminal paper of 1979. Originally, the literature stated that crises were caused by weak economic fundamentals, i.e. the acceleration in the domestic credit expansion related to the monetization of fiscal deficit was the main factor that explained the loss of international reserves and ultimately, to a speculative attack on the currency. This attack depleted reserves and forced the authorities to abandon the parity.

However recently many have argued that the authorities might have abandoned the parity for reasons other than a depletion of official international reserves. The authorities may be concerned about the adverse consequences of policies needed to maintain the parity i.e. through higher interest rates or other economic variable such as the employment level.

Recent models also have suggested that crisis may occur without any noticeable change in economic fundamental. An important assumption in these models is that economic policies were not predetermined but responds to changes in the economy, and people considered this relationship in forming their expectations. At the same time, economic agents' expectations and actions affected some variables to which economic policies respond. Accordingly, this circularity created the possibility for multiple equilibria and the economy may move from one equilibrium to another without a change in the fundamentals.
3.2.1 The First Generation Model

Basically the early work on currency crises called the ‘first generation’ was developed in response to currency crises in developing countries [i.e. Mexico (1973-1982) and Argentina (1978-1981)]. This model was derived from the work done by Stephen Salant and Dale Henderson (1978), which focused on speculative attacks on the government-controlled price of gold. Following this, other researchers realised that similar logic could be applied not only to speculative attacks on commodity boards trying to stabilise commodity prices, but also to central banks trying to stabilise exchange rates. Soon after the Salant-Henderson model, the currencies crises model was designed by Krugman (1979) and was then refined by Flood and Garber (1984). They constructed a linear model simplifying Krugman’s account and extended the model to a stochastic environment. Following this Garber and Blanco (1986) developed an early structural test of the first generation model. Since then the model has been widely extended. The logic of currency crises was similar to a speculative attack on commodity stock.

Specifically, according to Krugman (1979), under a fixed exchange rate a persistent loss of international reserves occurs when the domestic credit expansion is in excess of the growth in money demand, therefore leading to speculative attack on the currencies. Under these circumstances, reserves deplete and the authorities are forced to abandon the parity. The process then ends with an attack as economic agents apprehend that the fixed exchange rate regime will eventually collapse, and therefore without an attack they would suffer a capital loss on their holdings of domestic money. The period preceding a currency crisis then is characterised by a gradual but
persistent decline in international reserves and a rapid growth of domestic credit relative to the money demand. In short, the model shows how a fixed exchange rate policy combined with excessively expansionary pre-crisis fundamentals can push the economy into crisis.

3.2.2 Second Generation Model

Generally, the ‘second generation’ model was designed to deal with the speculative attack in Europe and Mexico in the 1990s. As pointed out by Flood and Marion (1998), these attacks are differed from the one observed in the ‘first generation’ model in two ways; (i) some of those speculative attacks in Europe, seemed to be unrelated to the economic fundamentals predicted by the ‘first generation’ model. (ii) The traditional methods could not be used to support the exchange rate parities, as the countries experiencing the attack are handcuffed by the partner’s monetary policies, i.e. the business cycle, the banking system, and tight borrowing.

Basically, the focus of the ‘second generation’ models is the importance of government’s role. In these models of currency crisis government rationally choose, on the basis of their assessment of costs and benefits in term of social welfare. In other words, the study dealt with how the government policy reacts to changes in private behaviour or when government faces an explicit trade-off between the fixed exchange rate policy and other objectives. Specifically, the government has a choice whether or not to defend a pegged exchange rate; it needs to use monetary policy to defend a pegged exchange rate (i.e. the interest rate). However, the increase in interest rates to ward off speculative attack leads to slower economic growth. Given a
particular constellation of macroeconomic fundamentals and reserves, government may become unwilling to defend the currency and the speculative attacks become a self-fulfilling prophecy. As pointed out by several authors, the East Asian countries does not fit well into either ‘first and second generation’ models of currency crisis [see Corsetti et.al (1999), Krugman (1998)]

3.2.3 ‘Twin Crises’

A third proposition knows as the ‘twin crises’, focuses on the interaction between banking crises and balance of payment crises. Here the role of the banking sector and the reversal flow prior to financial crises are emphasised. Many of the balance of payment crises are preceded by a rapid expansion in banking activity and they often coincide with domestic banking crises. A study by Kaminsky and Reinhart (1996) shows that financial liberalisation and deregulation are closely related to the emergence of banking crises.

3.3 Recent Work on Currency Crises

There have been a growing volume of literature on the causes and effects of the Asian crisis. A list of potential market fundamentals has been provided by recent theoretical work. However, since the relative importance of various fundamentals varies over-time for a single country and also varies across countries, it is quite difficult to draw a conclusion from these results.
Before the 1990s, the standard ‘first generation’ models have played a crucial role in identifying fundamentals useful for prediction. It was believed that the main cause of a speculative attack was a fiscal deficit financed by domestic credit creation. International reserves will gradually decline as the monetary authority monetized the budget deficit. The government reserve holdings will be depleted as they are used to defend the investors’ attack on the fixed exchange rate. In other words, the decline in international reserves played an important role in triggering the collapse of a fixed exchange rate.

Recent models have suggested that the countries might decide to abandon the parity with concern about the evolution of other key economic variables. A variety of factors may affect the authorities’ objective function and these could be used as leading indicators of a currency crisis. [see Ozkan and Sutherland (1995)]. A decision to maintain a fixed exchange rate by increasing the domestic interest rate may result in higher financing cost for the government. If the authorities are concerned about the fiscal consequences of their exchange rate policy, the decision to abandon the parity may depend on the stock of public debt.

Recent models have also suggested that crises could occur without any noticeable change in economic fundamentals. The contingent nature of economic policies may give rise to multiple equilibria and generate self-fulfilling crisis. These models assume that economic policies are not predetermined but respond to changes in the economy and economic agents also take this relationship into account in forming their expectations. At the same time, the expectations and actions of economic agents also affect some variables to which economic policies respond. Thus, the economy may
move from equilibrium to another without a change in the fundamentals. However, models of self-fulfilling are difficult to predict as it may be difficult to find a tight relationship between fundamentals and crises; crises may sometimes occur without a previous significant change in fundamentals.

Goldstein (1998) published a book on which he explains how the Asian crisis arose and spread. The two main explanations are financial sector weaknesses and external sector problems. The corrective policy measure that could help to end the crisis is also outlined. In addition, the shortcomings that occur in the international financial system that requires reform are also suggested to reduce the chances of a recurrence.

Montes (1998) also published a book in an attempt to understand the South East Asian crisis. He suggests that the crisis originated from the banking sector due to imprudent expansion and diversification of domestic financial market, fuelled by short-term private borrowings. However, this was true in the case of Thailand, but less so for Indonesia, Malaysia and the Philippines. According to him, although there was huge current account deficit, the four Asian countries had a high saving rates and low inflation rates in the 1990s. Thus, the South East Asia vulnerability was due to ‘credit crunch’. Cited in Montes, a study done by Kaminsky and Reinhart (1996) states that there were only three banking crises associated with the 25 balance of payment crises during 1970-1979. However, during 1980-1995, there were 22 banking crisis coincided with 46 balance of payment crisis. This was due to financial liberalisation from the 1980s. Therefore, the South East Asian currency crisis is attributed to the ‘twin liberalisation’ of domestic financial system and the opening of the capital
account. In addition, he also suggests measures to insulate the domestic banking system for short-term volatility through regulatory measures and capital control.

Krugman (1999) also published a book on Asian crisis in which he explains how the event could have occurred, how the affected countries can recover, and how countries can prevent the crisis from reoccurring. The main question about the recession that spread across Asia was, how did it happen? Krugman stated that what really happened was 'panic' which can be explained by a circular process. He used figure to illustrate the process - loss of confidence; plunging currency, rising interest rates, slumping economy; financial problems for companies, banks and households. Start anywhere in the circle, let say, with a decline in confidence would make both domestic and foreign investors want to pull their money out of the country, ceteris paribus, this would cause the currency to plunge in value. Since the central bank could not support the value of its currency by buying it on the foreign exchange market, the only way it could prevent the currency's decline was to raise interest rates and pull the local currency out of circulation. However, both the decline in the currency's value and the rise in interest rates created financial problems for business, financial institutions and companies. Since many of them had dollar debts, this became more burdensome as the number of local currency per dollar increased. On the other hand if they had debts in local currency, it also became harder to service as interest rates soared. This caused loss of confidence even further and the economy went into a meltdown.
3.4 Empirical Literature

Generally, a number of variables have been used in the empirical literature to characterise the period preceding currency crises. Kaminsky and Reinhart (1998) provide an extensive review on empirical studies on currency crisis. Their studies provide information on the numerous and varied experiences with currency crises, which cover both industrial and developing countries. Frankel and Rose (1996) also present a study in which few indicators are examined to explain currency crises. The study covers 105 developing countries for the period of 1971-1992. Indicators that have been used are such as fiscal deficit/GDP, per capita GDP growth, reserves/imports, current account/GDP, etc. Sachs, Tornell and Velasco (1995) investigates why some countries were more affected by the Mexican crisis than others. Indicators such as real exchange rate, saving/GDP, capital inflows/GDP, consumption/GDP, current account/GDP are used.

3.4.1 Indicators

Based on the empirical studies, there are a large number of variables used as indicators of currency crises. Basically, all variables can be divided into a few broad categories and subcategories. These include:

i) Current account: real exchange rate, current account balance, trade balance, imports, term of trade, price of exports, saving and investment.
ii) Capital account: foreign direct investment, short-term capital, flows, capital flows, international reserves, and differentials between domestic and foreign interest rates.

iii) Debt: total external debt, short term debt, debt service, foreign aid, etc.

iv) International variables: foreign real GDP growth, interest rates and price level.

v) Real Sector: real GDP growth, output, employment/unemployment, wages, and change in stock

vi) Fiscal Variables: fiscal deficit, government consumption, credits to the public sector.

vii) Political Instability

From the studies, it can be seen that variables such as international reserves, the real exchange rate, credit growth, and domestic inflation have received a great deal of support as useful indicators of currency crises. In addition, the trade balance, export performance, real GDP growth and the fiscal deficit also received support. It has also been observed that the current account balance did not receive much support as a useful indicator of crises as the information provided by the behaviour of the current account balance to some extent may already be reflected in the evolution of the real exchange rate. This is proved as most of the studies in which the effect of the current account balance was found to be non-significant; the real exchange rate was included but had a significant effect.

In this study, the third set of variables, debt, will be focused in explaining the Asian crisis. Specifically, variable such as debt/GDP, debt/export are used to calculate a solvency index\(^7\) to see whether there was evidence of insolvency prior to the crisis.
3.5 Summary

Empirical studies show that there are a broad variety of indicators that can be used to predict currency crises. Indicators such as the real exchange rate, the trends of the international reserve, domestic credit, and domestic inflation have proved to be useful in predicting crises. Other indicators such as the trade balance export performance, real GDP growth, and money growth, M2/international reserves and fiscal deficit have also received support as useful indicators.

The debt variable is the main focus of this study; the solvency index that is calculated in chapter six is based on the debt indicator i.e. total external debt, total debt service. However, instead of using debt as a percentage of GDP or export, a linear combination of these two indicators is used to avoid the moral hazard problem. Detail discussion on this issue is given in chapter 6.
NOTES

1 See Nixson and Walters (1999).

2 Salant was an economist worked at the Board of Governor of the Federal Reserve system at that time.

3 See Flood and Marion (1998) for a full detail on the ‘first generation’ model.

4 A detail survey on this model is provided by Agenor, Bhandari and Flood (1992).

5 Full detailed on this model is given in Flood and Marion (1998).

6 Among major contributions to the literature on the ‘twin crisis’ are Velasco (1987), Goldfajn and Valdes (1997), Chang and Velasco (1998a, 1998b)

7 In this study, the linear combination of GDP and exports is used to avoid the moral-hazard problem.
CHAPTER FOUR
MACROECONOMIC OUTLOOK

4.1 Introduction

As discussed in chapter 2, there are several views that have been put forth about the root of the crisis, ranging from fundamental weaknesses, a deteriorating current account, and a slow down in growth rate due to a high short-term debt. While, others believe that it was a case of creditors and investors panic, a view, which states that the sudden shifts in market expectations and confidence, unexplained by fundamentals, were the cause of the initial financial turmoil. When the crisis erupted, it caused panic in the domestic and foreign investors. Radelet and Sachs (1998), however, argue that it was partly caused by the faulty policy response of the IMF and the international financial community.¹

In this chapter, the macroeconomic outlook of the four Asian countries is analysed prior to the crisis. Specifically discussion on current account deficit is presented in section 4.2, followed by the macroeconomic fundamentals prior to the crisis in section 4.3. (i.e. real exchange rate, inflation rate, saving and investment, foreign reserves, etc). Section 4.4 discusses the issue of foreign debt, and a summary is provided in section 4.5.
4.2 Current Account Imbalances

Evidence on current account imbalances can be used to analyse the Asian crisis. As stated in the literature the current account deficit can be one of the sources that cause disruptive tensions in the financial markets. There are quite a number of studies that examine with financial and balance of payment crises. [See: Dornbusch et.al (1995), Mishkin (1996), Kaminsky et.al (1998)]. Cited in Corsetti et.al (1999) Lawrence Summers, the US Deputy Treasury Secretary, wrote in The Economist that any current account deficit which exceeds 5 percent of GDP has to be given close attention, especially if it is financed in a way that could lead to rapid reversals.² By referring to this figure, obviously several Asian countries might have the problem. One can obviously notice that those countries that have sizable current account deficits in the 1990s were those currencies collapsed in 1997.

The four Asian countries’ current account in the 1990s is shown in table 4.1. Both Thailand and Malaysia experienced deficits over the decade. Thailand experienced over 6% of gross domestic product (GDP) in each year in the 1990s and reached about 9% of GDP in 1995 and 1996. In the Malaysian case, the deficit was above 10% of GDP in 1993 but then dropped to 3.7% of GDP in 1996. Similarly, the Philippines also experienced the imbalances with a deficit of around 5% of GDP for four years, which was still high in the remaining years, while Indonesia experienced over 4% of GDP in 1990-1991. However, the deficit reduced again in 1995-1996 to 3-4% of the GDP.
Table 4.1: Current Account (% of GDP)

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<td>-3.6</td>
</tr>
<tr>
<td>Philippines</td>
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<td>Thailand</td>
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<td>-8.4</td>
<td>-8.5</td>
<td>-2.4</td>
</tr>
</tbody>
</table>


Compared to the 1980s, the current account deficits for these countries were far higher. In the late 1980s, the current account deficits averaged about 0.3% of GDP in the five countries (Malaysia, Thailand, Indonesia, Philippines and Korea). In fact, during this time Malaysia experienced current account surpluses of 2.4% of GDP. Conversely, current account deficits averaged 4.0% of GDP between 1990-1996.

Based on the current account positions, it is clear that there was preliminary evidence that the currency crises were associated with an external competitiveness problem. Those countries with large current account deficit throughout the 1990s were the ones that came under attack in 1997. Apparently, the appreciation of the U.S dollar relative to the currencies of the high deficit countries i.e Thailand, Malaysia, the Philippines and Indonesia approached 78, 52, 52 and 151% respectively. Countries that experienced small deficit or surpluses in their current account did not suffer a comparable depreciation. Hence, it can be concluded that the problems in the current account may have played a significance role in the Asian crises. However, it is commonly argued that current account deficits are not always a good predictor as can be seen in countries such as Indonesia and South Korea with the smallest deficits were
the hardest hit countries, whereas Malaysia’s deficit was much larger in 1995 (8.9% of GDP) than it was in 1996 (3.7%).

As stated earlier, debt/GDP ratio is usually used to measure the solvency of a country. The so-called “resource balance gap” can be calculated which is the difference between the current trade balance and trade surplus, required to stabilize the debt to GDP ratio in the long run. Accordingly, a country with a large trade deficit to GDP or large debt to GDP ratio or large differential between the interest rate and the growth rate of the economy will have a larger gap.

In calculating the ‘resource balance gap’ one needs to make assumptions about the long run differential between the real interest rate and the growth rate of the economy. It is argued both at the theoretical and empirical level that the difference is positive in a steady state, although negative values are observed in the short run.

According to Corsetti et al (1999), the trade balance adjustment required to stabilize the foreign debt to GDP ratio at the 1996 value for Malaysia, Thailand, Indonesia and the Philippines was 2.3%, 6.9%, 3.3% and 6.5% respectively (assuming that the differential between the real exchange rate and output growth is 1%). Obviously, the resource gaps were quite large in 1996.

With regard to external imbalances, the issue of sustainability becomes complex. It can be related not only to the country’s ‘willingness to pay’ but also the creditor ‘willingness to lend’. This is discussed in chapter 6. With the Asian’s current account position in mind, we proceed to the analysis of the macroeconomic fundamentals.
4.3 Macroeconomic Fundamentals

4.3.1 The Growth Rates

A large current account deficit will not be a problem as long as a country has a high current and expected economic growth. The East Asian economies experienced a rapid growth with equity, which caused a reduction in poverty and increase in longevity. During the period from 1966 to 1996, per capita income grew at an average annual rate of 4.4 percent in Malaysia, 4.7 percent in Indonesia, and 5.2 percent in Thailand. This growth together with a relatively unchanged income distribution caused a dramatic drop in poverty rates. Specifically, figure 4.1 shows GDP growth rate in 1990s for the four Asian economies. It is clear that all countries had remarkably high growth rates in the 1990s. The average was more than 7 percent of GDP, except for the Philippines where growth rates were low in the early 1990s, but still averaged 5 percent after 1994. In 1996, the region experienced a marginal slowdown in growth (source: see Appendix C).

Specifically, the real GDP per capita annual growth averaged just over 5 percent for East Asia between 1965-1989. As stated in the World Bank (1993), among the common features of this high performance were high saving and investment rates, high growth rates of human and physical capital, high productive growth, and high growth in manufactured exports. 

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Figure 4.1: GDP Growth Rate (%)
Despite the fact that during 1960s to 1990s, the East Asia countries experienced a tremendous economic performance, the extent of economic meltdown experienced in late 1997 means that it might not be relevant to talk of an East Asia miracle. As defined by Morrisey and Nelson "a miracle is something that cannot be explained, a surprise can be explained (in that one can identify the contributing factors) but was not anticipated". Following this it is argued by several authors (see Krugman (1994) and Young (1992, 1994, 1995) that the Asian economic miracle was not due to total factor productivity (TFP) growth but rather to factor accumulation i.e. capital and labour inputs.

This view was controversial as it implies that the TFP growth contributes very little for the Asian economic growth and also the high rates of Asian economic growth would not be sustainable in the long run. Krugman's views were debatable and criticized by several authors who argued that the method used underestimate output and productivity due to errors in the measurement of the growth in productivity in the service sector. In addition, data availability and reliability differ substantially among countries, therefore the estimation of TFP is difficult to compare internationally, despite the same method being adopted. (see section 4.3.1.1 for further discussion).

A high economic growth may also make a country more vulnerable to a crisis. As stated by Corsetti et.al (1999) this is due to overly optimistic beliefs that the economic expansion will persevere unabated in the future. Eventually, this will lead to an increase in both consumption and investment, and large capital inflows that can make it easy to finance the increasing demand. Under these circumstances, currency crises
can be trigged by an external shock, which can lead to a sudden change in expectation and cause a rapid reversal of capital flows.

As pointed out by Corsetti et al., although the argument of TFP can predict a slowdown of growth, obviously it cannot explain the Asian crisis in 1997. However, it does point out that the high rate of growth of the 1990s into the future was not necessarily warranted by fundamentals. High growth rates can affect the savings and investment decision as it may have contributed to a lower riskiness and costs of a strategy of excessive reliance on foreign capital and current account imbalances.

4.3.1.1 Total Factor Productivity

Many attempts have been made to explain the East Asia economic success or ‘miracle’. As mentioned in chapter 1, the economic performance of the countries was obvious in the 1990s compare to a few decades ago. Many have agreed that the most important reason for the East Asia economic success was the adoption of an export-oriented industrialization strategy. By contrast, other developing countries got trapped as they adopted import substitution.

The literature on economic growth focused attention on the question of which factor of production is the most important in maintaining long-run sustainable growth. The early growth models i.e. Harrod-Domar, Ranis-Fei and big push suggested that investment and savings were the important factors that contribute to the long-run sustainable growth. However, in 1960s and 1970s it was thought that the technological change was the primary determinant of long-term growth. As capital is
associated with diminishing returns and capital and technology are mobile across countries, over time there will be a process of growth convergence between developed and developing countries. In the 1980s, the new growth theory emerged, which once again stressed the importance of investment deriving from increasing returns to capital. The new growth theory also implies a divergence of growth between developed and developing countries overtime as capital accumulation is more rapid in developed countries and subject to increasing returns. However, there is doubt on the implications of the new growth theory as Young (1992, 1995) finds that Hong Kong and Singapore experienced similar rates of high economic growth, although Singapore had much higher rates of capital accumulation than Hong Kong. In his series of papers (1992, 1994, 1995) he argues that the East Asian countries experienced high growth rates through an increasing rates of labour force participation and through high rates of investment. Krugman (1994) also emphasizes that the economic growth of East Asia is not sustainable in the long run as the growth of the economies come much more from factor accumulation rather than improvement in TFP.

Young (1992, 1994, 1995) and Kim and Lau (1994), find that the productivity growth in East Asia countries are relatively low. These results are derived from the growth accounting approach based on the transcendental logarithmic (translog) production function.

Although the translog production function provides some theoretical justifications for the commonly used procedures in growth accounting studies, there exists problems of factor input measurements i.e. the measurement of capital inputs. Basically, the measurement of TFP depends on few things such as the specification of the
relationship between input and output, the right measurement of the factor inputs and also the weight used to the different categories of input in the aggregation of sub-inputs. However, as stated by Chen (1997) data availability and reliability differ substantially among countries; therefore the estimation of TFP is difficult to compare internationally, despite the same methodology being adopted. Accordingly, the low TFP growth in East Asia could be related to the improper measurement of capital inputs.

4.3.1.2 Empirical Studies on East Asian Economic Growth and TFP.

From the literature, the empirical results of studies on developed and developing countries are quite different. Most of the studies of developed economies indicates that TFP is more important source of growth than factor inputs i.e. Denison (1967) find that over 50% of output growth could not be explain by increases in factor inputs for eight European countries. Kanomori (1972) find that in 1955-1968, 60% of Japan’s output growth was explained by TFP. Chen (1977) found that for the period of 1955-1970, 55.1% of Japan’s economic growth was due to TFP.

Empirical studies of growth accounting for developing countries in Asia began in the late 1960s. In most of the studies the role of TFP in economic growth is much less important than in the findings for developed countries. Table 4.2 shows a summary of empirical studies of the Asian countries. Most of the studies use the same method. However, they involved a different time period and therefore the adjustment made to the data is based on different assumptions.
Chen (1977), does not make adjustments to the official data but he calculates the capital stock data for Singapore and Hong Kong using the conventional approach of accumulating investment to an assumed or derived base year capital stock. For the definition of TFP, Chen includes the effect of resource reallocation. Therefore, the residual or TFP includes everything i.e. the quality changes of capital that are not reflected by the official price deflator, the quality change of labour, the effects of resources reallocation and economies of scale, etc. In short, 50% of output growth can be explained by TFP, which by assumption includes most of the quality of factor inputs.

The World Bank (1993) study uses labour input adjusted for education attainment and capital input deflated by a modified deflator; therefore the residual or TFP excludes most quality changes in factor inputs. If TFP is considered as technological change, much of the quality improvement in factor inputs is therefore not counted as technological change; TFP is largely a concept of disembodied technological change.

Young (1995) makes an adjustment on the data of factor inputs to get rid of the 'scale effect' - i.e. quality change in the process of the aggregation of sub-inputs. He classifies capital input into 5 categories, and cross-classifies labour by up to seven attributes. Therefore the residual or TFP or technological change in his estimates excludes quality improvements in factor inputs. His TFP by assumption is largely disembodied technological change.

Based on the above adjustments made to quality improvements in factor inputs, different studies achieved different results for TFP estimates. With a substantial and
careful adjustments made to quality improvements in factor inputs i.e. in Young’s (1995) study, the residual or TFP estimates is relatively small. In short, when factor inputs are adjusted extensively for quality improvement, the estimation of TFP will be smaller.

Although the concept of TFP is very useful, there is a limitation of its usefulness for the study of economic growth. TFP should be used only for disembodied technological change. It depends on how factor input data are measured. TFP can also include many other sources of growth because TFP is just a residual. Data availability and reliability are major problems in developing countries; therefore it is quite difficult to make a comparison of different studies. Accordingly the importance of the residual would be smaller if capital utilization, capital input deflators, etc are taken into account.

4.3.2 Investment Rates/ Private and Public Savings

The current account is equal to the difference between national savings and investment, and therefore a deficit can occur due to a fall in savings or an increase in investment. As commonly known, borrowing from abroad is less ‘dangerous’ for sustainability if it is used to finance new investment, which leads to increased productive capacity and to higher future export receipts, rather than consumption. In this respect, a current account deficit, which is accompanied by a fall in saving rates is regarded as more problematic than a deficit accompanied by rising investment rates. According to Jomo (1998) in 1997, the savings-investment gap was 5% of GNP;
Table 4.2: The East Asia Total Factor Productivity Growth (%)

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</thead>
<tbody>
<tr>
<td><strong>Indonesia</strong></td>
<td>1.2**</td>
<td>0.8</td>
<td>1.2</td>
<td></td>
<td>0.8</td>
<td>1.2</td>
<td></td>
</tr>
<tr>
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<td>1.1**</td>
<td>0.9</td>
<td>2.0</td>
<td></td>
<td></td>
<td>2.0</td>
<td></td>
</tr>
<tr>
<td><strong>Philippines</strong></td>
<td>-</td>
<td>-0.4</td>
<td>-0.8</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Thailand</strong></td>
<td>1.5**</td>
<td>1.8</td>
<td>2.0</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Hong Kong</strong></td>
<td>4.3</td>
<td>3.6</td>
<td>2.4</td>
<td>2.3</td>
<td>3.1</td>
<td>-</td>
<td></td>
</tr>
<tr>
<td><strong>Korea</strong></td>
<td>5.0</td>
<td>3.1</td>
<td>1.2</td>
<td>1.7</td>
<td>2.1</td>
<td>1.5</td>
<td></td>
</tr>
<tr>
<td><strong>Singapore</strong></td>
<td>3.6</td>
<td>1.2</td>
<td>1.9</td>
<td>0.2</td>
<td>0.8</td>
<td>1.5</td>
<td>2.2</td>
</tr>
<tr>
<td><strong>Taiwan</strong></td>
<td>4.3</td>
<td>3.7</td>
<td>1.2</td>
<td>2.6</td>
<td>2.9</td>
<td>2.0</td>
<td>-</td>
</tr>
</tbody>
</table>


Source: Various Studies on TFP

gap was bridged by heavy reliance on foreign direct investment (FDI). However, high FDI and foreign debt have in turn caused a growth of an income outflow abroad. As can be seen, the borrowed funds were used for investment, and the investment rate to GDP actually rose over the 1990s. It was between 37 percent and 45 percent of GDP. However, the social profitability of investment was falling over the 1990s.

Figure 4.2 shows the investment rates as a percentage of GDP of the four Asian countries (source: see Appendix C). It can be seen that all the four countries experienced high rates of investment throughout the 1990s. Most countries had rates above 30% of GDP with the exception of the Philippines.
Figure 4.2: Investment Rates (% of GDP)
A standard measure of investment efficiency is the incremental capital output ratio (ICOR), it is the ratio between the investment rate and the output growth. Obviously, the ICOR had increased in the period between 1993-1996 compared to 1987-1992, (except for Indonesia and the Philippines). This indicates that on average the profitability of new projects in the region was falling prior to the 1997 crisis. (see table 4.3)

Table 4.3: Incremental Capital Output ratio (ICOR)

<table>
<thead>
<tr>
<th></th>
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</thead>
<tbody>
<tr>
<td>Malaysia</td>
<td>3.7</td>
<td>4.8</td>
</tr>
<tr>
<td>Indonesia</td>
<td>4.0</td>
<td>3.8</td>
</tr>
<tr>
<td>Philippines</td>
<td>6.0</td>
<td>5.5</td>
</tr>
<tr>
<td>Thailand</td>
<td>3.4</td>
<td>5.1</td>
</tr>
</tbody>
</table>


Private and Public Savings

The sustainability of the current account imbalances can also be analyzed by looking at private and public savings. It is argued that a fall in national savings caused by lower public savings is more problematic than a fall in private savings which is a transitory phenomenon. An increase in public sector deficit will end up to a build up of foreign debt.

Figure 4.3 shows the saving rate in Asia, characterized by very high saving rates throughout the 1990s (most of the cases 30% and in some cases 40%). However, the
Figure 4.3: Saving Rates (% of GDP)
Philippines recorded the lowest rates where saving rates fluctuated between 17% to 20%. In the Indonesian case, the saving rate fell below 30% after 1992 whereas in Malaysia the saving rate was below 30% until 1993 (source: see Appendix C).

4.3.3 Inflation Rates

In evaluating the sustainability of the current account and external debt, the inflation rate is also one of the important factors. A high inflation rate may indicate a poor macroeconomic policy. Having a high inflation rate signals that the fixed/semi fixed exchange rate regime can be exposed to speculative attacks. Figure 4.4 shows inflation rate for the four Asian countries (source: see Appendix C). It is obvious that in the 1990s most of the countries’ inflation rates were relatively low except for the Philippines where its inflation rate was nearly 20% in 1990-91, but fell to 8% by 1996. Nevertheless, there are doubts about these countries’ ability to keep inflation low in the future as they have experienced problems in the banking and financial sector.

4.3.4 Openness

It is argued that economies that are relatively open are vulnerable to terms of trade shocks and also to restructured trade policies in other countries. At the same time they are less likely to face sustainability problems, as a large export sector strengthens the countries’ ability to service their debt obligations (see the discussion in chapter 5). By looking at the ratio of the average exports and imports to GDP, obviously the four Asian countries were markedly open. (See table 4.4). As can be seen, Indonesia has
the lowest degree of openness, which is about 26-27%. For the Philippines and Thailand they are 30-40% whereas Malaysia it is above 80%.

Table 4.4: Openness (average* exports and imports as a percentage of GDP)

<table>
<thead>
<tr>
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<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Malaysia</td>
<td>75.23</td>
<td>86.52</td>
<td>76.64</td>
<td>87.72</td>
<td>92.15</td>
<td>97.42</td>
<td>91.50</td>
<td>93.55</td>
</tr>
<tr>
<td>Philippines</td>
<td>30.40</td>
<td>31.09</td>
<td>31.58</td>
<td>35.58</td>
<td>36.98</td>
<td>40.26</td>
<td>44.90</td>
<td>54.20</td>
</tr>
<tr>
<td>Thailand</td>
<td>37.76</td>
<td>39.24</td>
<td>38.98</td>
<td>39.69</td>
<td>40.99</td>
<td>44.88</td>
<td>42.19</td>
<td>46.69</td>
</tr>
</tbody>
</table>

*average = [(Ex+Im)/2]/GDP

Source: Corsetti et.al (1999)

With regard to the export growth rate, each country’s export growth is shown in table 4.5. As can be seen the export growth rate began to slow down considerably in 1996. This was due to adverse developments, which cut into the competitiveness of exporters. Exports were slowed down by a significant deterioration in the term of trade as a result of an appreciation in the real exchange rate. This causes a further increase in current account deficits. However, Radelet and Sachs (1998a, 1998b) state that the changes in international condition i.e. the depreciation of Japanese yen and the terms of trade losses could not explain the sudden eruption of the currency crisis.
Table 4.5: Export Growth Rate (1995-1996)\(^a\)
(percent)

<table>
<thead>
<tr>
<th>Country</th>
<th>Value Growth</th>
<th>Volume Growth</th>
<th>Unit value Change</th>
</tr>
</thead>
<tbody>
<tr>
<td>Indonesia</td>
<td>13.4</td>
<td>9.7</td>
<td>10.3</td>
</tr>
<tr>
<td>Malaysia</td>
<td>26.0</td>
<td>5.8</td>
<td>15.6</td>
</tr>
<tr>
<td>Philippines</td>
<td>31.6</td>
<td>16.7</td>
<td>17.0</td>
</tr>
<tr>
<td>Thailand</td>
<td>25.1</td>
<td>-1.3</td>
<td>14.2</td>
</tr>
</tbody>
</table>

\(^a\)Table was dollar values of export

Source: Radelet and Sachs (1998)

4.3.5 Real Exchange Rate

An appreciation of the real exchange rate will cause a loss in competitiveness and worsen the trade balance, therefore jeopardizing the sustainability of the current account. Based on data on nominal exchange rates in the 1990s, in the Malaysian case, the currency moved between 2.5-3.5 (10% range) in the 1990s. For Thailand, the baht was fixed to the dollar between 25.2 and 25.6, while in Philippines the peso/dollar fluctuated between 24 and 28 during 1990-1995. However, from spring 1995 until early 1997, it was fixed at 26.2.

Based on several studies, it was shown that countries that have an appreciation in their currencies experienced a larger deterioration of the current account while countries that had experienced a real depreciation had current account surpluses. The real exchange rate of the four Asian countries is shown in figure 4.5 (source: see Appendix C). In 1997, the real exchange rates appreciated by 19% in Malaysia, 23% in the Philippines, 12% in Thailand and 8% in Indonesia.
Figure 4.5: Real Exchange Rate
4.3.6 Political Instability and Uncertainty

Besides all the factors discussed above, political instability can also reduce the willingness of the international financial community to provide current account financing. Expectation about the political and financial environment also gives rise to the balance of payments and exchange rates crisis particularly when economic fundamentals are not very strong.

In the 1990s, a great deal of political instability could be observed in Asia. In 1997, for instance there were cabinet reshuffles in Thailand, there was elections and tensions in Indonesia, etc. Eventually, events in each of the country added to the seriousness of the crisis and accordingly triggered both the domestic and foreign investors to withdraw.
4.4 Foreign Debt Accumulation

A country may have a short run liquidity problem when its reserve stock is less than its overall burden of external debt services. It is said to have a liquidity problem when panicking creditors are not willing to roll over existing short-term credit as a result of a rapid devaluation. In short, a crisis is a pure liquidity shortfall, if a large fraction of a country’s external liabilities are short term.

As stated in the literature the debt/export ratio is of a great concern because of its negative effects on investment and savings. This can be explained by the resources used to service debt, which causes crowding out public investment and discourages private investment. In addition, the high debt/export ratio indicates debt overhang, leads to the anticipation of economic agents about future tax liabilities for its servicing. [see Borensztein (1990b) and Eaton (1987)]. The debt hypothesis states that since an indebted country benefits partially from increases in output or exports, for which some of the proceeds are paid to the creditors, there will be a disincentive effect not to initiate programs that will lead to future growth. However, several authors argued that a high debt/export ratio is not indicative of debt overhang as the disincentive effect only arises when it becomes impossible for a debtor to meet its contractual obligations. [see Krugman(1988; 1989 and Sachs(1989)] If the high debt service/export ratio is serviced regularly it would not lead to distortions of production or investment decisions. Obviously a high debt/export ratio implies that funds have to be transferred abroad in the future, thus raising the implicit cost of domestic capital.
Another important point of a high debt/exports ratio is that the high stock of foreign debt can be connected with lower investments. This can be explained in two ways. Firstly, interest payments on foreign indebtedness lower the funds available for investment in the domestic economy in the current period. Secondly, a country loses the amount of money that if it had been invested domestically, would have had a multiple effect and been a catalyst for future investment.

Table 4.6 shows the foreign debt as a percentage of GDP for the four Asian countries. Based on World Bank figures, it considers a debt to GDP ratio of less than 48% as low risk, 48 to 80% as medium risk. As can be seen from the table Indonesia experienced a relatively high ratio in 1991; 68% and it was 63% in 1997. For Malaysia it was around 40 percent since 1993. While for Thailand the ratio was about 38% of GDP in 1991 and reached 60.6% in 1997. The Philippines experienced 71% of GDP in 1991 but then it dropped to 49.7% in 1996.

Table 4.6: Foreign Debt (as a percentage of GDP)

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</tr>
</thead>
<tbody>
<tr>
<td>Malaysia</td>
<td>35.8</td>
<td>35.5</td>
<td>34.5</td>
<td>40.7</td>
<td>40.4</td>
<td>39.3</td>
<td>40.1</td>
<td>48.0</td>
</tr>
<tr>
<td>Indonesia</td>
<td>65.9</td>
<td>68.2</td>
<td>68.7</td>
<td>56.4</td>
<td>61.0</td>
<td>61.5</td>
<td>56.7</td>
<td>63.5</td>
</tr>
<tr>
<td>Philippines</td>
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<td>71.5</td>
<td>62.3</td>
<td>66.1</td>
<td>62.4</td>
<td>53.2</td>
<td>49.8</td>
<td>55.3</td>
</tr>
<tr>
<td>Thailand</td>
<td>32.8</td>
<td>38.4</td>
<td>37.5</td>
<td>34.1</td>
<td>33.3</td>
<td>33.8</td>
<td>50.1</td>
<td>60.7</td>
</tr>
</tbody>
</table>

Source: World Debt Table (1999)
Table 4.7 shows the share of short-term debt. As can be seen the figure was relatively modest; 32% in Malaysia, 26% in Indonesia, 37% in Thailand and 26% in the Philippines for 1997.

Table 4.7: Short term Debt (percentage of total)

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</thead>
<tbody>
<tr>
<td>Malaysia</td>
<td>12.4</td>
<td>12.1</td>
<td>18.2</td>
<td>26.6</td>
<td>21.1</td>
<td>21.2</td>
<td>27.8</td>
<td>31.6</td>
</tr>
<tr>
<td>Indonesia</td>
<td>15.9</td>
<td>18.0</td>
<td>20.5</td>
<td>20.2</td>
<td>20.2</td>
<td>20.9</td>
<td>25.0</td>
<td>26.4</td>
</tr>
<tr>
<td>Philippines</td>
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<td>15.2</td>
<td>16.0</td>
<td>14.0</td>
<td>14.3</td>
<td>13.4</td>
<td>19.3</td>
<td>26.0</td>
</tr>
<tr>
<td>Thailand</td>
<td>29.6</td>
<td>33.1</td>
<td>35.2</td>
<td>53.0</td>
<td>60.7</td>
<td>72.4</td>
<td>41.4</td>
<td>37.3</td>
</tr>
</tbody>
</table>

Source: World Debt Table (1999)

For the debt service ratio, the estimates for the Asian countries are considered low owing to the exclusion of the roll over of short-term liabilities. Specifically, the service ratio is defined as the interest on all debt plus the principal to be repaid on long term debts as a share of total exports. This is shown in table 4.8. Obviously in 1997 the debt service ratio was below 20% in most of the countries except for Indonesia (30%). The Philippines experienced a rate above 20% until 1993, and dropped to 9.2% in 1997. The World Bank considers 18% as the warning threshold.
Table 4.8: Debt Service Ratio as a Ratio of Exports

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<td>30.9</td>
<td>36.8</td>
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<td>23.0</td>
<td>24.4</td>
<td>25.6</td>
<td>18.9</td>
<td>16.4</td>
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<tr>
<td>Thailand</td>
<td>16.9</td>
<td>13.0</td>
<td>13.8</td>
<td>13.7</td>
<td>13.5</td>
<td>11.6</td>
<td>11.5</td>
<td>15.4</td>
</tr>
</tbody>
</table>

Source: World Debt Table (1999)

However, if one looks at the ratio of short-term debt to foreign reserve and the ratio of debt service plus short-term debt to foreign reserves, there might be a problem. The figures were quite high for most of the countries. (see table 4.9).

As pointed by several authors, short-term debt is regarded as an important variable in predictive models and became crucial in discussions of the onset of crises. It indicates that any country has more short-term debt than reserves can suffer a self-fulfilling balance of payment crisis if its creditors reluctant to roll over loans.[see Radelet and Sachs(1998a), Corsetti et.al (1998)]. This variable is able to predict the crisis quite well. Based on BIS-Reporting banks, at the end of 1996, eleven of the forty-two countries had ratios of short-term debt to reserves greater than one. For instance Indonesia had a ratio of 2.0, Thailand 1.2, in which they faced severe financial difficulties in 1997.
Table 4.9: Short term Debt and Debt Service plus Short Term Debt
(% of foreign reserves)

<table>
<thead>
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</thead>
<tbody>
<tr>
<td></td>
<td>Std</td>
<td>Std*</td>
<td>Std</td>
<td>Std*</td>
<td>Std</td>
<td>Std*</td>
<td>Std</td>
<td>Std*</td>
</tr>
<tr>
<td>Malaysia</td>
<td>19.5</td>
<td>64.0</td>
<td>19.7</td>
<td>45.9</td>
<td>21.1</td>
<td>43.6</td>
<td>25.5</td>
<td>41.0</td>
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<tr>
<td>Indonesia</td>
<td>149.3</td>
<td>282.9</td>
<td>154.6</td>
<td>278.8</td>
<td>172.8</td>
<td>292.0</td>
<td>159.7</td>
<td>176.6</td>
</tr>
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<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Philippines</td>
<td>479.1</td>
<td>867.6</td>
<td>152.3</td>
<td>257.0</td>
<td>119.4</td>
<td>217.1</td>
<td>107.7</td>
<td>79.5</td>
</tr>
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<td></td>
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<td></td>
</tr>
<tr>
<td>Thailand</td>
<td>62.6</td>
<td>102.4</td>
<td>71.3</td>
<td>99.3</td>
<td>72.3</td>
<td>101.3</td>
<td>92.5</td>
<td>99.7</td>
</tr>
</tbody>
</table>

Std is short-term debt
Std* is short-term debt plus debt service
Source: World Debt Table (1999)
Based on this finding, one can say that short-term debt larger than can be covered by reserves may be sufficient for an economic crisis. Nonetheless, it is not a necessary condition, as Malaysia has prudent policies toward short-term debt could not prevent the spread of the crisis.

As previously mentioned, the short-term debt to reserves is not very good measure of solvency. However, according to Furman and Stiglitz (1998), this variable matter for three main reasons. First, the ratio of short-term debt to reserves do measure liquidity. Second, a high ratio of short-term debt to reserves may signal imprudent macroeconomic policies. Third, the ratio of short-term debt to reserves is an indicator of the vulnerability of a country to a self-fulfilling withdrawal of capital flight.

4.5 Summary

This chapter analyses the macroeconomic fundamental of the four Asian countries, which shows that most countries had strong economic fundamentals prior to the crisis. This conclusion is reached on the basis of parameters such as low inflation rates, high savings rates, and high growth rates, etc. The current account deficit was a problem as countries that were under attack were the ones with large current account deficits. However, the commonly held view is that the current account deficit is not a problem as long as it is sustainable. A detailed discussion on this issue is given in chapter 6.
NOTES

1 For further details see Radelet and Sachs (1998).


4 As stated in Corsetti, et.al (1999) – the current account identity is $B_{t+1} = (1+r) B_t - T_t$
   where B is the net debt position and T is the trade balance. Then divide both sides by current GDP. Now assumes that GDP grows at the constant rate $g$, Thus $Y_{t+1}/Y_t = 1+g\%$. Accordingly the above equation can be rewritten as $(1+g)b_{t+1} = (1+r) b_t - T_t$
   where $b=B/Y$ and $t=T/Y$. Therefore the debt to GDP ratio to be constant in the long run at some level $b$, the trade balance surplus must be equal to $(r-g)b$.

5 For further details see Krugman (1998).

6 See Morrissey and Nelson.

7 For full explanation of the Harrod-Domar and Ranis-Fei models, see Ghatak (1978).

8 The transitory fall in savings today will be offset by higher savings in the future, when the anticipated increase in income actually materializes. A transitory fall in private savings (due to an increase in consumption) is determined by expectations of higher future GDP growth raising permanent income.
See Krugman for further details.

As stated by several authors the World Bank estimates for the debt service ratio include interest payments on all foreign debt but principal payments only for long term debt so the roll over of short-term liabilities is not included.

For further detail, refer to Furman and Stiglitz (1998).
CHAPTER FIVE

FOREIGN TRADE: ESTIMATING INCOME AND PRICE ELASTICITIES
OF EXPORTS AND IMPORTS

5.1 Introduction

The use of elasticities is one of the important tools in economics and is important in guiding decisions on a wide range of economic policies, such as taxation, foreign trade, distribution, forecasting, etc. Specifically, for the foreign trade sector, elasticities provide a useful study on international linkages and trade policies. In addition, the role of elasticities is becoming increasingly important in dealing with the debt crisis in developing countries. [Cline (1984), Dornbush (1985)]. The effectiveness of a trade policy, for instance, is dependent upon the size of the income and price elasticities in both exports and imports. With knowledge of these elasticities, an appropriate policy can be designed to respond to problems faced by a country.

Additionally, information about elasticities is not only crucial to the debtor country, but to the creditor as well. Decision on debt rescheduling, and stabilisation policies of a country, usually depend upon the income and price elasticities in its foreign trade. The solvency of a country can be determined by using the prediction of the price elasticity of export demand and GDP supply; a solvency index of a country can then be calculated. With this in mind, the purpose of this chapter is to analyze and
estimate the ASIAN foreign trade sector. It has been the main leading economic force, and has provided the countries with high creditworthiness in international credit markets.

Specifically, the organisation of this section is as follows. Section 5.2 presents the literature review of price and income elasticities in the developing countries followed by the analytical framework in section 5.3. Data and estimation method is presented in section 5.4. Detailed estimation results are given in section 5.5 and finally in 5.6, a summary is presented.

5.2 Literature Review on Income and Price Elasticities of Exports and Imports

The issue of price and income elasticities has been discussed by economists for many years, either theoretically or empirically. Among the leading authors who have contributed in their writing on this issue are Prebisch (1950), Singer (1950), and Nurske (1959). All of them have stated that the price and income elasticities of export demand for the less developed countries (LDCs) are relatively small. On the other hand, others [Balassa (1971,1978), Bhagwati (1988,1990), Khan (1974), Riedel (1984,1991)] have stated the irrelevance of this view as countries such as the newly industrialised economies (NIEs) have achieved great success due to the implementation of outward-oriented development strategies. These two different views can be explained by a shift in trade compositions i.e. from primary commodity to manufacturing goods.
The focal point of the recent debate tries to explain the leading force of the rapid growth of the NICs exports; whether it is because of the high, and statistically significant price elasticities, or the high and statistically significant income elasticities, or both.

Generally, the literature has provided a wide range of estimates for the elasticities value; the elasticities dispersion turns out to be important as it leads to uncertainty in the balance of payment prediction for the debt rescheduling agreement, and also to the ongoing development plan of developing countries. Focusing on this issue, several important papers will be reviewed, particularly by some influential authors; Muscatelli et.al (1992, 1994) and Athukorala and Riedel (1994, 1996); who attempt to find a solution to the empirical estimation of the size of price and income elasticities of the developing countries. Other related papers on income and price elasticities of industrial countries are also reviewed. In addition, papers discussing the method used for estimating income and price elasticity are discussed.

The empirical studies by Bond (1985), Cline (1984), Goldstein and Khan (1982), Muscatelli (1994, 1995), Marquez and Mc Neilly (1988), O'Neill and Ross (1991) have supported the conventional view which states that the price elasticities of demand for the newly industrialised countries’ (NICs) exports are small. However, the world income elasticity of demand for the NIC’s exports is significant and high. On the other hand, others [Riedel (1984, 1988b), Athukorala and Riedel (1991)] have criticised the conventional approach, and have found that income elasticities are insignificant and the price elasticities of export demand are infinite.³
However, some of the earlier empirical studies on foreign trade, which estimate export and import, concentrate on the demand side, and the supply side is totally ignored. As only one side of the market is focused, the method that is usually employed to estimate the elasticity of export and import tends to be the single equation method i.e. the ordinary least square (OLS). As has been criticised by Orcutt (1950), Herberger (1953) and Prais (1962), and pointed out by Goldstein and Khan (1962), among others, such methods caused the estimates to be biased and inconsistent, in the presence of any possible simultaneity between quantities and prices. Simultaneity, in particular, implies correlation between the explanatory variables in the equation and the disturbance term, and so violates one of the conditions of the classical least square analysis.

The single equation method has continued to be used under the assumption that an individual country faces exogenous prices of its exports and imports, which supports the small country assumption. Under these circumstances, the simultaneity bias disappears as prices, and the disturbance term, will no longer be correlated in the equation. Although, the small country equation can quite easily be accepted theoretically, it has been questioned empirically, especially with regard to its use in the formulation and estimation of export functions.

In the case of imports, it is easier to justify; apparently, the price of imports is invariant to an individual country’s demand. A study by Magee and Glyfason (1978), for example showed that in the case of the U.S, the price elasticity is quite high, meaning that the import price is not greatly affected by importers.
Specifically, a study by Houthakker and Magee (1969) estimates the price and income elasticities of demand for both exports and imports for 15 industrial countries. Despite being aware of biases, they use the ordinary least square methods, and use an annual data set for the period of 1951-1966. However, for the United States more detail is analysed where trade destinations and commodity classes are used. From the result obtained, the income elasticity is significant where the value is between 1 and 2. However, for the price elasticity most of the countries showed that the estimate is insignificant and a few countries have incorrect signs.\footnote{4}

With regard to the model formulation, Khan and Ross (1976), evaluate the functional form of the aggregate import demand equations. As frequently found in the literature, the quantity of import demanded is a function of the input price relative to the domestic price and the domestic income. They analyze the function form of the import equation for three countries: the United States, Canada and Japan using quarterly data over the period of 1960-1972. Based on the results gained using the Box-Cox (1964) analysis of transformations, it suggests that a log-linear form is better than a linear one.

Similarly, Boyland et.al (1980) examine three of the EEC: Ireland, Denmark and Belgium, to form the optimal functional form of aggregate import demand equation. They then compare their results with the study done by Khan and Ross (1976). Annual data set for the period of 1953-1975 is used and the log-linear form is employed. Similar to results obtained by Khan and Ross, they agree that the log-linear functional form is the appropriate function for those countries' import demand equations.
Concerning the issue of simultaneity, many studies have been carried out to deal with this problem. In eliminating simultaneity bias, equation of both demand and supply has to be specified explicitly. The estimation then can be evaluated by applying the OLS to the reduced form equation or employing the instrumental variable (IV), or two stage least square (2SLS) methods [Turnovsky (1968), Khan (1974)]. The alternative is to use a system method, specifically three stage least squares to estimate the structural equation simultaneously [(Gan, (1981), Goldstein and Khan (1987), Riedel (1988), Marquez and Mc Neilly (1988), Muscatelli et.al (1992)], or the maximum likelihood method. [Goldstein and Khan (1978), Muscatelli et.al (1995).

Khan (1984) investigates the import and export demand for 15 developing countries, in which the impact of the price changes of traded and non-traded goods on the trade flows of these countries is tested. Furthermore, it illustrates the importance of quantitative restrictions on the estimates. As usual, the log-linear form is used in the estimation. The two stage least square (2SLS) approach is used for both equilibrium and disequilibrium models. From the results obtained, both import and export equations for a single equilibrium are relevant. The price elasticities of imports and exports are indeed larger than would have been expected. However, income elasticities are low for both imports and exports.

Specifically, Goldstein and Khan (1978) examine the price elasticities for both export demand and export supply, where eight industrial countries are analysed. Their study covers the period of 1955-1970 and quarterly data on aggregate exports are used. As bias might exist through the two-way relationship between export quantities and price,
two models of export demand and supply are formed, and they are then estimated simultaneously where the full information maximum likelihood is used, as it is the best estimator for the asymptotic theory. The results obtained show that the estimated price elasticities of the export demand, for most of the countries, are significantly different from zero. Specifically, the price elasticities of six of the eight countries are greater than unity. For all of the eight countries, the income elasticities are significantly different from zero at 1% level. They find the Koyck-type distributed lag indicates that the adjustment that takes place to changes in the independent variables is not very long, and usually it is less than one year.

Aspe and Giavazzi (1982) examine both the simultaneity issues between the excess supply and demand functions for exports, and their interaction with the domestic demand for export goods. In particular, the case of Germany’s machinery is analyzed. Based on their findings, Orcutt’s suggestion on treating the domestic and foreign market simultaneously is reconfirmed, and suggests that price discrimination exists.

Marquez and Mc Neilly (1988) have developed a model which estimates income and price elasticities for non-OPEC countries based on the major SITC commodity groups. By using quarterly data for the period of 1973 - 1984 and based on 2SLS, the result obtained is between 1.4 and 1.9 for the income elasticity. In addition, the properties of the error term, the dynamic specification and parametric stability are also tested.

Besides the simultaneity issue, problems of specification and distributed lags also have to be clarified. These two terms are actually linked together to estimate a trade model; one considers that adjustment is completed and in the other, only part of the
adjustment occurs in each period. For the partial adjustment model, there are lagged dependent variables used to estimate the trade equations [Khan (1974), Goldstein and Khan (1978)]. For instance, Goldstein and Khan use a distributed lag for the employment variable.

However, by using the partial adjustment model in the form of distributed lags, some problems might exist. As mentioned by Maddala (1977) among others, even though there is a serial correlation in the error term, a distributed lag model can still produce a reasonable and significant coefficient. Therefore, the issue of serial correlation must be taken care of before one uses the distributed lag model. Also, by using the same full adjustment model and applying it to the partial adjustment model, a reduction in serial correlation will be shown since, by using the lagged dependent variables, one might extract most of the serial dependence among the residuals. Based on this, one might wrongly conclude that the distributed lag model is superior to the full adjustment model. Moreover, the $R^2$ for the partial adjustment model tends to be higher than the full adjustment model, if the serial correlation is not corrected.

Another argument regarding the size of elasticities of export is the issue of normalisation. As argued by Riedel, by using the conventional approach for which the export volumes are modelled as a demand equation, which depends upon the domestic price relative to world price, and on world income, the price elasticities of demand tend to be low and the income elasticities of demand tend to be very high. Accordingly, for a small country, the export demand function should be normalised for price rather than for quantity. Based on his study on Hong Kong, in which the equation is normalised for export price, the results obtained support the view that
Price elasticities of demand are insignificant. Riedel argues that the results gained from the previous studies are misleading, as the supply side influences are neglected. By using the simultaneous equation method, results gained are similar to the value generally accepted in which the value is between -0.5 to -1.0 for the price elasticities and between 2.0 to 4.0 for the income elasticities. (See Goldstein and Khan (1982, 1985), Magee (1975), and Stern (1975). Furthermore, Athukorala and Riedel (1991), in their study on Korean exports of machinery and transport, showed similar results.

The issue of normalisation then was challenged by several authors [Faini et.al (1992), Muscatelli et.al (1992, 1994), Muscatelli (1995)]. Specifically, Faini, Clavijo, and Selmali (1992), examine the empirical evidence of manufactured export demand functions for 23 less developed countries (LDCs). The issue of export growth in LDC, constrained by the international environment is analyzed, and, following this, the small country hypothesis is tested. The view that export performance is determined by the supply factor is also evaluated. The LDC's growth constraint is examined globally. They also analyze whether LDC's exports compete with northern products or with other LDCs. Based on a claim made by Cline (1982) that an outward shift in the LDCs export supply will cause a decline in prices, and therefore weaken the success of an export led strategy, they find that almost 80% of the gain of devaluation on export revenue disappears when other LDCs competitors retaliate.

Muscatelli et.al (1994) use the Phillips-Hansen cointegration method to test Riedel's data, and find that the price elasticity of demand is actually low and income elasticities are high. Also, according to them, by using a more dynamic specification model of demand and supply, apparently the normalisation paradox disappears.
In contrast, Athukorala and Riedel (1994) have criticised the results obtained from the study above in which they were influenced by the choice of coefficient restriction. By using a more appropriate coefficient method and then applying it to the Phillips-Hansen cointegration method, the earlier results obtained by Riedel were reconfirmed.

In addition, data quality is also crucial in estimating the trade model. As pointed out by Muscatelli et al. (1994), Athukorala and Riedel (1995), the use of unit price indices, as proxies for the import and export price, causes bias to the export timing in response to the price changes and to the elasticities estimates. In addition, the effect on the estimated long run elasticities, as a result of the dynamic mis-specification that might occur, is less severe if one uses an annual data set compared to the quarterly data set.

Another problem that needs to be taken into account is the issue of the aggregation level. Aggregation across different commodity groups, or different countries, must be well determined. Different groups of commodity can be aggregated only if the pattern of their export demand is comparable.

Specifically, O'Neill and Ross (1991) examine factors that determine the South Korean’s aggregate exports to three destinations, namely; the US, Japan, and the EC for the period of 1970s and 1980s. Economic growth and relative price, which are determined by the exchange rate, and the development of domestic supply, are the main focus of the model. Their result shows that income elasticity of export demands tends to be higher in the United States.
Muscatelli, et al. (1995a), investigate the four newly industrialised Asian economies (NIEs) export performance, on which they model their bilateral exports flow to three areas of exports destination: the US, Japan and the EC. Their results show that the estimated long run price, and income elasticity’s of export demand, to those three areas of destination are different. Generally, the price elasticity of exports is low, but the income elasticities are higher than those obtained in the previous study, and this can be explained by a difference in the composition of export products to each destination.

In a subsequent study, Muscatelli et al. (1995b) develop a model of export demand and supply for six newly industrialised Asian economies (NIEs), by using the systems method. Their results show that the price elasticity of export demand for all the countries is significant and the reason is because of the non-price factors for example quality of products and marketing strategies.

Based on the above survey of literature, it is concluded that the elasticities issue is not conclusive. There are many factors that have to be considered i.e simultaneity, model specifications, data quality, the issue of normalization, and the level of aggregation across country and commodity, etc. Accordingly, consideration will be given to, if not all, some of the above problems in estimating income and price elasticities for the Four Asean countries. A review of the literature is summarized in table 5.1.
<table>
<thead>
<tr>
<th>Study</th>
<th>Countries cover and sample period</th>
<th>Method used</th>
<th>Comments</th>
</tr>
</thead>
<tbody>
<tr>
<td>Houthakker and Magee (1969)</td>
<td>15 industrial countries (1951-1966)</td>
<td>OLS</td>
<td>Income elasticity is significant — value between 1 and 2</td>
</tr>
<tr>
<td>Khan and Ross (1976)</td>
<td>United States, Canada and Japan (1960-1972)</td>
<td>OLS</td>
<td>Log linear form is better than the linear one</td>
</tr>
<tr>
<td>Goldstein and Khan (1978)</td>
<td>8 industrial countries (1955-1970)</td>
<td>Export demand and export supply are formed and estimated simultaneously using FIML</td>
<td>Price elasticities for most of the countries are different from zero. The price elasticities for six of eight countries are greater than one</td>
</tr>
<tr>
<td>Boyland et al. (1980)</td>
<td>EEC: Ireland, Denmark, Belgium (1953-1975)</td>
<td>Optimal function form of aggregate import demand</td>
<td>Same as Khan and Ross — log linear functional form is the appropriate function.</td>
</tr>
<tr>
<td>Aspe and Giavazzi (1982)</td>
<td>Germany</td>
<td>Examine simultaneously issue between the excess supply and demand functions</td>
<td>Suggests that price discrimination exist</td>
</tr>
</tbody>
</table>
Table 5.1: continued

<table>
<thead>
<tr>
<th>Study</th>
<th>Sample Description</th>
<th>Methodology</th>
<th>Findings</th>
</tr>
</thead>
<tbody>
<tr>
<td>Khan (1984)</td>
<td>15 developing countries</td>
<td>2SLS</td>
<td>Price elasticities of imports and exports are larger than what are expected. But income elasticities are low for both imports and exports.</td>
</tr>
<tr>
<td>Marquez and Mc Neilly (1988)</td>
<td>Non-opec countries based on the major SITC commodity groups</td>
<td>2SLS</td>
<td>Income elasticities between 1.4 and 1.9</td>
</tr>
<tr>
<td>Riedel (1988)</td>
<td>Hong Kong exports of manufactured goods</td>
<td>Equation is normalised for export price</td>
<td>Price elasticities is high and income elasticities is insignificant</td>
</tr>
<tr>
<td>Athukorala and Riedel (1990)</td>
<td>Korean exports of machinery tool</td>
<td></td>
<td>Price elasticities is high and income elasticities is insignificant</td>
</tr>
<tr>
<td>O'Neill and Ross (1991)</td>
<td>South Korea's aggregate exports to US, Japan and EC</td>
<td></td>
<td>Income elasticities of export demands are higher in the US.</td>
</tr>
<tr>
<td>Mustacelli, Stevenson and Montagna (1994)</td>
<td>Asian New Industrial Economies (NIEs)</td>
<td>Phillip-Hansen cointegration method</td>
<td>Stress that the intra-LDC competition is important</td>
</tr>
<tr>
<td>Faini, Clavijo and Semlali (1992)</td>
<td>23 Less Developed Countries</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
### Table 5.1: continued

<table>
<thead>
<tr>
<th>Muscatelli (1995a)</th>
<th>4 Asian NIEs to three areas of exports destination: US, Japan and EC</th>
<th>The estimated long run price and income elasticities of export demand to those three areas are different.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Muscatelli (1995b)</td>
<td>Six Asian (NIEs) System methods</td>
<td>Price elasticity of export demand for all countries are significant due to non-price factors</td>
</tr>
</tbody>
</table>
5.3 Analytical Framework

There are quite a number of studies that estimate trade equations for ASEAN. However, since there have been many economic changes in the world generally, and in Asia, in particular, a re-examination, using the latest data available, and employing the current econometric techniques, is essential. Therefore, the purpose of this section is to develop the following model of foreign trade in which all the methodological issues concerning the trade equation estimation will be taken into consideration:

**Long-run Export and Import Equations**

\[
\log Q_x^d = a_0 + a_1 \log (P_x/P_w) + a_2 \log Y_w + a_3 \log Gci_t + U_{xt} \tag{1}
\]

\[a_1 < 0, \ a_2 > 0, \ a_3 > 0\]

\[
\log Q_m^d = b_0 + b_1 \log (P_m/GP) + b_2 \log Y_{bt} + V_{mt} \tag{2}
\]

\[b_1 < 0, \ b_2 > 0\]

Where:

- \(Q_x\) = Exports of goods
- \(P_x\) = Price of exports
- \(P_w\) = Price of world exports
- \(Y_w\) = a scale variable
- \(Gci\) = Export composition index
- \(Q_m\) = Imports of goods
- \(P_m\) = Price of home country imports
- \(GP\) = General price level
- \(Y_{bt}\) = Real income of home country
- \(U_{xt}, V_{mt}\) = error terms
Following the same model that is frequently found in the literature, the quantity demanded is a function of relative price and income. These are the two important independent variables in demand for exports and imports equations. The prices of exports and imports are assumed to be exogenous, which follows from the small country assumption. As mentioned in the previous section, the simultaneity bias disappears as prices and the disturbances term, will no longer be correlated in the equation. The commonly used log linear functional form is employed instead of the linear one as it implies that the elasticities are constant.

Equation (1) is the demand for exports, which is dependent upon the relative price of exports with respect to the world price (Px/Pw), the scale variable (Yw) which captures world demand conditions and the export composition index (Gci). Homogeneity in prices is assumed to hold in the long run so that demand depends only on relative prices and the scale variable. The choice of scale variable may vary; some authors use (trade weighted) world income as a scale variable [Khan (1974), Goldstein and Khan (1978), Aspe and Giavazzi (1982), Marquez and McNelly (1988)] while others, e.g. Muscatelli et al. (1995), use trade weighted imports of the country's export destination as a scale variable. In this study, world income is used as a scale variable. The coefficients of $a_1$ and $a_2$ are the price and income elasticities of foreign demand for home country exports and are expected to be negative and positive respectively. The coefficient $a_3$ is expected to be positive.
Equation (2) is the import demand, which depends on the relative price of imports with respect to the general price level \((P_m/GP)\), and the real income of the home country \((Y_b)\). The coefficients \(b_1\) and \(b_2\) are expected to be negative and positive respectively.

5.4 Data and Estimation Method

5.4.1 List of Variables, their Description and Computations

\[Q_x = \text{Index of the volume of exports (1990=100)}\]

\[Q_m = \text{Index of the volume of imports (1990=100)}\]

\[P_x = \text{Index of the unit value of exports (1990=100)}\]

\[P_m = \text{Index of the unit value of imports (1990=100)}\]

\[GP = \text{The domestic price level, measured by each country's consumer price index (1990=100)}\]

\[Y_b = \text{Nominal GNP deflated by domestic price level}\]

\[P_w = \text{index of the world export price (1990=100)}\]

\[Y_w = \text{the index of the world income (1990=100)}\]

\[GCI = \text{Export Composition Index (1990=100)}\]

The study uses the annual data for the period of 1963-1995. The computations of these variables appear in Appendix A.1.
5.4.2 A Review of Cointegration and Error Correction Mechanism (ECM)

Basically, the concept of cointegration simply suggest that although the two variables are nonstationary, they may still be moving together in time, meaning that a linear combination of those two variables might be stationary. In other words, although the two variables are nonstationary, there might still be a “genuine” long run relationship between them.

There are quite a number of studies that survey or discuss the issue of cointegration. In fact, many recent econometrics textbooks now discuss the concept of cointegration [see Madalla (1992), Thomas (1993), Davidson and MacKinnon (1993), Greene (1993), Hamilton (1994)]. The concept of cointegration is discussed in detail in several econometric books for example Banerjee et.al (1993), Charemza and Deadman (1992) - especially in chapter 5. In addition, selected papers on cointegration are published which are edited by Engle and Granger (1991).

The cointegration analysis has become a useful technique in empirical macroeconomics, to model, or estimate, the long-run relationship for time series data. Thus, with the cointegration analysis, one can use nonstationary data and the spurious results are avoided. In short, the analysis provides an effective framework for testing, estimating and modelling the long run relationship using time series data.
Cointegration

Two time series $X_t$ and $Y_t$ are co-integrated if

i) both time series are integrated of the same order.

ii) there is some linear combination of the two series which is integrated of order zero, that is stationary (i.e. $u_t = Y_t - \gamma X_t \sim I(0)$)

In practice, obviously the long run relationships often contain more than two variables and the problem becomes much more complicated. As pointed out by Charemza and Deadman (1992), if variables in a long run relationship are of a different order of integration, and the order of integration of the dependent variable is lower than the order of integration of the explanatory variables, then there should be at least two explanatory variables co-integrated of this highest order, if the necessary condition for stationarity of the error term is to be met. In addition, in the multivariate case there could be more than one stationary linear combination linking cointegrated variables.

Ordinary Least Squares estimates the cointegrating vector $\gamma$, and the OLS residual from the cointegrating regression is given as

$$\hat{u}_t = Y_t - \hat{\gamma}X_t$$

Cointegration implies that $\hat{u}_t \sim I(0)$ so that cointegration can be tested by testing the null hypothesis (of non-cointegration) that $u_t \sim I(1)$. The Dickey-Fuller test and the test based on the Durbin-Watson statistic that was proposed by Sargan and Bhargava (1983) can be used to test the hypothesis. The standard Dickey-Fuller tables are not
appropriate since $\tilde{u}_t$ is a generated variable. Appropriate tables are available in Engle-Granger (1987), MacKinnon (1991), etc.

Specifically, the DF/ADF tests for stationarity of the estimated residual is as follows;

**The Dickey-Fuller (DF) Test**

$$\Delta \tilde{u}_t = \eta \tilde{u}_{t-1} + \epsilon_t$$

Under the null hypothesis, $\eta = 0$. On the alternative hypothesis, $\eta < 0$, so that the $t$ test is performed to test whether $\eta$ is significantly less than zero. The $t$ statistic on $\eta$ is the DF statistic.

**The Augmented Dickey-Fuller (ADF) Test**

$$\Delta \tilde{u}_t = \eta \tilde{u}_{t-1} + \sum_{i=1}^{k} \phi_i \Delta \tilde{u}_{t-i} + \epsilon_t$$

Under the null hypothesis, $\eta = 0$. On the alternative hypothesis, $\eta < 0$, so that the $t$ test is performed to test whether $\eta$ is significantly less than zero. The $t$ statistic on $\eta$ is the ADF statistic and has the same distribution as the DF statistic.

The Cointegrating Regression Durbin-Watson (CRDW) can also be used to test the null that $\eta = 0$. Under the null hypothesis of non-cointegration, the CRDW $= 0$ and on the alternative hypothesis of cointegration, CRDW $> 0$. 
Similar to the DW statistic, the CRDW is computed as:

$$CRDW = \frac{\sum (\hat{u}_t - \hat{u}_{t-1})^2}{\sum \hat{u}_t^2}$$

where $\hat{u}_t$ is the estimated OLS residual from the cointegrating regression. The critical values for the CRDW test can be found in table 2 of Engle and Granger (1987) and in table 4 of Engle and Yoo (1987). A useful rule of thumb suggested by Banerjee et.al (1987), is that if $CRDW < R^2$ is indicating of non-cointegration.

Cointegration and Error Correction Mechanism

There are two main methods for estimating cointegrating relationships suggested in the literature: the Engle-Granger two-step approach and the Johansen approach.

The most widely used procedure is the Engle-Granger (EG) type of static long run regression. However, the estimated parameters in the static long run OLS are subject to bias in small samples since the lagged terms are ignored (see Banerjee et.al). One way to correct this problem is to include dynamic components (i.e. differences and lagged) to the cointegrating regression. [see Wickens and Breusch (1988), Phillips and Loretan (1991), Saikkonen (1991), Charemza and Deadman (1992), Cuthbertson et.al (1992)]. Other econometricians have suggested correcting the bias by appropriate corrections and modifications to the static parameter estimates [see Engle and Yoo (1991), Phillip and Hansen (1990), Park and Phillips (1988), West (1988)].
The second main method, due to Johansen (1988, 1991) and Johansen and Juselius (1990), is a system based approach which enables one to determine the number of existing cointegrating relationships in the variables.

A detailed analysis of cointegration and error correction mechanism can also be found in Hylleberg and Mizon (1989). Meanwhile a variety of ways of presenting the cointegrated system, with emphasis on the error correction model representations, is given by Phillips and Loretan (1991). These models have become the most common approach in incorporating the economic theory relating to the long-run relationship between variables and the short run disequilibrium behaviour.

**Engle-Granger Two-Stage Procedure**

This method has been used widely in the literature. It was originally introduced by Engle and Granger (1987), where they suggest that the estimation should take place in two stages.

In the first stage, all dynamics are ignored and the long run parameters are estimated by OLS. By using all the relevant tests described in the previous sections, let us assume that the variables in question are found to be cointegrated. Now the second stage can proceed.

In the second stage, a short run model with an error-correction mechanism (ECM) by the OLS is estimated. The Granger Representation Theorem (GRT), states that if a pair of variables are cointegrated, there will exist an ECM relating these variables.
Given the long run cointegrating relationship:

\[ Y_t = \gamma X_t + u_t \]

The simple ECM can be written as

\[ \Delta Y_t = \lambda_1 \Delta X_t + \lambda_2 (Y - \gamma X)_{t-1} + \varepsilon_t \]

where \( \varepsilon_t \) is an error term, \( \theta_t \) is the ECM term. At this stage the estimated \( \lambda_2 \) and other short run parameters are obtained. It is also permissible to include the first differences of other I(1) variables that do not appear in the long run relationship; meaning that these variables affect \( Y \) only in the short run. The estimated \( \lambda_2 \) in this short run equation should be negative and statistically significant, as this is the necessary condition for the variables to be co-integrated. Combining the two steps will provide a model incorporating both the long run and the dynamic short run components.\(^{11}\)

Nevertheless, the Engle-Granger two-stage procedure has been criticised for small sample bias present in the OLS estimation of the cointegrating equation. This bias is carried over into the second stage, (i.e. the disequilibrium error) estimates of the short run parameter. An additional problem arises when dealing with three or more series since there can be more than one cointegrating vector and the Engle-Granger procedure can only identify a single vector. Another shortcoming of the OLS is that, due to non-normality of the distribution of the estimators of the cointegrating vector, no sensible judgement can be made about the significance of the parameter.

The dynamic OLS (DOLS) can be applied. The potential of simultaneity bias and small sample bias among regressors is dealt with the inclusive of lagged and led
values of the first differences of the I(1) variables.[see Phillips and Lorestan (1991) and Saikkonen(1991)]. The robust standard errors facilitate valid inference to be made upon the coefficients of the variables entering as regressors in levels.

Based on this model, the long run export demand and import demand equations are as follows;

**Long-run exports demand**

\[ Z = (a_0, a_1, a_2, a_3), X = [1, (p_x/p_w), (Y_w), (G_c)] \]

\[ Q_{x_t} = z'x_t + \sum_{j=-m}^{m} \alpha_j \Delta(p_x/p_w)_{t-j} + \sum_{j=-n}^{n} \beta_j \Delta Y_w_{t-j} + \sum_{j=-p}^{p} \lambda_j \Delta G_c_{t-j} + \nu x_t \]

**Long-run imports demand.**

\[ Z = (b_0, b_1, b_2), X = [1, (p_m/g_p), (Y_b)] \]

\[ Q_{m_t} = z'x_t + \sum_{j=-m}^{m} \delta_j \Delta(p_m/g_p)_{t-j} + \sum_{j=-k}^{k} \eta_j \Delta Y_b_{t-j} + \nu m_t \]

Since an investigation of the short run dynamics are also of interest in this analysis as a comparison to a long-run estimations, and important for several other factors of modelling, the VECM is also employed in facilitating inferences regarding the short run.
As demonstrated by Engle and Granger, once a number of variables are found to be cointegrated, there always exists a corresponding error-correction representation which implies that changes in the dependent variable are a function of the level of disequilibrium in the cointegrating relationship, which captured by the error correction term, as well as changes in other explanatory variables.

The general vector error-correction for export demand with

\[ Z = (a_0, a_1, a_2, a_3); X = [1, (px/pw), (Yw), (Gci)] \]

\[ \Delta Q_x_t^d = \sum_{j=1}^{r} \phi_j \Delta Q_{x,-j}^d + \sum_{j=0}^{m} \alpha_j \Delta (px/pw)_{t,-j} + \sum_{j=0}^{n} \beta_j \Delta (Yw)_{t,-j} + \sum_{j=0}^{p} \lambda_j \Delta Gci_{t,-j} + \sum_{j=1}^{r} \mu \Delta (Q_{x,-j}^d - Z'X_{t-1}) + \epsilon_t \]

And the general VECM for import demand with

\[ Z = (b_0, b_1, b_2); X = [1, (pm/gp), (Yb)] \]

\[ \Delta Q_m_t^d = \sum_{j=1}^{r} \phi_j \Delta Q_{m,-j}^d + \sum_{j=0}^{l} \delta_j \Delta (pm/gp)_{t,-j} + \sum_{j=0}^{k} \pi_j \Delta Yb_{t,-j} + \sum_{j=1}^{r} \nu \Delta (Q_{m,-j}^d - Z'X_{t-1}) + \epsilon_t \]

When the variables are cointegrated, then in the short term, deviations from this long-term equilibrium will feed back on the changes in the dependent variable in order to force the movement towards the long-term equilibrium. In other words if the dependent variable is driven directly by this long-term equilibrium error, then it is responding to this feedback. The short-term effect is reflected by the significance tests of the ‘differenced’ explanatory variables.
Johansen – Maximum Likelihood Approach (VAR model)

The Johansen (1991) method is the most widely used procedure for estimating multivariate cointegrating systems. Assume that the vector of variables $Z$ has the following VAR representation;

$$Z_t = \sum_{i=1}^{k} A_i Z_{t-i} + \varepsilon_t$$

where $Z_t$ consists all $n$ variables of the model and $\varepsilon_t$ is a vector of random errors. This model can be reformulated into a vector error-correction (VECM) form as follows;

$$\Delta Z_t = \sum_{i=1}^{k-1} \Gamma_i \Delta Z_{t-i} + \Pi Z_{t-k} + \varepsilon_t$$

where $\Gamma_i = -(I - A_1 - ... - A_i)$ (i=1,...,k-1)

$\Pi = -(I - A_1 - ... - A_k)$

Johansen (1988, 1991, 1996) and Johansen and Juselius (1992) base a test for cointegration on the rank of the $\Pi$ matrix. When the $\Pi$ matrix has a full rank equal to $n$, then it can be shown that $Z$ must be stationary. If the rank of $\Pi$ is zero, then $\Pi$ is a null matrix and there is no cointegration. If the rank of $\Pi$ is equal to $r<n$ then $\Pi$ can be written as the product of two matrices, $\alpha$ and $\beta$, i.e. $\Pi = \alpha \beta$ in which the cointegrating space is defined by $\beta$ and the adjustment factors are defined by $\alpha$. This parameterization separates out the short run adjustment and long run equilibrium. The
\( \Pi \) matrix contains information on the long run relationship; \( \Pi = \alpha \beta \) where \( \alpha \) is the speed of adjustment to disequilibrium, and \( \beta \) is a matrix of the long run coefficients.

The Johansen approach provides direct estimates of the cointegrating vectors and allows testing the numbers of cointegrating vectors. In a VAR model explaining \( N \) variables there can be at most \( r = N-1 \) cointegrating vectors. Generally, the statistical properties of the Johansen approach are much better and the cointegrating test is of high power compare to the Engle-Granger method.

In practice, the Johansen approach also has a few disadvantages. First, if the sample size is small, the estimates obtained for cointegrating vector \( \beta \) may not be well determined. Second, if the cointegrating vector is not a unique one, there will be an identification problem and it may be difficult to disentangle economically meaningful cointegrating vectors. As a consequence, a strategy is to use both approaches and compare the results.
5.4.3 Preliminary Data Analysis

Since the time series data is used, the issue of nonstationarity can be a major problem for the empirical econometrics analysis where most macroeconomic time series are subject to some type of trend. By using MICROFIT 4.0 version, data for all countries is tested to see whether all variables are non stationary.

Specifically, the relevant tests for integration level can be examined in several ways; i.e. the Integration Durbin Watson (IDW) statistics test and regression-based t tests i.e. the Dickey-Fuller (DF) and Augmented Dickey-Fuller tests. [See Dickey and Fuller (1979)]. The regression based-t tests and the DF tests have received much attention in the applied econometric literature, therefore, both the Dickey-Fuller (DF) and an Augmented Dickey-Fuller (ADF) test are used in this study. These are both t tests and rely on rejecting the hypothesis that the series is a random walk in favour of stationarity. The first step in our empirical analysis is then to test the order of integration of all variables.
Table 5.2: The DF/ADF Test for Unit Roots (Export)

<table>
<thead>
<tr>
<th>Variables</th>
<th>Levels</th>
<th>1st Differences</th>
</tr>
</thead>
<tbody>
<tr>
<td>Country</td>
<td>DF ADF(1)</td>
<td>DF ADF(1)</td>
</tr>
<tr>
<td>Malaysia</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Q_x^a</td>
<td>-1.4475</td>
<td>-1.3313</td>
</tr>
<tr>
<td>Px/Pw</td>
<td>-1.8852</td>
<td>-2.3029</td>
</tr>
<tr>
<td>Yw</td>
<td>-3.0719</td>
<td>-3.1144</td>
</tr>
<tr>
<td>Gci</td>
<td>-2.2639</td>
<td>-1.9793</td>
</tr>
<tr>
<td>Indonesia</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Q_x^d</td>
<td>-0.7810</td>
<td>-3.2414</td>
</tr>
<tr>
<td>Px/Pw</td>
<td>-0.8934</td>
<td>-1.3512</td>
</tr>
<tr>
<td>Yw</td>
<td>-1.4669</td>
<td>-2.1276</td>
</tr>
<tr>
<td>Thailand</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Q_x^a</td>
<td>-1.7780</td>
<td>-1.7399</td>
</tr>
<tr>
<td>Px/Pw</td>
<td>-1.6544</td>
<td>-1.9116</td>
</tr>
<tr>
<td>Yw</td>
<td>-3.2107</td>
<td>-2.1688</td>
</tr>
<tr>
<td>Gci</td>
<td>-2.8161</td>
<td>-3.0014</td>
</tr>
<tr>
<td>Philippines</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Q_x^a</td>
<td>-1.7027</td>
<td>-2.2053</td>
</tr>
<tr>
<td>Px/Pw</td>
<td>-1.3380</td>
<td>-1.8139</td>
</tr>
<tr>
<td>Yw</td>
<td>-3.8837</td>
<td>-2.9312</td>
</tr>
<tr>
<td>Gci</td>
<td>-3.2397</td>
<td>-2.5257</td>
</tr>
</tbody>
</table>

Notes to table: All variables are in log. Variables are as follows; total export index (Q_x^a), relative price (Px/Pw), a weighted (by the share of exports) average of the trade partners GDP (Yw) and export composition index (Gci). Critical value is -3.551. All econometric computations have been carried out by Microfit 4.0 Version [see Pesaran and Pesaran (1997)]. In most of the cases, the intercept terms are included in the relevant DF and ADF equations. An augmentation of one seems to sufficient to secure lack of autocorrelation of the error terms, however, in some cases, no augmentation was necessary.
The DF/ADF test for the unit roots for both export and import equations for all countries are shown in table 5.2 and table 5.3.

Table 5.3: The DF/ADF Test for Unit Roots (Import)

<table>
<thead>
<tr>
<th>Variables</th>
<th>Levels</th>
<th>1st Differences</th>
</tr>
</thead>
<tbody>
<tr>
<td>Country</td>
<td>DF</td>
<td>ADF(1)</td>
</tr>
<tr>
<td>Malaysia</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Qm</td>
<td>-0.5268</td>
<td>-0.5636</td>
</tr>
<tr>
<td>Pm/Gp</td>
<td>-1.3794</td>
<td>-1.9296</td>
</tr>
<tr>
<td>Yb</td>
<td>-1.4940</td>
<td>-2.0916</td>
</tr>
<tr>
<td>Indonesia</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Qm</td>
<td>-1.7411</td>
<td>-2.5599</td>
</tr>
<tr>
<td>Pm/Gp</td>
<td>-3.1421</td>
<td>-1.2691</td>
</tr>
<tr>
<td>Yb</td>
<td>-1.3572</td>
<td>-1.8071</td>
</tr>
<tr>
<td>Thailand</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Qm</td>
<td>-0.7757</td>
<td>-1.5146</td>
</tr>
<tr>
<td>Pm/Gp</td>
<td>-1.0663</td>
<td>-1.8596</td>
</tr>
<tr>
<td>Yb</td>
<td>-1.6134</td>
<td>-2.5190</td>
</tr>
<tr>
<td>Philippines</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Qm</td>
<td>-0.8426</td>
<td>-0.7381</td>
</tr>
<tr>
<td>Pm/Gp</td>
<td>-0.6882</td>
<td>-0.7704</td>
</tr>
<tr>
<td>Yb</td>
<td>-1.4304</td>
<td>-1.8214</td>
</tr>
</tbody>
</table>

Notes to table: All variables are in log
Variables are as follows; total import index (Qm), relative price (Pm/Gp) and the real income (Yb).
Critical value is -3.551
All econometric computations have been carried out by Microfit 4.0 Version [see Pesaran and Pesaran (1997)]. In most of the cases, the intercept terms are included in the relevant DF and ADF equations. An augmentation of one seems to sufficient to secure lack of autocorrelation in the error terms, however, in some cases, no augmentation was necessary.
As can be seen in table 5.2 (exports) and table 5.3 (imports), none of the calculated values are less than the critical values. All variables are I (1) in levels but stationary in first differences. Since all variables in export and import demand equations are integrated of order one, we can proceed with the estimation for the long run relationship.

5.5 Estimation and Results

5.5.1 Testing for Cointegration

5.5.1.1 The OLS Residual-Based Test

Table 5.4 reports the ADF residual based test results for cointegration for the export demand equations. Charemza and Deadman (1992)- Table 2, provide approximate critical values for the cointegration test for 30 observations with m=3 at 5% level of significance which are -3.71 (lower bound) and -3.50 (upper bound). Specifically, one would reject the null hypothesis of no cointegration if the value was below -3.71; and would not reject the null if the value were above -3.50. Values between -3.71 and -3.50 lie in the inconclusive region. Therefore, based on the test statistics, for the case of Malaysia and Indonesia, the null hypothesis of no cointegration for the corresponding residual obtained from the long run export demand equation, can be rejected at 5% level of significance.
Table 5.4: ADF Residual-based Test for Cointegration
The Long-run Export Equations

<table>
<thead>
<tr>
<th></th>
<th>Test Statistics</th>
<th>Critical Values*</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>DF</td>
<td>ADF(1)</td>
</tr>
<tr>
<td>Malaysia</td>
<td>4.24</td>
<td>-4.33</td>
</tr>
<tr>
<td>Indonesia</td>
<td>-2.67</td>
<td>-3.90</td>
</tr>
<tr>
<td>Thailand</td>
<td>-3.58</td>
<td>-3.64</td>
</tr>
</tbody>
</table>

Notes to table:
*The critical values are obtained from Charemza and Deadman (1992) with 30 numbers of observation and m=3. One also can refer to other sources of critical value tables i.e MacKinnon (1991), Engle-Granger (1987, Table II and III), Engle and Yoo (1987)

However, for Thailand long run export demand equation, the corresponding residual obtained from the equation is in the ‘inconclusive region’ at 5% level of significance although the null of no cointegration can be rejected at 10% level of significance. For the case of Philippines the null of no cointegration can also be rejected at 10% level of significance.

For the import demand equation, one can reject the null hypothesis of no cointegration at 5% level of significance for the case of Malaysia and Indonesia. For the Philippines, one can reject the null hypothesis of no cointegration at 10% level of significance. For Thailand, the corresponding residual obtained from the equation is slightly below the upper bound critical value. However, it is assumed that all variables are cointegrated as the standard tests are over-cautious in rejection of the null hypothesis of no cointegration. This emphasizes type 1 error whereas type 2 error i.e. failing to reject the null when it is false, is more important here. Consequently, we should be generous in interpreting the statistics. Accordingly, all variables involved in
the equations are cointegrated, or, in short, the long run relationships among variables are not spurious. This is shown in Table 5.5.

**Table 5.5: ADF Residual-based Test for Cointegration**

**The Long-run Import Equations**

<table>
<thead>
<tr>
<th>Test Statistics</th>
<th>Critical Values*</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>DF ADF(1)</td>
</tr>
<tr>
<td>Malaysia</td>
<td>-2.99 -3.69</td>
</tr>
<tr>
<td>Indonesia</td>
<td>-2.13 -3.29</td>
</tr>
<tr>
<td>Thailand</td>
<td>-1.79 -2.34</td>
</tr>
<tr>
<td>Philippines</td>
<td>-1.89 -2.80</td>
</tr>
</tbody>
</table>

Notes to table:

*The critical values are obtained from Charemza and Deadman (1992) with 30 numbers of observation and m=2. One also can refer to other sources of critical value tables i.e MacKinnon (1991), Engle-Granger (1987, Table II and III), Engle and Yoo (1987)*

The CRDW is used to see whether all the variables are cointegrated. Engle and Yoo, provide a CRDW critical value for n=50; the two variables case is 0.78 at 5 percent level of significance and 0.69 at 10 percent level of significance. By looking at the CRDW test statistics, the value of CRDW for Malaysia’s export demand is 1.42, Indonesia: 0.91; Thailand: 0.92 and the Philippines: 1.34. These are all larger than the 5% critical values and therefore the null of no cointegration is rejected.
5.5.1.2 The DOLS

The dynamic OLS parameter estimates of the long-run export demand with all variables in levels, along with their approximate asymptotic standard errors for all countries are presented in Table 5.6. Based on the results obtained, for most cases both the long run income and price elasticities have correct signs as anticipated. The long run income elasticities vary from 0.15 (Philippines) to 1.37 (Thailand). In all cases, they are significant. The long-run price elasticities vary from -0.26 (Indonesia) to -2.41 (Thailand). The export composition index is included, however it is only significant for Malaysia, and so is dropped for the other three countries.

Table 5.6: The DOLS Export Demand Equations (long run)

<table>
<thead>
<tr>
<th>Country</th>
<th>Px/Pw</th>
<th>Yw</th>
<th>Gci</th>
<th>ser</th>
<th>R²</th>
</tr>
</thead>
<tbody>
<tr>
<td>Malaysia</td>
<td>-0.35</td>
<td>0.21</td>
<td>1.69</td>
<td>0.05</td>
<td>0.99</td>
</tr>
<tr>
<td></td>
<td>(0.0646)</td>
<td>(0.0621)</td>
<td>(0.1715)</td>
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</tr>
<tr>
<td>Indonesia</td>
<td>-0.26</td>
<td>0.53</td>
<td>-</td>
<td>0.12</td>
<td>0.96</td>
</tr>
<tr>
<td></td>
<td>(0.1076)</td>
<td>(0.0488)</td>
<td></td>
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</tr>
<tr>
<td>Thailand</td>
<td>-2.41</td>
<td>1.37</td>
<td>-</td>
<td>0.12</td>
<td>0.98</td>
</tr>
<tr>
<td></td>
<td>(0.3911)</td>
<td>(0.0723)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
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<td>-</td>
<td>0.12</td>
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</tr>
<tr>
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<td>(0.0656)</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

The price elasticities in the import demand equations are correctly signed and are significant. The long run price elasticity of import demand vary from -0.27 (Philippines) to -1.50 (Thailand). The income variable was also correctly signed and significant for all cases. The long run income elasticities vary from 0.35 (Philippines) to 0.90 (Malaysia). Table 5.7 reports the result for import demand equations that show the correct sign for both the income and price elasticities.
Table 5.7: The DOLS Import Demand Equations (long run)

<table>
<thead>
<tr>
<th>Country</th>
<th>Pm/Gp</th>
<th>Yb</th>
<th>Ser</th>
<th>R²</th>
</tr>
</thead>
<tbody>
<tr>
<td>Malaysia</td>
<td>-1.24</td>
<td>0.90</td>
<td>0.24</td>
<td>0.93</td>
</tr>
<tr>
<td></td>
<td>(0.858)</td>
<td>(0.1169)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Indonesia</td>
<td>-0.41</td>
<td>0.46</td>
<td>0.14</td>
<td>0.96</td>
</tr>
<tr>
<td></td>
<td>(0.1974)</td>
<td>(0.0996)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Thailand</td>
<td>-1.50</td>
<td>0.70</td>
<td>0.09</td>
<td>0.98</td>
</tr>
<tr>
<td></td>
<td>(0.1505)</td>
<td>(0.0215)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Philippines</td>
<td>-0.27</td>
<td>0.35</td>
<td>0.15</td>
<td>0.88</td>
</tr>
<tr>
<td></td>
<td>(0.0898)</td>
<td>(0.069)</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

The Short run Elasticities (ECM).

The vector error-correction model estimates the short-run parameters. As can be seen from table 5.8, (for both exports and imports equations), the coefficients appear to have the predicted signs and for most cases they are statistically significant. Based on the results, several points can be made. First, the statistical significance and magnitude of the error correction term indicates that the relative price and income (export composition index for the Malaysian case) do, as a component of the long-run cointegrating relationship through the lagged error correction term, jointly influence export demand over the long-term. Second, the error correction term is significant with an adjustment coefficient of -0.53839 (i.e. Export demand – Malaysian case), indicates that in the case we are off the long-run demand curve, overall demand adjusts to its long-run equilibrium level with about 53.8% of the adjustment taking place within the first year.

The sign of the error correction term coefficient indicates that changes in the demand adjust in an opposite direction to the previous period’s deviation from equilibrium. If the error correction term is not significant, this implies that in this estimated model,
any short-run adjustment to long term equilibrium is primarily through the other variables in the system and not through the channel of export demand. The error correction model estimates provide a quantitative assessment of the short-run price and income elasticity of exports and imports demand. For example, the short-run price and income elasticities of export demand for Thailand are -0.205 and 0.388 respectively.

The diagnostic tests for both exports and imports demand for all countries are also acceptable. For example, the p-value for the LM-F test of the null of no autocorrelation for Malaysia's export demand is 0.62, therefore we do not reject the null of no autocorrelation. Similarly, for Indonesia's export demand, the p-value for the LM-F test of the null of no autocorrelation is 0.35, thus we do not reject the null of no autocorrelation. There is also no evidence of non-normality or functional misspecification for all countries.
Table 5.8: The Short-run Estimated Export and Import Demand (ECM)

**Malaysia**

**Export**

\[
\Delta Q_{xt} = 0.014 - 0.1735 \Delta (lpx/pw)_t + 0.329 \Delta yw_t - 0.1803 \Delta G_{ct} + 0.181 \Delta Q_{xt-1}
\]

\[
(0.0883) \quad (0.1579) \quad (0.1949) \quad (0.1344)
\]

\[-0.538 U_{t-1} + \varepsilon_t \]

(0.1165)

\[R^2 = 0.71\]

\[S.E. of Regression = 0.06\]

\[DW-Statistic = 2.03\]

\[F\text{ stat (5,25)} = 12.23\]

\[LM - F (1,24) = 0.246 (0.62)\]

\[RESET - F (1,24) = 0.229 (0.64)\]

\[Normality CH-SQ(2) = 1.973 (0.37)\]

\[Heteroscedasticity F-(1,29) = 0.003 (0.96)\]

**Import**

\[
\Delta Q_{mt} = -3.744 - 1.219 \Delta (lpm/gp)_t + 1.188 \Delta yb_t + 0.454 \Delta Q_{mt-1} - 0.750 U_{t-1} + \varepsilon_t
\]

\[(0.599) \quad (0.356) \quad (0.178) \quad (1894)\]

\[R^2 = 0.48\]

\[S.E. of Regression = 0.18\]

\[DW-Statistic = 1.69\]

\[F\text{ stat (4,25)} = 5.77\]

\[LM - F (1,24) = 1.35 (0.26)\]

\[RESET - F (1,24) = 1.53 (0.23)\]

\[Normality CH-SQ(2) = 31.72\]

\[Heteroscedasticity F-(1,28) = 0.20 (0.66)\]

**Indonesia**

**Export**

\[
\Delta Q_{xt} = -0.228 - 0.292 \Delta (lpx/pw)_t + 1.27 \Delta yw_t - 0.348 U_{t-1} + \varepsilon_t
\]

\[(0.167) \quad (0.3392) \quad (0.1166)\]

\[R^2 = 0.44\]

\[S.E. of Regression = 0.11\]

\[DW-Statistic = 1.69\]

\[F\text{ stat (3,27)} = 7.03\]

\[LM - F (1,29) = 0.92 (0.35)\]

\[RESET - F (1,27) = 4.30 (0.05)\]

\[Normality CH-SQ(2) = 2.73 (0.26)\]

\[Heteroscedasticity F-(1,29) = 1.67 (0.21)\]
Import

\[ \Delta Q_{m}^d = 0.04 - 0.294(lpm/gp)_t + 0.476\Delta y_{bt} + 0.56\Delta Q_{m-1}^d - 0.58U_{t-1} + \varepsilon_t \]

\[ R^2 = 0.61 \]

\[ \text{S. E of Regression} = 0.10 \]

\[ \text{DW- Statistic} = 2.19 \]

\[ \text{F stat (4,21)} = 8.425 \]

\[ \text{LM - F (1,19)} = 0.67 (0.42) \]

\[ \text{RESET - F (1,19)} = 7.84 (0.10) \]

\[ \text{Normality CH-SQ(2)} = 1.26 (0.32) \]

\[ \text{Heteroscedasticity F-(1,24)} = 1.15 (0.29) \]

Thailand

Export

\[ \Delta Q_{x}^d = 0.09 - 0.205A(lpx/pw)_t + 0.388\Delta y_{wt} + 0.723\Delta (lpx/pw)_{t-1} - 0.29 U_{t-1} + \varepsilon_t \]

\[ R^2 = 0.30 \]

\[ \text{S. E of Regression} = 0.08 \]

\[ \text{DW- Statistic} = 1.83 \]

\[ \text{F stat (4,25)} = 2.64 \]

\[ \text{LM - F (1,24)} = 0.13 (0.72) \]

\[ \text{RESET - F (1,24)} = 0.47 (0.98) \]

\[ \text{Normality CH-SQ(2)} = 1.27 (0.53) \]

\[ \text{Heteroscedasticity F-(1,28)} = 1.32 (0.26) \]

Import

\[ \Delta Q_{m}^d = -0.019 - 1.402A(lpm/gp)_t + 1.225\Delta y_{bt} + 0.935\Delta y_{bt-1} - 0.508U_{t-1} + \varepsilon_t \]

\[ R^2 = 0.62 \]

\[ \text{S. E of Regression} = 0.07 \]

\[ \text{DW- Statistic} = 1.88 \]

\[ \text{F stat (4,24)} = 9.916 \]

\[ \text{LM - F (1,23)} = 0.03 (0.86) \]

\[ \text{RESET - F (1,23)} = 3.70 (0.10) \]

\[ \text{Normality CH-SQ(2)} = 0.99 (0.61) \]

\[ \text{Heteroscedasticity F-(1,27)} = 0.04 (0.83) \]
Philippines

Export

\[ \Delta lQ_{Ix_t} = 0.396 - 0.646 \Delta (lpx/pw) + 0.520 \Delta lyw_t - 0.1414 U_{t-1} + \varepsilon_t \]

\( R^2 = 0.51 \)

S. E of Regression = 0.10

DW- Statistic = 1.73

F stnt (3,26) = 9.21

LM- F (1,25) = 0.09 (0.77)  RESET -F (1,25) = 0.16 (0.70)

Normality CH-SQ(2) = 0.07 (0.97)  Heteroscedasticity F-(1,28) = 0.32 (0.58)

Import

\[ \Delta lQ_{mt} = -0.025 - 0.294 \Delta (lpm/gp) + 0.494 \Delta lyb_t + 0.428 \Delta Qm_{d,1} - 0.582 U_{t-1} + \varepsilon_t \]

\( R^2 = 0.58 \)

S. E of Regression = 0.09

DW- Statistic = 1.49

F stnt (4,24) = 8.60

LM- F (1,23) = 1.23 (0.28)  RESET -F (1,23) = 0.28 (0.61)

Normality CH-SQ(2) = 1.01 (0.60)  Heteroscedasticity F-(1,27) = 0.13 (0.73)
5.5.2 The Johansen Maximum Likelihood Approach (VAR)

The Basic Steps of the Johansen Procedure.

First by using the Augmented Dickey Fuller Test with a constant and time trend, the order of integration of each variable in the multivariate model is tested. Second, by restricting the intercept in the long-run model, the model is specified whether it should include intercept and the time trend. Third, the lag length should be determined. The lag length is selected for each country by using the Schwarz Baryesian Criterion (SBC) and Akaike Information Criterion (AIC). Fourth, the number of cointegrating vectors is tested. This can be done by testing for reduced rank, finding the presence of \( r < (n-1) \) cointegrating vectors in \( \beta \), which means finding the number of \( r \) linearly independent columns in \( \Pi \). This method uses a reduced rank regression which provides \( n \) eigenvalues \( \lambda_1 > \lambda_2 > \ldots > \lambda_n \) and their corresponding eigenvectors. The null hypothesis that there are at most \( r \) cointegration vectors can be tested using the likelihood ratio test (the trace statistic).

\[
\lambda_{trace} = -2 \log(Q) = -T \sum_{i=r+1}^{n} \log(1 - \lambda_i)
\]

where \( r = 0,1,2,\ldots,n-2,n-1 \)

\( Q \) is the restricted likelihood divided by unrestricted maximised likelihood. Another test of significance of the largest \( \lambda \) is the maximal eigenvalue (\( \lambda \)-max-statistic), which is
\[ \lambda_{\text{max}} = -T \log(1 - \lambda_{r,t}) \]
where \( r = 0,1,2,\ldots,n-2,n-1 \)

Fifth, estimates and inference for the parameters of the cointegrating vector. After determining the number of cointegration vectors, try and interpret them in the structural economic relationships underlying the long-run model.

**Specification of the Cointegrating VAR Model.**

Information from the unrestricted VAR model in Microfit 4 was used to determine the order of the VAR for all the countries. The Schwarz Bayesian Criterion (SBC), and the Akaike Information Criterion (AIC) were used to determine the optimal lag length. For Malaysia, \( k = 2 \); Indonesia, \( k = 1 \); Thailand, \( k = 2 \); the Phillipines, \( k = 1 \). (For the exports demand).

The log-likelihood ratio statistics were then used for testing zero restrictions on the coefficients of a subset of deterministic/exogenous variable. In all cases, the presence of an intercept could not be rejected.

The results of the Johansen Juselius cointegration tests for all countries are shown in Table 5.9. The trace statistic and the eigenvalue (maximum) test show that there exists only one cointegrating relationship for all the cases.
Table 5.9: The Johansen Maximum Likelihood
Cointegration Test - Exports

Malaysia: Cointegration with Unrestricted Intercepts and No Trends in the VAR
(k=2)

<table>
<thead>
<tr>
<th>Eigenvalue</th>
<th>$\lambda_{\text{max}}$</th>
<th>$\lambda_{\text{Trace}}$</th>
<th>$H_0 = r$</th>
<th>$H_A = P-r$</th>
<th>Critical Value</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>0.70729</td>
<td>39.31401</td>
<td>55.1817</td>
<td>0</td>
<td>1</td>
<td>27.42</td>
</tr>
<tr>
<td>0.26291</td>
<td>9.7613</td>
<td>15.8678</td>
<td>1</td>
<td>2</td>
<td>21.12</td>
</tr>
<tr>
<td>0.15325</td>
<td>5.3231</td>
<td>6.1064</td>
<td>2</td>
<td>3</td>
<td>14.88</td>
</tr>
<tr>
<td>0.0241842</td>
<td>0.78339</td>
<td>0.78339</td>
<td>3</td>
<td>4</td>
<td>8.07</td>
</tr>
</tbody>
</table>

Indonesia: Cointegration with Unrestricted Intercepts and No Trends in the VAR (k=1)

<table>
<thead>
<tr>
<th>Eigenvalue</th>
<th>$\lambda_{\text{max}}$</th>
<th>$\lambda_{\text{Trace}}$</th>
<th>$H_0 = r$</th>
<th>$H_A = P-r$</th>
<th>Critical Value</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>0.60813</td>
<td>29.9783</td>
<td>53.9768</td>
<td>0</td>
<td>1</td>
<td>27.42</td>
</tr>
<tr>
<td>0.43334</td>
<td>18.1758</td>
<td>23.9985</td>
<td>1</td>
<td>2</td>
<td>21.12</td>
</tr>
<tr>
<td>0.16377</td>
<td>5.7233</td>
<td>5.8228</td>
<td>2</td>
<td>3</td>
<td>14.88</td>
</tr>
<tr>
<td>0.031024</td>
<td>0.099431</td>
<td>0.099431</td>
<td>3</td>
<td>4</td>
<td>8.07</td>
</tr>
</tbody>
</table>

Thailand: Cointegration with Unrestricted Intercepts and No Trends in the VAR
(k=2)

<table>
<thead>
<tr>
<th>Eigenvalue</th>
<th>$\lambda_{\text{max}}$</th>
<th>$\lambda_{\text{Trace}}$</th>
<th>$H_0 = r$</th>
<th>$H_A = P-r$</th>
<th>Critical Value</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>0.65517</td>
<td>33.0058</td>
<td>39.6372</td>
<td>0</td>
<td>1</td>
<td>21.12</td>
</tr>
<tr>
<td>0.17991</td>
<td>6.1485</td>
<td>6.6315</td>
<td>1</td>
<td>2</td>
<td>14.88</td>
</tr>
<tr>
<td>0.015457</td>
<td>0.48291</td>
<td>0.48291</td>
<td>2</td>
<td>3</td>
<td>8.07</td>
</tr>
</tbody>
</table>
Philippines: Cointegration with Unrestricted Intercepts and No Trends in the VAR (k=1)

<table>
<thead>
<tr>
<th>Eigenvalue</th>
<th>$\lambda_{max}$</th>
<th>$\lambda_{trace}$</th>
<th>$H_0 = r$</th>
<th>$H_A = r$-r</th>
<th>Critical Value</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>95% L-max 95% trace</td>
</tr>
<tr>
<td>0.51959</td>
<td>21.2602</td>
<td>35.7503</td>
<td>0</td>
<td>1</td>
<td>27.42 45.70</td>
</tr>
<tr>
<td>0.25767</td>
<td>8.6410</td>
<td>14.4902</td>
<td>1</td>
<td>2</td>
<td>21.12 28.78</td>
</tr>
<tr>
<td>0.16226</td>
<td>5.1345</td>
<td>5.8492</td>
<td>2</td>
<td>3</td>
<td>14.88 15.75</td>
</tr>
<tr>
<td>0.024346</td>
<td>0.71476</td>
<td>0.71476</td>
<td>3</td>
<td>4</td>
<td>8.07 8.07</td>
</tr>
</tbody>
</table>
Table 5.10: The Johansen Maximum Likelihood Cointegration Test - Imports

Malaysia: Cointegration with Unrestricted Intercepts and No Trends in the VAR
(k=2)

<table>
<thead>
<tr>
<th>Eigenvalue</th>
<th>$\lambda_{max}$</th>
<th>$\lambda_{trace}$</th>
<th>$H_0 = r$</th>
<th>$H_A = P-r$</th>
<th>Critical Value</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>90% L-max</td>
</tr>
<tr>
<td>0.51084</td>
<td>22.17</td>
<td>27.83</td>
<td>0</td>
<td>1</td>
<td>19.02</td>
</tr>
<tr>
<td>0.15299</td>
<td>5.14</td>
<td>5.67</td>
<td>1</td>
<td>2</td>
<td>12.98</td>
</tr>
<tr>
<td>0.016594</td>
<td>0.52</td>
<td>0.52</td>
<td>2</td>
<td>3</td>
<td>6.5</td>
</tr>
</tbody>
</table>

Indonesia: Cointegration with Unrestricted Intercepts and No Trends in the VAR (k=2)

<table>
<thead>
<tr>
<th>Eigenvalue</th>
<th>$\lambda_{max}$</th>
<th>$\lambda_{trace}$</th>
<th>$H_0 = r$</th>
<th>$H_A = P-r$</th>
<th>Critical Value</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>90% L-max</td>
</tr>
<tr>
<td>0.48118</td>
<td>17.72</td>
<td>27.99</td>
<td>0</td>
<td>1</td>
<td>19.02</td>
</tr>
<tr>
<td>0.28714</td>
<td>9.14</td>
<td>10.28</td>
<td>1</td>
<td>2</td>
<td>12.99</td>
</tr>
<tr>
<td>0.041468</td>
<td>1.14</td>
<td>1.14</td>
<td>2</td>
<td>3</td>
<td>6.5</td>
</tr>
</tbody>
</table>

Thailand: Cointegration with Unrestricted Intercepts and No Trends in the VAR (k=2)

<table>
<thead>
<tr>
<th>Eigenvalue</th>
<th>$\lambda_{max}$</th>
<th>$\lambda_{trace}$</th>
<th>$H_0 = r$</th>
<th>$H_A = P-r$</th>
<th>Critical Value</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>90% L-max</td>
</tr>
<tr>
<td>0.62767</td>
<td>29.64</td>
<td>31.63</td>
<td>0</td>
<td>1</td>
<td>19.02</td>
</tr>
<tr>
<td>0.06386</td>
<td>1.98</td>
<td>1.99</td>
<td>1</td>
<td>2</td>
<td>12.98</td>
</tr>
<tr>
<td>0.3434E-3</td>
<td>0.0103</td>
<td>0.010304</td>
<td>2</td>
<td>3</td>
<td>6.5</td>
</tr>
</tbody>
</table>

Philippines: Cointegration with Unrestricted Intercept and No Trends in the VAR (k=2)

<table>
<thead>
<tr>
<th>Eigenvalue</th>
<th>$\lambda_{max}$</th>
<th>$\lambda_{trace}$</th>
<th>$H_0 = r$</th>
<th>$H_A = P-r$</th>
<th>Critical Value</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>90% L-max</td>
</tr>
<tr>
<td>0.46026</td>
<td>18.50</td>
<td>28.30</td>
<td>0</td>
<td>1</td>
<td>22.26</td>
</tr>
<tr>
<td>0.20704</td>
<td>6.96</td>
<td>9.80</td>
<td>1</td>
<td>2</td>
<td>16.28</td>
</tr>
<tr>
<td>0.090358</td>
<td>2.84</td>
<td>2.84</td>
<td>2</td>
<td>3</td>
<td>9.75</td>
</tr>
</tbody>
</table>
The Johansen likelihood ratio statistics were used to determine the number of cointegrating vectors \( r \). Both the maximal eigenvalue and the trace tests were used, testing the null hypothesis of \( r \) cointegrating vectors for \( r = 0 \), followed by \( r \leq 1 \) and \( r \leq 2 \).

For the export demand equation, in most cases the maximal eigenvalue test (\( \lambda \)-max test) indicates that the null hypothesis of zero cointegrating vectors is rejected at 95% critical value except for the case of the Philippines. [See Pesaran and Pesaran, Microfit 4 (1997)]. The trace test confirms that there is only one cointegrating relationship among the variables for all countries except for the case of the Philippines. However, based on the choice of the number of cointegrating relations using model selection criteria, both the Akaike Information Criteria (AIC) and the Hannan-Quinn Criteria (HQC) select one cointegrating relationship.

For the import demand equation, the maximal eigenvalue test and the trace test, indicate that the null hypothesis of zero cointegrating vectors is rejected at 90% critical value except for the case of the Philippines and Indonesia. Nevertheless, based on the choice of the number of cointegrating relations using model selection criteria, the Schwarz Bayesian Criteria (SBC) selects one cointegrating relationship for both the Philippines and Indonesia.
The estimation of the normalized cointegrating vector then is obtained as the existence of the relationship among the variables is accepted. This is shown in Table 5.11.

For most of the cases, the price and income elasticities of export demand are all correctly signed. In the Malaysian case, the long run price and income elasticities are -0.35 and 0.20 respectively. They are both statistically significant. The export composition index also has the predicted sign and is also significant with the value of 1.71. In the Indonesian case, the long run price and income elasticities are -0.3 and 0.67, respectively and both are statistically significant. For the case of Thailand, the price and income elasticities have the predicted sign and both are significant. The long run price elasticity is -2.69 and the long run income elasticity is 1.43. For the Philippines, the long run price elasticity is -0.25 and the long run income elasticity is 0.17. They are both correctly signed and significant.

A restriction is imposed on the export composition index (GCI) that \( a_4 = 0 \), obviously for the Malaysian case, the \( \chi^2 \) is statistically significant, and therefore the null hypothesis of no relationship between the export demand and the export composition index is rejected.
For the import demand equations, in all cases the price and income elasticities are all correctly signed and are significant (see table 5.11). These results suggest that both relative price and real income are crucial in determining import demand.

Comparison between the Engle-Granger Two-Step Method and the Johansen VAR approach can be seen in table 5.11. Previous empirical studies on exports demand, as discussed earlier, supported the conventional view which states that the price elasticities of exports demand are small. Results from the Engle-Granger two-step procedure then are inline with this conventional view. The low price and income elasticities of exports demand can be explained by the aggregate data used in this study.
Table 5.11: Comparison between Engle-Granger Two-Step Method and the Johansen VAR Approach.

<table>
<thead>
<tr>
<th>Country</th>
<th>Variables</th>
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5.6 Summary

Based on the analysis, one can observe the existence of cointegration among variables for both export and import demand. The results for exports and imports demand are reasonably good and both the price and income elasticity of exports and imports demand, have correct signs as anticipated. The inclusions of the export composition index in the export demand equation (i.e. Malaysian case) lower the value of the price elasticity. The commodity type effects are implicitly captured by the income and price effects if they are not included in the equation (i.e. for the Malaysian case, it is significant). However, non-price competition such as quality and marketing strategy should also be included in the export demand model to give accurate estimations. Meanwhile, the inelasticity of export demand for most countries are expected, as the bulk of these countries exports are in the form of strategic raw materials used for industrial purposes. In other words, the income elasticity, which is less than one can be explained by the aggregate data used in this study, i.e. the inclusion of data on agricultural goods and food. As is known, the price elasticity differs across the commodity group where the price elasticity of manufactured goods is higher than that of agricultural products. Similarly, it applies to the income elasticity of demand.

Furthermore, the unit value indices are used in this study due to data problems. As mentioned earlier, the use of export and import unit value indices might also affect the results obtained. Unit value indices have proved to be less reliable proxies, especially when the class of exports is not homogenous.
Based on the results obtained, two important implications for policy considerations can be drawn. Firstly, foreign income is a significant variable in the export demand equation, suggesting that foreign disturbance in the form of fluctuation in foreign economic activities is likely to be transmitted to those countries. Secondly, the Marshall-Lerner conditions are met for Malaysia and Thailand. For example for Malaysia, the estimates obtained are $-0.35$ and $-1.24$ for the price elasticities of export and import demand respectively. The sum of these is $-1.59$, therefore the Marshall-Lerner condition are satisfied easily, suggesting that appreciations (depreciations) in exchange rates can worsen (improve) the current account in a period of one year. This is also true for Thailand where the sum of the price elasticities of export and import demand is $-3.91$. For the case of Indonesia and the Philippines, however, the sum of the price elasticities of exports and imports are $-0.67$ and $-0.59$ respectively. This can be explained by the J-curve, in which import and export demands tend to be relatively inelastic due to the existence of lags. The J-curve also shows that currency depreciation takes time to affect the current account.
NOTES

1 For defining and measuring trade strategy see Bhagwati (1990), Liang (1992), Milner (1994) and the references therein.

2 This is done following method used by Cohen (1985).

3 Based on their study on Hong Kong's total exports of manufactures and South Korea's exports of machinery.

4 The inadequate results obtained are claimed due to some limitation i.e. short time series and inadequate data.


6 For a detailed description of the variables and data sources, see Appendix A.

7 For choices of functional form (i.e. linear vs. log-linear) see Khan and Ross (1977) and Boylan et al. (1980).

8 The world price and income indices facing a country, are calculated using a similar method to that used by Houthakker and Magee (1969) and Goldstein and Khan (1978). Further details see Appendix A.
These signs are expected according to economic theory. The higher the price of a country’s exports relative to other countries, ceteris paribus, the smaller the demand for the country’s exports. The higher the level of foreign income, ceteris paribus, the larger the foreign demand for the country’s exports.

Similarly, these signs are expected based on economic theory. The higher the import price relative to the domestic price, ceteris paribus, the smaller the demand for imports. The higher the real income of the country, the higher the demand for imports.


See table 5.8 – The short run estimated export and import demand.

See Engle and Yoo (1987-Table 4).

One can also see Engle-Granger (1987)- CRDW critical values for n=100, the two variable case.
CHAPTER SIX

A SOLVENCY MODEL FOR THE FOUR ASIAN COUNTRIES

6.1 Introduction

The ‘fundamentalists’ state that the causes of the Asian crisis were the weaknesses in fundamentals i.e. a deteriorating current account, the slow down in growth, short term debt reaching dangerous levels, etc. However, current account deficits are not a problem as long as they are sustainable. As mentioned earlier, the notion of solvency is used in the literature for assessing current account sustainability. Indicators such as debt/GDP, debt/export are usually used as a measure of a country’s indebtedness. Nevertheless, this static measure fails to take into account the dynamic aspects of solvency i.e. growth rate, interest rate. With regard to the debt crisis in 1980s, Cohen (1985) argued that the change in the relationship between the interest rate paid on the debt and the expected growth of exports was the cause of this crisis.¹ If the interest rates were below the growth rate of export earnings of a country, then the wealth of a country in present value terms would be infinite and there would be no solvency problem. Apparently, in the 1980s the real interest rates were higher than the rate of growth of most Less Developed Countries (LDCs), and this created problems for those countries.

In the case of Asian, in the 1990s there was evidence that most of the affected countries experienced a slowing down in their growth rates. Taking this into account the dynamic measure of indebtedness that was introduced by Cohen can be used to
assess these countries' ability to repay their debt. These countries need to know the fraction of a country's resources, which has to be transferred to the creditors in order to be considered solvent. Following the same method used by Cohen (1985) the solvency indices for all countries will be calculated. Specifically, the outline of this chapter is as follows: Section 6.2 presents a review on debt/solvency. Section 6.3 presents econometric studies on solvency. Section 6.4 explains the model in which the intertemporal budget constraint is discussed. Section 6.5 describes the solvency index followed by section 6.6, which presents an invariant measure of wealth. Section 6.7 discusses the repudiation threat followed by section 6.8 on assessing the solvency of an indebted country. The derivation of the calculation of the solvency index is given in section 6.9. The application to the four Asean countries is presented in section 6.10 followed by section 6.11, which is the estimation of GDP supply. Section 6.12 presents the calculation of the solvency indices for the four Asean countries. Finally section 6.13 provides a summary.

6.2 A Review on Debt/Solvency

Looking back to the 1980s debt crisis, being unable to roll over short-term debts that were due, Mexico was pushed to the brink of default. This was soon followed by a withdrawal of creditors from developing countries, which led to debt rescheduling, defaults and renegotiations. As can be seen in 1990s, there have also been several dramatic reversals in large scale lending to emerging markets, for instance Mexico, Turkey, Venezuela in 1994, Argentina in early 1995 and the East Asian countries in 1997. Accordingly for Mexico, Argentina, Indonesia, South Korea and Thailand, an outstanding amount of international loans were arranged to prevent defaults on debt
Obviously all of these episodes have several similar characteristics i.e. sudden shifts in financial flows; they cause a severe contraction within the debtor countries.

As stated by Radelet and Sachs (1998b), most observers have tried to explain the Asian crisis by two types of fundamental factors. First, sudden changes in international market conditions that affect the ability of debtors to repay their outstanding loans i.e. shifts in interest rates, commodity prices or trade conditions. Second, sudden changes in the debtor country that cause creditors to reassess the country's ability to service the foreign debt i.e. change in political leadership or economic policy or in the burden of debt. However, in the case of the crisis in 1994-95 (Argentina, Mexico, Turkey, and Venezuela) the first factor seemed to be stable because the U.S interest rates were moderate. As argued by Dornbusch, Goldfajn and Rodrigo Valdes, the Mexican crisis can be explained by the second factor, which was poor macroeconomic management within country. In the case of the Asian, neither of both factors seemed to be relevant. Conditions in international financial markets, commodity market and the trading system were fine as well as the domestic factors.

Radelet and Sachs (1998b) suggest the third category to explain the Asian crisis, which is the intrinsic instability in international lending. As pointed out by other researchers this factor also was the explanation for the Mexican crisis. Accordingly as stressed by Radelet and Sachs "international loan markets are prone to self-fulfilling crises, in which although individual creditors may act rationally, market outcomes produce sharp, costly and fundamentally unnecessary panicked reversals in capital flows."
With regards to debt issues, there are different views about the diagnosis of the debt problem. According to Eaton (1989), the three main reasons are, i) illiquidity, ii) insolvency, iii) unwillingness to pay. Accordingly, in explaining the existence of external debt problems different theoretical models have been developed. An illiquid borrower does not have enough ready cash to repay current debt servicing, however it has the net worth to repay the debt in the long term. It is viewed that the debt crisis is seen as temporary, and the problem will be solved by new financing arrangements. Under these circumstances, it is necessary for the debtor country to ask for additional loans as the difficulties that occur are for a short run, especially if it is also believed that the country has a bright prospect in the long run. This is known as “illiquidity approach” in the debt literature.4

For the second reason, it is viewed that the debtor country does not repay the debt because it is unable to pay, meaning that the lending is tied by a solvency constraint. Here an insolvent borrower lacks the net worth to repay outstanding debts out of its future earnings. Traditionally, the static measures of external debt i.e. debt/exports ratio or debt/GDP ratio or debt service ratio, are usually used to evaluate the ability-to-pay of an indebted country. It simply says that to be solvent, a country must repay all its foreign debt to its creditors. Consequently, it is believed that the problem that occurs reflects insolvency; then rescheduling or new loans will not improve the situation, in fact these will add burden to the country’s existing debt.

As stated by Radelet and Sachs the illiquidity-insolvency model can be used to explain herd-behaviour in financial market, which is “cases where creditors act on the basis of the actions of other creditors, not on the basis of debtor’s fundamentals, as
perceived by the individual investor^6 (see chapter 2, section 2.3.2). On the other hand, Banerjee (1992), Mishkin (1999) and Stiglitz (1999) examined in detail the role of asymmetric information among creditors as a cause of market instability. Accordingly each individual creditors would rationally respond to the action of other creditors rather than the private information^6 The simple example on herd-behaviour is given by Radelet and Sachs (1998).^7

As in a household or a government, a nation faces a budget constraint, which is its balance of payment constraint. Generally, a nation is solvent if it can meet its intertemporal budget constraint. In other words, the country’s net debt does not exceed the present value of current and future primary (non-interest) surpluses. [see Currie and Levine (1991), Ghatak and Levine (1994), Wicks and Uctum(1993)].

\[
D_t = [PV_t, TB_t (r)]
\]

(6.1)

where \(D_t\) is the nation’s net external debt at time \(t\), \(PV\) denotes the present discounted value, at time \(t\), of the entire planned or expected future stream of trade surpluses \((TB)\) at the discounted rate of \(r\). Equation 6.1 indicates that the present discounted value of future trade balance surpluses is equal to the nation’s current net external debt. Alternatively the solvency condition can be written as;

\[
D_t \leq \sum_{t=0}^{\infty} \frac{(TB)_{t+1}}{(1 + r)^{t+1}}
\]

(6.2)
provided that the “no-ponzi game” condition hold

\[
\lim_{t \to \infty} \frac{D_{t+1}}{(1+r)^t} \leq 0
\]

Equation (6.1) and (6.2) denote the national solvency that the debtor country faces when \( r > 0 \). In both equations, it is assumed that \( r > 0 \) and therefore the condition where \( r < 0 \) is ruled out and the nation cannot play a successful “ponzi-game”: the nation cannot forever pay the interest on its outstanding external debt through borrowing. In other words, a debtor country with \( D_t > 0 \) at time \( t \) will have to run primary surpluses sometime in the future in order to service its external debt.

For the third reason, the debtor country may be liquid and able to pay its debt but unwilling to do so. Under these circumstances, new lending may be constrained by ‘repudiation risk’. The borrowing country will compare the perceived costs and benefits dealing with repayments. If the cost is greater than the benefit, the borrower will threaten to abandon its obligations and face retaliation from creditors. However, the cost of default is high enough to prevent the debtor country from defaulting. These includes the seizure of assets, exclusion from future borrowing, decline in the trustworthy reputation.

Based on these three main reasons, three different policy strategies for debtors, creditors and the relevant international institutions can be drawn. Proponents of the ‘liquidity view’ believe that the debt problem is only temporary due to the unfavourable global economic environment, and therefore should be solved by rescheduling and new lending. Meanwhile the ‘ability to pay’ proponents view that
the debt problem is not a short-run payment problem and therefore has to be solved with some debt relief rather than rescheduling.

6.3 **Econometric Studies on Solvency (ability-to-pay)**

There are many econometric studies in the literature. Studies by Frank and Cline (1971); used eight indicators to identify external servicing difficulties. Among the explanatory variables used are debt service ratio, import/GNP ratio, and imports/reserves ratio, per capita GNP, export growth, amortization/debt ratio, compressibility of imports. The study cover 26 countries for the period of 1960-1968 and of the eight variables, only three are statistically significant which are debt service ratio, imports/reserves ratio and amortization/debt ratio.

Feder and Just (1977) use logit analysis to analyze the ability-to-pay of the debtor countries. The economic indicator of debt servicing capacity that is employed is based on Avramoric’s et.al (1964) study. Seven of the indicators are the same as used by Frank and Cline (1971) and two additional variables are capital inflows and growth of per capita domestic product. They find that six variables, which are debt service ratio, import/reserves ratio, per capita income, outstanding debt/current amortization ratio, capital inflows/debt service ratio and real export growth rate are statistically significant.

Following the study by Feder and Just (1977), the logit/probit/tobit models are used substantially to analyze the debt servicing capacity of debtor countries. Some of the major contributions are from Cline (1984), Edwards (1984), Feder et.al (1981),
Kharas (1984), McFadden et.al (1985), Hajivassiliou (1987, 1989), Lee (1991), etc. Study by Hajivassiliou (1987, 1989), Lee (1991) and McFadden et.al (1985) use the framework of credit rationing and a theory of LDC borrowing with potential repudiation developed by Eaton and Gersovitz (1981a). Meanwhile Lee (1991) uses the multi period willingness to pay model developed by Eaton and Gersovitz (1981a). Here he differentiates between sovereign debt and non-publicly guaranteed private external debt. Based on the willingness to pay model, the probability of default is said to be a function of several variables which are interest rate on international lending, per capita GDP growth rate, total external debt/GNP ratio, growth rate of industrialized countries' GNP, government debt held domestically/GDP ratio, and variability of changes in per capita GDP. By using logit analysis he finds that three variables which are interest rate on international lending, per capita GDP growth rate and total external debt/GNP ratio are statistically significant in explaining both commercial and official rescheduling cases.

However, earlier empirical studies fail to differentiate between liquidity and solvency problems, which is important for a decision to reschedule i.e the question of debt servicing capacity. Accordingly, this has led to a separate solvency literature. Here, only the long-run aspects of debt capacities are taken into consideration. In this solvency literature the net external debt (D) and the net discounted present value of future income stream (PV) of a debtor country are compared. The country is considered to be solvent as long as $D < PV$. The issue of solvency has received much attention in recent years. Sach (1984) uses a two period models while others (i.e Buiter and Patel (1992), Cohen (1991), Currie and Levine (1991), Ghatak and Levine (1994) employ infinite horizon models. In the two period models, both the principal
and interest on external debt incurred in the first period have to be repaid by the end of the second period, and therefore solvency requires that second period income exceed or equal external indebtedness and debt service obligation.

In an infinite horizon framework, however principals would not have to be repaid, but the present value of debt service payments must exceed the value of the principal. Accordingly, if \( r > n \), the solvency budget constraint requires that the discounted present value of the stream of future income is not less than the current external debt level. This is what so called a ‘no-ponzi game’ (or transversality) condition, in which the ‘dynamic inefficiency’ is ruled out. Nevertheless, if \( r < n \), the discounted value of the future income is said to be infinite and the nation can play a successful ‘ponzi game’ [see Cohen (1991), Currie and Levine (1991)]. In this case, the country has infinite net wealth and therefore can borrow as much as it wishes and remain solvent.

With equation (6.5) and (6.6), assuming \( r > n \), a country with \( D > 0 \), at time \( t \) will have to run primary surpluses sometime in the future in order to service its external debt. Solvency does not require that the debt to repaid, it is just impossible indefinitely to finance the interest bill through new borrowings. This means that sometime in the future primary surpluses must be attained and any further borrowing will not be high enough to pay the entire existing debt interest. The solvency evaluation requires that the net external debt grows at a slower rate than the interest rate.

In recent years, unit root test and the cointegration analysis are used to test whether government spending and revenue (i.e. government’s budget constraint) and country’s exports and imports (i.e. nation’s budget constraint) are cointegrated. Here the existence of a genuine and stable long-run relationship is a necessary condition for the
country to satisfy its intertemporal budget constraint and for the current account
deficits to be sustainable in the long run. Major contributions come from Hamilton and
Flavin (1986) and subsequently developed by Trehan and Walsh (1991), Wilcox

Based on the observations of the three decades from 1950s to the early 1980s, it is
obvious that the real growth rate was greater than the interest rate (i.e. $n>r$), but in the
early 1980s, the hierarchy between the two rates has changed and this has caused
problems to all debtor countries in financing high interest rate payments out of slow
growth. And for 1990s, there was evidence that those affected Asean countries
experienced a slowing down in the growth rate.

6.4 The Model

In this model, we are concerned with the solvency of an indebted nation. Therefore,
the domestic budgetary problem is eliminated and the government’s wealth is the
same as the nation’s wealth.

$$W_I = \sum_{t=0}^{\infty} \frac{Y_t}{\prod_{s=0}^{t}(1+r_s)}$$

(6.3)

Based on equation (6.3), we have two possibilities which are;
i) The rate of interest is above the rate of growth of the economy \( (r_t > n_t) \). Under this circumstance, the country's wealth is said to be finite and a fixed fraction of its resources should be transferred to creditors to be considered as solvent.

ii) The rates of interest are below or equal the rate of growth of the economy \( (r_t \leq n_t) \). In this case the country's wealth is infinite and therefore there is no solvency problem.

In the second case where \( r_t < n_t \), time can solve the external debt problem, whereby rescheduling the external debt can always reduce the debt/GDP or debt/exports ratio of a nation. As argued in the literature, in the long run the real interest rates exceed the growth rate \( (r_t > n_t) \) of the economy. This restriction is imposed as the case of \( r_t < n_t \) there is no solvency problem.

Based on the situation of the real interest rates is greater than the growth rates of the economy, the nation is said to have a finite wealth and it cannot play a successful "ponzi-game". As in a household or a government a nation faces a budget constraint, which is its balance of payment constraint. Generally, a nation is solvent if it can meet its intertemporal budget constraint. In other words, the country's net debt does not exceed the present value of current and future primary (non-interest) surpluses. [see Currie and Levine (1991), Ghatak and Levine (1994), Wickens and Uctum (1993)]

**The Intertemporal Budget Constraint**

Generally, the basic accounting identity for an open economy during period \( t \) can be written as follows;
\[ Y_t = (1 + n_t) Y_{t-1} \quad (6.4) \]
\[ D_t = (1 + n_t) D_{t-1} \quad TB_t = (1 + n_t) D_{t-1} + (IM_t - EX_t) \quad (6.5) \]

where
\[
\begin{align*}
Y & = \text{gross domestic product} \\
D & = \text{net external debt (gross debt-gross assets)} \\
n & = \text{growth rate} \\
r & = \text{the world real interest rate} \\
TB & = \text{trade balance} \\
EX & = \text{exports} \\
IM & = \text{imports}
\end{align*}
\]

Basically at any time \( t \), the nation produces \( Y \) and its aggregate spending is given as;
\[
A_t = C_t + I_t + G_t
\]

Therefore
\[
Y_t = A_t + (EX_t - IM_t) \quad (6.6)
\]

The left-hand side of equation (6.6) represents the nation’s aggregate income at the end of period \( t \) and the right-hand side of (6.6) denotes total expenditure.

The trade balance of the nation can be expressed as
\[
TB_t = (EX_t - IM_t) = Y_t - A_t \quad (6.7)
\]

where \( TB_t - rD_{t-1} \) is the current account of the nation.
Based on this framework, solving forward in time the intertemporal budget constraint that a nation must obey can be written as

\[ D_0 = \sum_{t=0}^{\infty} \frac{TB_t}{\prod_{s=0}^{t}(1 + r_s)} \]

or

\[ D_0 = \sum_{t=0}^{\infty} \frac{Y_t - A_t}{\prod_{s=0}^{t}(1 + r_s)} \]

Equation (6.8) simply means that the external debt at the end time \( t \) must equal to the present value of the future net surplus if the country is solvent, provided that

\[ \lim_{t \to \infty} \frac{D_t}{\prod_{s=0}^{t}(1 + r_s)} = 0 \]

(6.9)

This condition is so-called the 'no-ponzi' game condition in the economic literature (or transversality), a country cannot roll over its external debt forever. If the left hand-side of equation (6.9) is greater than zero and the debt stock is greater than the future expected payments, it means that the country has a debt overhang problem. In other words, the present discounted value of a nation’s external debt must tend toward zero in the long run. The only constraint that transversality condition imposes on the debt is that \( r > n_b \) in the long-run meaning that the numerator in equation (6.9) must grew less rapidly than the denominator. However, a debtor country may also face a problem in choosing its consumption pattern according to its intertemporal budget constraint as
creditors may impose a credit ceiling due to threat of default. Therefore, lenders might want to be sure that the borrowers' external debt is not very high so that the debtor country prefers not to service its debt.

6.5 The Solvency Index

Cohen (1985) develops a solvency index to measure the fixed fraction of a debtor country's earning that should be allocated to the repayment of the external debt to satisfy the solvency condition. If a country's trade surplus is greater or equal to the fixed fraction, a debtor country is considered as solvent. As long as $n_t > r$, in the long-run the debtor country's wealth is infinite (in discounted present value term) and there is no solvency problem. The country's income can repay any level of initial debt in finite time. However, if $n_t < r$, the country's wealth is finite and the external debt level must be compared with the present value of future revenue.

The solvency index actually calculates the minimum level of external debt repayment when $r > n_t$. The index weights the external debt/exports ratio by an average measure of the difference between expected real growth and real interest rates in the future. Here the hierarchy of these two rates in time is taken into consideration. Thus the index is superior to the traditional static measures of solvency, i.e. external debt/GDP ratio or external debt/exports ratio, etc. In this case, although a country has a small foreign debt, it may be less solvent if the growth rate is slower compared to a country with a larger foreign debt but grows faster. Empirically, Cohen (1985), showed that the debtor countries (in 1983) with a few exceptions needed to repay 15% of their exports to be said solvent. The solvency indices for few countries were calculated i.e.
Turkey (7.7%), Argentine (16.4%), Mexico (12.11%) and Brazil (15%). By comparing these percentages to the actual transfers, all these countries successfully passed the solvency test.

Based on Cohen's study, there was criticism of the use of exports as a denominator instead of GDP. He then tackled this problem, in his following study and used the weighted average of both exports and GDP. This is called the Invariant Measure of Wealth (IMW). By using the IMW, which is the linear combination (weighted average) of the country's GDP and exports, it will not be affected by the overvaluation and devaluation of the domestic currency.

It is argued that if the creditors prefer basing their lending on the GDP measure, this will encourage the debtor country to change its relative price structure in such a way as to artificially increase the value of its GDP (i.e. by overvaluing its currency). The other way around if creditors base their estimations on the export measure; that is the country will devalue its currency ineffectively.

Cohen and Sachs (1986) stated that the debtor country has the ability to repudiate its external debt. Regarding the repudiation issue, Cohen takes a different view from the traditional willingness to pay view. He states that it is difficult to calculate the cost of default due to its complexity and ‘information asymmetry’ as to whether a given default is due to debtor’s objective inability to pay or not. He argues that if a debtor country has not defaulted at the current (at time t) value of its external debt/IMW, this means that the value is not yet too high. If not, the debtor country would have defaulted. This simply means that, if a debtor country at time t prefers to repay a fixed
fraction $\pi$, of its resources ($\pi IMW$) to creditors rather than default, by implication (ceteris paribus) the country will also be willing to repay in the future. Therefore the $\pi IMW$ can be associated with the primary surplus (TB) in equation (6.8).

\[
D(t) \leq \sum_{i=0}^{\infty} \frac{(TB)_{tu_i}}{(1 + r^t)^{tu_i}}
\]

(6.10)

\[
D(t) \leq \sum_{i=0}^{\infty} \frac{(\pi IMW)_{tu_i}}{(1 + r^s)^{tu_i}}
\]

(6.11)

provided that the following 'no-Ponzi game' condition, holds

\[
\lim_{t \to \infty} \frac{D_{tu_i}}{(1 + r^t)} \leq 0
\]

In the long run, it is assumed that the real interest rate is higher than the growth rate. Observations of the three decades from the 1950s to the early 1980s show that the real growth rates were higher than the interest rate (i.e. $n > r_t$). However, in the early 1980s there was a change in which the interest was higher than the growth rate. Empirically, Currie and Levine (1991), in their study compare the annual individual GDP growth rates for G7 countries with global real ex post short term interest rates. It is shown that $r_t < n$ for the 1970s but $r_t > n_t$ for the 1980s. Similarly, Ghatak and Levine (1994) in their study, support that $r_t > n_t$ as this was the situation for most LDCs since the beginning of the 1980s. As the result, the nation faces the so called 'no Ponzi' game condition.
6.6 An Invariant Measure of Wealth

Following Cohen (1998a), here we assume that the government owns the export industry and only the government has access to the world financial and good markets. It sells the exports good abroad and sells domestically the imported goods. However, the domestic prices set by the government may not reflect the world price. We then need to decide how to define the best estimation for the countries’ resources. As argued in Cohen’s paper (1991) there is ‘moral hazard’ problem by using either GDP or exports. If the creditors base their lending on the GDP measure, this encourages the debtor country to change its relative price structure in such a way as to increase artificially the value of its GDP. On the other hand, if creditors base their lending on the export measure, this induce the country to change its policy in the opposite direction. Thus, to avoid this problem, the best way is to use an appropriate measure of weighted average of these two measurements, as called “invariant measure of wealth” by Cohen (1991). Accordingly,

\[ \text{IMW} = \alpha(\text{EX}) + (1-\alpha)(\text{GDP}) \]

where EX is real exports and GDP is real home output. Following the method proposed by Cohen (1987, 1988a, 1991a) the IMW is calculated as the linear combination and it does not depend on the real exchange rate.
6.7 Repudiation Threat

Following Eaton and Gersovitz (1981), Cohen and Sachs (1986) and Cohen (1988), we assume that the government is able to repudiate its external debt. With regard to this, the creditors may impose sanctions on the defaulting country. The defaulting country will then suffer two penalties; first, the country loses its access to international capital markets so that it is forced into financial autarky. Second, there is a direct penalty on production following debt repudiation (i.e. loss of efficiency following increased difficulties in foreign trade). Thus, GDP becomes

\[ GDP_t = (1-\lambda) IMW_t \]

The nation’s resource base is scaled down by a factor \( \lambda \) hence the cost of debt repudiation is \( \lambda IMW \). Given the path of the nation’s wealth, the nation will select its pattern of consumption, subject to the constraint \( D_t (1+r) < \max W_t \). The equilibrium then will be characterized by the two following conditions; \( \lambda = 1 \) or \( \lambda < 1 \). In the case where \( \lambda = 1 \), the country can never profitably repudiate its debt. In this case the credit markets work efficiently and the indebted countries only face the intertemporal budget constraint. On the other hand, if \( \lambda < 1 \), this leads to a threat of repudiation, subsequently the lenders should impose a credit ceiling on borrowers to prevent from a default decision. Accordingly, the credit ceiling that imposed by creditors can be determine knowing that the indebted countries would never pay more than cost of repudiation, which is \( \lambda IMW \).
6.8 Assessing the Solvency of an Indebted Country.

The creditors might want to impose a credit ceiling which will keep the country from defaulting. However, the calculation of the appropriate credit ceiling is quite complicated. A country is willing to service its debt today based on its expectations on future credit ceilings. Consequently we need to find the path $D_t$ of maximum which the external debt of the country must never exceed if the creditors are to get their money back.

The debtor countries are not allowed to borrow more than a fraction (let say $\pi$) of its wealth, in which $\lambda IMW$ is the cost of repudiation. Knowing the cost of repudiation, the solvency index can be used to determine whether a debtor country would default or service its debt.

6.9 Derivation of the Calculation of the Solvency Index

Following Cohen (1985), the solvency indices for the four Asian countries will be calculated. However, before proceeding, it is necessary to clarify the proxy that used to calculate the nation’s resources. As mentioned earlier, the use of GDP or exports alone, will create distortions. As stated by Cohen, the creditors will face the ‘moral hazard’ problem; that is if they use GDP as their lending base, the debtor country may change its relative price structure since this will increase artificially the value of its GDP (i.e. overvaluing its currency). On the other hand, if lenders base their lending on export measure, this will encourage the country to change its policy oppositely (i.e.
by devaluing its currency. Therefore, the linear combination of GDP and exports will be used:

\[ IMW = \alpha \text{EX} + (1-\alpha) \text{GDP} \]

Where \( \text{EX} = \)exports
\( \text{GDP} = \)real output
\( \alpha = \)the weight of exports
\( (1-\alpha) = \)the weight of the home output

by using IMW, a small change in the real exchange rate would not affect the WA.

\[ \frac{dIMW}{de} = \alpha \frac{dEX}{de} + (1-\alpha) \frac{dGDP}{de} = 0 \]

where \( e = \) real exchange rate which is defined as \( e = \frac{PW}{PX} \) where \( PW \) is the world price facing the country and \( PX \) is the domestic prices (express in US dollar), \( d \) is the total derivative operator. The above expression then can be written as

\[ \alpha = \frac{\frac{dGDP}{de}}{\frac{dGDP}{de} - \frac{dEX}{de}} \]

\[ \alpha = \frac{(e/GDP)(dGDP/de)}{(e/GDP)(dGDP/de) - [(e/GDP)(dEX/de)]} \]

\[ \alpha = \frac{\eta GDP}{\eta GDP - [(EX/GDP)(\eta EX)]} \]

(6.12)
Where $\eta_{EX}$ = the elasticities of Export

$\eta_{GDP}$ = the elasticities of GDP with respect to real exchange rates

$EX/GDP$ = the export share in home output

As the estimation of export demand and output supply equations use real exchange rate as $e = PX/PW$, the expected signs of the long run elasticities in equation (6.12) have opposite signs. Thus the appropriate weights for export and output can be written as:

$$\alpha = \frac{-\eta_{GDP}}{-(\eta_{GDP}) + [(EX/GDP)(\eta_{EX})]}$$

(6.13)

As mentioned earlier, the solvency index measures the fixed fraction (let say $\pi$) of a country's resource IMW that it should allocate to repay its external debt.

With regards to debt repudiation, the cost of repudiation is ($\lambda IMW$), as mentioned earlier there are two possibilities which are $\lambda = 1$ or $\lambda < 1$. If $\lambda = 1$, the threat of debt repudiation is not to be credible, meaning that the indebted country does not an option to repudiate its external debt. However if $\lambda < 1$, this will cause a threat of debt repudiation. As a result, a credit ceiling is required to prevent the lenders from default.

Based on this, the creditors know that the lenders would never pay more than cost of repudiation $\lambda IMW$ when the credit ceiling binds. The equation for a credit ceiling can be expressed as
The wealth of a country is given as,

\[ W_t = \sum_{s=1}^{a} \frac{IMW}{\prod_{j=s+1}^{r_s} (1 + r_j)} \]

It is the present discounted value of the country's future resources. Consequently, a credit ceiling imposed by creditor is

\[ D_t \leq \lambda IMW_t \]

This means that, debtor countries are not allowed to borrow more than a fraction (\( \pi \)) of its wealth, in which \( \lambda IMW_t \) is the cost of repudiation. Knowing the cost of repudiation, the solvency index can be used to determine whether a debtor country would default or service its debt.

Accordingly, a solvency index is

\[ \delta = \frac{D_t}{\lambda IMW_t} \]

If \( \delta < 1 \), the country is solvent but if \( \delta > 1 \), the country might not want to fully repay its debt. However, since the creditors do not know exactly the cost of repudiation, the simple definition is used instead. By definition, a country is considered to be solvent if and only if there is a path of external indebtedness which satisfies the transversality condition and which the country is willing to repay rather than defaulting at time \( t \).
A debtor country will repay its debt at time t, by a fixed fraction, which is;

\[ D_t = \sum_{t=0}^{\infty} \frac{\pi IMW_{t+1}}{\prod_{j=1}^{t}(1 + r_j)} \]

\( \pi \) is a fixed fraction of a country resource that should be allocated to repay the external debt in order to satisfy the intertemporal external solvency condition. The solvency index is proportional to the debt/resource ratio and to the difference between growth rate and interest rate. In order for a country to be considered solvent, it requires that the external debt grow slower than the real interest rate, meaning that the debtor's resources must grow faster than the debt. As stated earlier one can easily evaluate whether a country is solvent or not by comparing \( \pi \) to the observed proportion.

In evaluating whether an indebted country which transfers a fixed fraction of its resources to the creditors is solvent or not, the country's resource base (IMW) needs to be calculated. As shown in equation (6.13), in order to calculate the countries IMW, the export demand elasticities and GDP supply elasticities are required. Based on this, the solvency index can be calculated.
6.10 Application to the Four Asian Countries

Calculation of the IMW

Referring to equation (6.13), two long run elasticities; which are export demand elasticity and GDP supply elasticity together with the export share in GDP are needed to calculate the weight of exports and GDP.

In chapter 5, the long run export demand elasticities for all countries are estimated. Here, the estimation of each country's GDP supply elasticities is then carried out.

6.11 GDP Supply

The long run GDP supply function is given by;

$$\log GDP_t = c_0 + c_1 \log \left( \frac{P_x}{P_w} \right)_t + c_i \log K_t + U_t$$

Where GDP = the real GDP of the country
PX/PW = the real exchange rate or relative price
K = capital stock – Following Muscatelli, it is constructed by using the gross fixed capital formation, where the capital output-ratio is multiplied by GDP. The capital-output ratio is derived on the basis of a three year moving average of incremental GDP and gross fixed capital formation for 1966. (Data is gathered from the International Financial Statistics, various issues).
Equation (6.14) is the GDP supply, which depends upon the relative price of exports to the world price \((\frac{P_x}{P_w})\), and the stock of capital \((K)\). The coefficients of \(c_1\) and \(c_2\) are expected to be positive.

Following the same method that is used in Chapter 5, the test of unit root is employed to see whether all variables are stationary. Based on the DF/ADF test, all variables are \(I(1)\), and since all variables are of the same order, the estimation for the cointegrating parameter is estimated using the dynamic OLS where lags and leads are included.

The ADF residual based test for cointegration is carried out and this is shown in table 6.1. As can be seen all countries pass the test except for Thailand. However, it is believed that all variables are cointegrated for the reasons explained earlier. (chapter 5 - section 5.5.1).

**Table 6.1: ADF Residual-based Test for Cointegration**

<table>
<thead>
<tr>
<th>Country</th>
<th>Test Statistics</th>
<th>Critical Values</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>DF</td>
<td>ADF(1)</td>
</tr>
<tr>
<td>Malaysia</td>
<td>-3.21</td>
<td>-4.13</td>
</tr>
<tr>
<td>Thailand</td>
<td>-1.82</td>
<td>-2.05</td>
</tr>
<tr>
<td>Indonesia</td>
<td>-3.19</td>
<td>-3.31</td>
</tr>
<tr>
<td>Philippines</td>
<td>-2.90</td>
<td>-3.30</td>
</tr>
</tbody>
</table>

Notes to table:* The critical values are obtained from Charemza and Deadman (1992) with 30 numbers of observation and \(m=2\). One also can refer to other sources of critical value tables i.e MacKinnon (1991), Engle-Granger (1987, Table II and III), Engle and Yoo (1987).

The estimated long run GDP is shown in table 6.2.
Table 6.2: The DOLS GDP Supply Equations (long run)

<table>
<thead>
<tr>
<th>Country</th>
<th>(px/pw)</th>
<th>k</th>
<th>ser</th>
<th>R^2</th>
</tr>
</thead>
<tbody>
<tr>
<td>Malaysia</td>
<td>0.33</td>
<td>0.60</td>
<td>0.05</td>
<td>0.99</td>
</tr>
<tr>
<td></td>
<td>(0.0955)</td>
<td>(0.0579)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Indonesia</td>
<td>1.10</td>
<td>1.98</td>
<td>0.13</td>
<td>0.98</td>
</tr>
<tr>
<td></td>
<td>(0.2450)</td>
<td>(0.2162)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Thailand</td>
<td>2.92</td>
<td>1.48</td>
<td>0.07</td>
<td>0.70</td>
</tr>
<tr>
<td></td>
<td>(1.0372)</td>
<td>(0.6532)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Philippines</td>
<td>1.78</td>
<td>1.89</td>
<td>0.25</td>
<td>0.92</td>
</tr>
<tr>
<td></td>
<td>(0.2828)</td>
<td>(0.2285)</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Notes to table: value in parenthesis is standard error.

The relationship between GDP and both relative price and capital stock is positive as expected. All variables have correct signs, and these prove to be sensible magnitude and all are significantly different from zero at the 5 percent level.

The second step of Engle-Granger error correction model (ECM) is then employed. From the result obtained the coefficient of the first lag of the residual for all countries are negative and significant. It measures the speed of adjustment to which GDP adjusts to its equilibrium level. The error correction term with an adjustment coefficient of -0.1645, indicating that in the case we are off the long-run supply curve, overall supply adjusts to its long-run equilibrium level with about 16.4% of the adjustment taking place within the first year (i.e. Malaysian case).

The statistical significance and magnitude of the error correction term indicates that the relative price (px/pw) and capital stock do, as a component of the long term cointegrating relationship through the lagged error correction term jointly, influence GDP supply over the long term.
Table 6.3: The Short-run Estimated GDP (ECM)$^{13}$

**Malaysia**

$\Delta GDP_t = 1.1574 + 0.3444 \Delta(PX/PW)_t + 0.646 \Delta(K)_t - 0.2289\Delta(PX/PW)_{t-1} - 0.1626 \Delta(K)_{t-1} - 0.1645 U_{t-1} + \epsilon_t$

\begin{align*}
R^2 &= 0.86 \\
DW &= 1.67 \\
RSS &= 0.04 \\
SER &= 0.04 \\
F-Stat(5,25) &= 31.41
\end{align*}

**Indonesia**

$\Delta GDP_t = 0.123 + 0.444 \Delta(PX/PW)_t + 0.865 \Delta(K)_t - 0.148 U_{t-1} + \epsilon_t$

\begin{align*}
R^2 &= 0.74 \\
DW &= 1.50 \\
RSS &= 0.12 \\
SER &= 0.07 \\
F-Stat(3,20) &= 18.69
\end{align*}

**Philippines**

$\Delta GDP_t = 0.102 + 0.147 \Delta(PX/PW)_t + 0.589 \Delta(K)_t - 0.225\Delta(K)_{t-1} - 0.03 U_{t-1} + \epsilon_t$

\begin{align*}
R^2 &= 0.7 \\
DW &= 1.98 \\
RSS &= 0.10 \\
SER &= 0.06 \\
F-Stat(4,25) &= 14.36
\end{align*}
Thailand

\[ \Delta \text{GDP}_t = 0.123 + 0.402 \Delta (P X/P W)_{t-1} + 0.167 \Delta (K)_t - 0.035 U_{t-1} + \varepsilon_t \]

\[ R^2 = 0.61 \]
\[ DW = 1.39 \]
\[ RSS = 0.06 \]
\[ SER = 0.05 \]
\[ F-\text{Stat}(3,26) = 13.76 \]

The IMW can be estimated based on the estimated GDP supply elasticities. From equation (6.10),

\[ \alpha = \frac{-\eta \text{GDP}}{-[\eta \text{GDP} + [(EX / GDP)(\eta EX)]]} \]

By replacing the relevant long run elasticities to the above equation, the weight for of export and GDP for each country is obtained. (See table 6.4)

**Table 6.4: The weight of Exports and GDP**

<table>
<thead>
<tr>
<th>Country</th>
<th>( \alpha )</th>
<th>IMW</th>
</tr>
</thead>
<tbody>
<tr>
<td>Malaysia</td>
<td>0.66</td>
<td>(0.66) Ex + (0.34) GDP</td>
</tr>
<tr>
<td>Indonesia</td>
<td>0.94</td>
<td>(0.94) Ex + (0.06) GDP</td>
</tr>
<tr>
<td>Philippines</td>
<td>0.95</td>
<td>(0.95) Ex + (0.05) GDP</td>
</tr>
<tr>
<td>Thailand</td>
<td>0.79</td>
<td>(0.79) Ex + (0.21) GDP</td>
</tr>
</tbody>
</table>

Notes to table: the value of \( \alpha \) is obtained by using equation (6.10) in which the price elasticity of export demand and price elasticity of GDP supply together with the share of exports to GDP are used.
6.12 Solvency Indices

Based on the estimation in section 6.5, the solvency index can be calculated.

\[ D_t = \sum_{x=1}^{\infty} \frac{\pi IMW_{t+x}}{(1 + r)^x} \]

As mentioned earlier, \( \pi \) is the fraction that is needed to service the debt. Assuming that the growth rate (of the IMW) and the interest rate are constant (i.e. \( n_t = r \) and \( n_t = n \)), the following is obtained.

\[ D_t = \sum_{x=1}^{\infty} \frac{\pi[(1+n)^x IMW_t]}{(1+r)} \]

\[ D_t = \pi IMW_t \frac{[(1+n)/(1+r)]}{1 - [(1+n)/(1+r)]} \]

\[ D_t = \frac{\pi IMW_{t+1}}{(r-n)} \]

Hence,

\[ \pi = (r-n) \frac{D_t}{IMW_{t+1}} \]

So, \( \pi \) is the debt/IMW ratio, which it takes into account the difference between the growth and interest rates.
The solvency indices for the four Asian countries in 1996 (prior to the crisis) are calculated based on the above formula. Here, one needs to know the external debt at the end of 1996 and also the resource base of each country at the end of 1997. In addition, the future growth of the IMW and the real interest rate need to be forecast. Two different hypotheses about the future growth and interest rate are made: pessimistic and optimistic. Accordingly, two different scenarios under which the difference between future growth and interest rate are assumed constant. First, the pessimistic view in which the different between interest rate and growth rate is 5.5 percent. Second the optimistic view in which the different between those two rates is 1 percent. As stated by Corsetti et.al (1998) the optimistic view is the realistic one.

All variables use to calculate the solvency indices are shown in table 6.5. Based on the value of $\alpha$ shown in table 6.4, the wealth average (IMW)is calculated for each country. The ratio of net debt/exports, net debt/GDP and net debt/IMW are also shown in the table.
Table 6.5: External Debt Ratio of the Four ASIAN Countries (million of US $)

<table>
<thead>
<tr>
<th>Year</th>
<th>Exports</th>
<th>GDP</th>
<th>IMW</th>
<th>Net Debt*</th>
<th>Net Debt/Ex</th>
<th>Net Debt/GDP</th>
<th>Net Debt/IMW</th>
</tr>
</thead>
<tbody>
<tr>
<td>Malaysia</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1990</td>
<td>34514.0</td>
<td>42774.6</td>
<td>37322.6</td>
<td>5574.0</td>
<td>0.16</td>
<td>0.13</td>
<td>0.15</td>
</tr>
<tr>
<td>1991</td>
<td>37630.0</td>
<td>45844.6</td>
<td>40422.9</td>
<td>5899.0</td>
<td>0.16</td>
<td>0.13</td>
<td>0.15</td>
</tr>
<tr>
<td>1992</td>
<td>42558.0</td>
<td>53223.5</td>
<td>46184.3</td>
<td>2559.0</td>
<td>0.06</td>
<td>0.05</td>
<td>0.05</td>
</tr>
<tr>
<td>1993</td>
<td>48368.1</td>
<td>53084.5</td>
<td>49971.7</td>
<td>-973.5</td>
<td>-0.02</td>
<td>-0.02</td>
<td>-0.02</td>
</tr>
<tr>
<td>1994</td>
<td>57584.9</td>
<td>60928.3</td>
<td>58721.6</td>
<td>4128.0</td>
<td>0.07</td>
<td>0.07</td>
<td>0.07</td>
</tr>
<tr>
<td>1995</td>
<td>68793.6</td>
<td>69869.3</td>
<td>69159.3</td>
<td>8455.2</td>
<td>0.12</td>
<td>0.12</td>
<td>0.12</td>
</tr>
<tr>
<td>1996</td>
<td>71806.3</td>
<td>75787.9</td>
<td>73160.0</td>
<td>9667.2</td>
<td>0.13</td>
<td>0.13</td>
<td>0.13</td>
</tr>
<tr>
<td>1997</td>
<td>70657.0</td>
<td>72945.3</td>
<td>71434.9</td>
<td>19585.2</td>
<td>0.28</td>
<td>0.27</td>
<td>0.27</td>
</tr>
<tr>
<td>Indonesia</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1990</td>
<td>29870.0</td>
<td>106141.2</td>
<td>34446.3</td>
<td>62413.0</td>
<td>2.08</td>
<td>0.58</td>
<td>1.81</td>
</tr>
<tr>
<td>1991</td>
<td>30458.2</td>
<td>116517.7</td>
<td>35621.8</td>
<td>63900.0</td>
<td>2.10</td>
<td>0.55</td>
<td>1.79</td>
</tr>
<tr>
<td>1992</td>
<td>32678.6</td>
<td>118904.0</td>
<td>37852.1</td>
<td>66284.6</td>
<td>2.02</td>
<td>0.56</td>
<td>1.75</td>
</tr>
<tr>
<td>1993</td>
<td>32511.6</td>
<td>122485.9</td>
<td>37910.1</td>
<td>60394.6</td>
<td>1.86</td>
<td>0.49</td>
<td>1.59</td>
</tr>
<tr>
<td>1994</td>
<td>33465.5</td>
<td>127257.7</td>
<td>39093.0</td>
<td>68842.4</td>
<td>2.06</td>
<td>0.54</td>
<td>1.76</td>
</tr>
<tr>
<td>1995</td>
<td>35869.3</td>
<td>132112.4</td>
<td>41643.9</td>
<td>72346.4</td>
<td>2.01</td>
<td>0.55</td>
<td>1.74</td>
</tr>
<tr>
<td>1996</td>
<td>35632.1</td>
<td>137816.1</td>
<td>41763.1</td>
<td>67084.8</td>
<td>1.88</td>
<td>0.49</td>
<td>1.61</td>
</tr>
<tr>
<td>1997</td>
<td>35386.0</td>
<td>115372.6</td>
<td>40185.2</td>
<td>64294.1</td>
<td>1.81</td>
<td>0.56</td>
<td>1.60</td>
</tr>
<tr>
<td>Year</td>
<td>Exports</td>
<td>GDP</td>
<td>IMW</td>
<td>Net Debt*</td>
<td>Net Debt/Ex</td>
<td>Net Debt/GDP</td>
<td>Net Debt/IMW</td>
</tr>
<tr>
<td>------</td>
<td>----------</td>
<td>---------</td>
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<td>--------------</td>
</tr>
<tr>
<td>Thailand</td>
<td></td>
<td></td>
<td></td>
<td></td>
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<tr>
<td>1990</td>
<td>31289.0</td>
<td>85640.0</td>
<td>42702.7</td>
<td>14860.0</td>
<td>0.47</td>
<td>0.17</td>
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<td>1991</td>
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<td>92686.75</td>
<td>47604.6</td>
<td>19108.5</td>
<td>0.53</td>
<td>0.21</td>
<td>0.40</td>
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<td>101336.6</td>
<td>52104.3</td>
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<td>0.50</td>
<td>0.19</td>
<td>0.37</td>
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<tr>
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<td>109850.1</td>
<td>57437.7</td>
<td>24775.4</td>
<td>0.57</td>
<td>0.22</td>
<td>0.43</td>
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<td>1994</td>
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<td>120324.0</td>
<td>63898.4</td>
<td>30220.0</td>
<td>0.62</td>
<td>0.25</td>
<td>0.47</td>
</tr>
<tr>
<td>1995</td>
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<td>129349.7</td>
<td>72189.2</td>
<td>36230.8</td>
<td>0.64</td>
<td>0.28</td>
<td>0.50</td>
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<tr>
<td>1996</td>
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<td>137478.2</td>
<td>73987.2</td>
<td>40068.9</td>
<td>0.70</td>
<td>0.29</td>
<td>0.54</td>
</tr>
<tr>
<td>1997</td>
<td>54397.9</td>
<td>109942.0</td>
<td>66062.2</td>
<td>48026.4</td>
<td>0.88</td>
<td>0.44</td>
<td>0.73</td>
</tr>
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<td>Philippines</td>
<td></td>
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<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1990</td>
<td>13920.0</td>
<td>39200.8</td>
<td>15284.0</td>
<td>29656.0</td>
<td>2.23</td>
<td>0.76</td>
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</tr>
<tr>
<td>1991</td>
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<td>39152.2</td>
<td>14071.7</td>
<td>25175.7</td>
<td>1.97</td>
<td>0.64</td>
<td>1.79</td>
</tr>
<tr>
<td>1992</td>
<td>13996.8</td>
<td>42046.8</td>
<td>15399.3</td>
<td>22700.0</td>
<td>1.62</td>
<td>0.54</td>
<td>1.47</td>
</tr>
<tr>
<td>1993</td>
<td>14315.7</td>
<td>40574.2</td>
<td>15628.6</td>
<td>23328.4</td>
<td>1.63</td>
<td>0.57</td>
<td>1.49</td>
</tr>
<tr>
<td>1994</td>
<td>16650.3</td>
<td>43594.4</td>
<td>17997.5</td>
<td>22717.7</td>
<td>1.36</td>
<td>0.52</td>
<td>1.26</td>
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<tr>
<td>1995</td>
<td>20939.6</td>
<td>46625.6</td>
<td>22223.9</td>
<td>19784.3</td>
<td>0.94</td>
<td>0.42</td>
<td>0.89</td>
</tr>
<tr>
<td>1996</td>
<td>23460.8</td>
<td>48999.1</td>
<td>24737.7</td>
<td>17611.1</td>
<td>0.75</td>
<td>0.36</td>
<td>0.71</td>
</tr>
<tr>
<td>1997</td>
<td>28229.9</td>
<td>47262.5</td>
<td>29181.5</td>
<td>21935.1</td>
<td>0.78</td>
<td>0.46</td>
<td>0.75</td>
</tr>
</tbody>
</table>

**Sources:** World Bank, World Debt Tables, various issues and International Financial Statistics.

*Net Debt = Total debt - (SDR+Reserve position + Foreign Exchange)*
Based on total debt and IMW under two different scenarios, results obtained are shown in table 6.6

Table 6.6: Solvency Index and Actual % Paid

<table>
<thead>
<tr>
<th>Year/country</th>
<th>Scenario 1</th>
<th>Scenario 2</th>
<th>TDS/IMW</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Debt/IMW*5.5%</td>
<td>Debt/IMW*1.0%</td>
<td></td>
</tr>
<tr>
<td>Malaysia</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1990</td>
<td>0.76%</td>
<td>0.14%</td>
<td>10.7%</td>
</tr>
<tr>
<td>1991</td>
<td>0.71%</td>
<td>0.13%</td>
<td>6.0%</td>
</tr>
<tr>
<td>1992</td>
<td>0.28%</td>
<td>0.05%</td>
<td>7.7%</td>
</tr>
<tr>
<td>1993</td>
<td>-</td>
<td>-</td>
<td>7.2%</td>
</tr>
<tr>
<td>1994</td>
<td>0.33%</td>
<td>0.06%</td>
<td>7.4%</td>
</tr>
<tr>
<td>1995</td>
<td>0.64%</td>
<td>0.12%</td>
<td>6.6%</td>
</tr>
<tr>
<td>1996</td>
<td>0.74%</td>
<td>0.14%</td>
<td>9.0%</td>
</tr>
<tr>
<td>Indonesia</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1990</td>
<td>9.63%</td>
<td>1.75%</td>
<td>27.9%</td>
</tr>
<tr>
<td>1991</td>
<td>9.30%</td>
<td>1.69%</td>
<td>27.8%</td>
</tr>
<tr>
<td>1992</td>
<td>9.67%</td>
<td>1.74%</td>
<td>28.1%</td>
</tr>
<tr>
<td>1993</td>
<td>8.47%</td>
<td>1.54%</td>
<td>28.0%</td>
</tr>
<tr>
<td>1994</td>
<td>9.08%</td>
<td>1.65%</td>
<td>24.6%</td>
</tr>
<tr>
<td>1995</td>
<td>9.51%</td>
<td>1.73%</td>
<td>25.6%</td>
</tr>
<tr>
<td>1996</td>
<td>9.13%</td>
<td>1.66%</td>
<td>32.4%</td>
</tr>
<tr>
<td>Thailand</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1990</td>
<td>1.71%</td>
<td>0.31%</td>
<td>11.1%</td>
</tr>
<tr>
<td>1991</td>
<td>2.04%</td>
<td>0.37%</td>
<td>8.89%</td>
</tr>
<tr>
<td>1992</td>
<td>1.87%</td>
<td>0.34%</td>
<td>8.35%</td>
</tr>
<tr>
<td>1993</td>
<td>2.09%</td>
<td>0.39%</td>
<td>8.84%</td>
</tr>
<tr>
<td>1994</td>
<td>2.31%</td>
<td>0.42%</td>
<td>9.0%</td>
</tr>
<tr>
<td>1995</td>
<td>2.70%</td>
<td>0.49%</td>
<td>8.9%</td>
</tr>
<tr>
<td>1996</td>
<td>3.35%</td>
<td>0.61%</td>
<td>10.9%</td>
</tr>
<tr>
<td>Philippines</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1990</td>
<td>11.5%</td>
<td>2.10%</td>
<td>25.5%</td>
</tr>
<tr>
<td>1991</td>
<td>8.96%</td>
<td>1.63%</td>
<td>19.0%</td>
</tr>
<tr>
<td>1992</td>
<td>7.98%</td>
<td>1.45%</td>
<td>21.8%</td>
</tr>
<tr>
<td>1993</td>
<td>7.10%</td>
<td>1.29%</td>
<td>20.0%</td>
</tr>
<tr>
<td>1994</td>
<td>5.61%</td>
<td>1.02%</td>
<td>13.8%</td>
</tr>
<tr>
<td>1995</td>
<td>4.34%</td>
<td>0.79%</td>
<td>12.7%</td>
</tr>
<tr>
<td>1996</td>
<td>3.30%</td>
<td>0.60%</td>
<td>8.9%</td>
</tr>
</tbody>
</table>

Notes to table: TDS is total debt service. IMW is the invariant measure of wealth. Obtained from the formula in table 6.4.
As can be seen in table 6.6 these are the fixed fraction of each country’s IMW that have to be allocated to the foreign debt service to be declared solvent under pessimistic and optimistic scenario. As the actual total debt service that each country paid in 1996-1997 period were greater than these indices, all countries were considered as solvent (see the forth column in table 6.6). Further details on calculation of solvency index and percentage that were actually paid by each country can be seen in appendix B.1 and B.2.

6.13 Summary

In evaluating the creditworthiness of each country the invariant measure of wealth (IMW) is used instead of using exports or GDP alone. By using the IMW, which it is the weighted average of the country’s exports and GDP, the ‘moral hazard’ problem discussed earlier is avoided. From empirical results obtained, the solvency conditions are satisfied in all countries. The countries are said to be satisfying their intertemporal external solvency condition as long as they allocate a fixed fraction \( \pi \) of their IMW to service the external debt, where \( \pi \) is the fraction required to satisfy the national budget constraint. It is clear that all countries passed the solvency test in the late 1997. Indonesia had the highest ratio of repayments to IMW to remain solvent, (i.e. 9.13%) in 1996/1997. Other countries show an index of between 1% to 4%. In the Philippines and Thailand case, it is shown that less than 4% of their IMW would be enough to repay their debts.
However, from table 6.6, the actual percentage paid by each country was higher than the one that was required to be declared solvent. Therefore, it can be concluded that for all countries the solvency conditions were satisfied and they do not seem to have had an external insolvency problem. As mentioned in chapter 2, there are several other hypotheses explaining the Asian crisis i.e. the financial bubbles and declining returns to investment, moral hazard which led to banks and other financial institutions in Asian to a situation of overindebtedness, imprudent domestic financial liberalisation and capital account opening, etc. Based on the empirical results of this chapter, it gives support for the view that the Asian crisis can be explained by the short-term illiquidity problem and creditors panic rather than insolvency.
NOTES


2 For further details see Cline (1984, 1985), Cooper and Sachs (1985).

3 See Radelet and Sachs (1998b).

4 For further details see Cline (1984, 1985). Also Cooper and Sach (1985).


6 For further detailed see Banerjee (1992), Mishkin (1999).

7 See Radelet and Sachs (1998b).

8 For further details of costs of default, see Kaletsky (1985), Krugman and Obstfeld (1991).


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For further details see Buiter (1990a), Currie and Levine (1991).

The same subscription used by Cohen (1988a) is used here; IMW which is the weighted average of exports and GDP of a country.

$\Delta$ are the first difference and $U_{t-1}$ is the error correction term.
CHAPTER SEVEN

CONCLUSION

7.1 Introduction

The Asian currency crisis has once again brought up the debate of the causes of currency crisis. Many have argued the core of the crisis was the result of deteriorating market fundamentals. Others have argued that the cause is a self-fulfilling crisis or investor’s herd behaviour. Can the weakness of economic fundamental explain the cause of crises or is it rather the act of a speculator and of panic and herding behaviour of investors in fear of financial losses? Is it the problem of illiquidity or insolvency?

This chapter presents the main conclusions of the thesis. The significance of the findings and the limitation of the study are also included. Areas of future research are suggested at the end of the chapter.

7.2 Conclusions

The macroeconomic outlook of the four Asian countries prior to the crisis was examined in Chapter Four. Based on the analysis present in Chapter Four, apparently all the countries had sound macroeconomic fundamental prior to the crisis. Although these countries experienced a current account deficit, this is not normally a problem as
long as it is sustainable. The notion of solvency is usually used in the standard theoretical criteria for assessing the current account imbalances. A country is considered to be solvent if the discounted value of the expected stock of its foreign debt in the infinitely near future is non-positive. This means that a country that accumulates foreign debt at a rate that is faster than the real cost of borrowing cannot expect to do so forever.

This study covers the period 1963-1995, includes four Asian countries and uses time series data. Specifically, the solvency index for each country is calculated prior to the crisis. In order to calculate these indices, the price elasticities of demand and GDP supply are needed. For the export demand equation, the new variable i.e. the export composition index (GCI) is added as an explanatory variable. However, this variable is only significance for the Malaysian case, and therefore it is dropped for other three countries. The Engle-Granger two-step Procedure is then employed to estimate the long run and short-run estimation. The results obtained prove all variables are cointegrated. The Johansen Maximum Likelihood is also used as a comparison with the Engle-Granger method.

The solvency index is calculated based on the price elasticity of demand and GDP supply and the main results indicate that all countries were solvent prior to the crisis. The current account deficit experienced by most affected countries was not a problem as long as they were solvent. The solvency index for Malaysia, Indonesia, Thailand and the Philippines were 0.74%, 9.13%, 3.35%, 3.30% respectively (with an assumption that r-n=5.5%). The amount that was actually paid in 1997 was greater than a fraction needed to be considered solvent (i.e. Malaysia 9%, Indonesia 32.4%,
Thailand 10.9% and Philippines 8.9%). This supports the view that the explanation of the Asian crises was the self-fulfilling losses of confidence. Obviously, participants in the financial markets respond to ‘signals’ in sometimes herd-like fashion. Information that is available is subjected to these participants’ interpretation and they can alter in a short notice.

From the analysis and supported by the empirical findings, it suggests that the crisis was a matter of short-term liquidity difficulties and panic rather than insolvency. Specifically, the four Asian countries have experienced an impressive economic and social performance for the past few decades. Besides the sound macroeconomic fundamental, these countries also have good records on total factor productivity which reflect on human development performance i.e. health and education (see Ranis and Stewart, 1998).

A further external credit could solve the problem. The financial system should then encourage the external private creditors to maintain their credit level rather than permitting them to ‘take-off’ (i.e. not to roll over their short term credit) and also to restructure their short-term credit over a longer term. As can be seen in chapter 2 (section 2.7) the four Asean countries are experiencing positive growth rates in 1999/2000. Most of the countries began to gain back their momentum toward recovery after experiencing negative growth rates in 1998. This once again supports the view that the cause of Asian crisis was an illiquidity problem rather than insolvency.
7.3 **Significance of the Findings**

i) The solvency index that presented in this study has advantages compared to the static measure of external debt i.e. debt/GDP and debt/exports. The use of invariant measure of wealth (IMW) as the proxy of country’s resources avoids the possibility of a moral hazard problem faced by the creditors. If the gross domestic product (GDP) measure were used by creditors as their lending base, this would encourage the debtor country to change its relative price structure in such a way as to increase artificially the value of its GDP (i.e. by overvaluing its currency). Conversely, if the export measure were used as a lending base, this would induce the country to devalue its currency. By using the weighted average of these two measures, it would not create such a distortion. Besides that, the solvency index takes into consideration the dynamic aspects; it includes future expectation of output growth and real interest rates. So, based on this index all parties such as debtors, creditors, policy makers can benefit. By referring to this index, creditors can decide whether to extend the maximum level of credit; that is $\pi$IMW.

ii) The trade policy can be analyzed based on the size of income and price elasticities of exports and imports presented in chapter five. By looking at these elasticities, both debtor and creditor countries can benefit. The structural adjustment and stabilization policies as well as debt rescheduling agreements basically depend on foreign trade projections which, in turn, depend on income and price elasticities. As for creditor countries, observing the restrictive and protective policy taken by industrial countries indicates that there will be a decline in the exports of debtors' countries, hence leading to problems in financial markets.
Based on the foreign trade model presented in chapter five, the comprehensive estimates of price and income elasticities are obtained. In estimating trade flow, consideration is given to the issue of nonstationary since data used is a time series data. The cointegration analysis is employed to tackle this problem; to make sure that the relationship is not spurious. The DF/ADF unit root test is carried out to see whether all variables are I (1),

Specifically the Engle-Granger two step procedure is used to estimate the import and export model. Results obtained are reasonably good and most of them have expected signs.

Two important implications for policy consideration can be derived from the estimation. One is that foreign income is a significant variable in the export demand equation, which indicates that foreign disturbances in the form of fluctuations in foreign economic activities are likely to be transmitted to these countries. The other is that the Marshall-Lerner conditions are easily met for the two countries. In the case of Malaysia, the estimates for price elasticities of exports and imports demands were $-0.35$ and $-1.24$ respectively. Their sum of $-1.59$ certainly satisfies the above condition. Similarly, in the case of Thailand, the sum of price elasticities of both exports and imports demand was $-3.91$. Therefore, the estimates do suggest that depreciations (appreciations) in exchange rates can effectively improve (worsen) the current account in the period of one year. However, for Indonesia and the Philippines, the sum of price elasticities of exports and imports demand for each case is less than one. The inelasticity of imports and exports demand might be explained by the
existence of lags. By using the J-curve, it can be seen that the currency depreciation will take some time to affect the current account.

7.4 The Limitation of the Study and Areas for Future Research

There are several limitations, which might affect the significance of the findings. They are;

i) The lack of data on several independent variables. The use of unit values for exports and imports price is certainly not without drawbacks. However since the actual transactions or contractual prices for these countries' exports and imports are not available, this proxy has been used.

ii) The results obtained should be better with the inclusion of non-price competition such as quality, marketing strategy, etc. Unfortunately, measures of non-price competition such as quality, marketing strategy, etc are not available.

iii) The value of solvency indices for each country depends on the estimations from both export demand and GDP supply. The small number of observation might affect the empirical results obtained as can be seen some of the elasticities of the two methods used show some differences. Using a large sample size might give us better results.
The limitation of the study discussed above, point to several areas for future research e.g. the use of both demand and supply in the trade model instead of using the single equation might give us a more accurate estimation, hence better solvency indices. Besides the proxy used for foreign indebtedness, i.e. debt/IMW, others proxies such as debt service and interest service ratios also can be used.

Also this study focuses on the solvency of a country and the government budget constraint is not included. Further research then can be carried out to see whether the government is solvent or not [see Hakkio and Rush (1991), Trehan and Walsh (1991)].

With regard to a currency crisis, further research can be done using several indicators that can add to a country’s vulnerability to a crash. Specifically, several indicators such as fiscal deficit/GDP, current account/GDP reserves/Imports can be used to analysed whether a country is vulnerable to a crisis or not [see Frankel and Rose (1996)]
A. The Computation of the Variables of Exports Demand.

All data required for the estimation were gathered and verified from various issues of the International Financial Statistics, and the World Tables of the World Bank. The trade share statistics used to compute the foreign variable were taken from the United Nations Yearbook of International Trade Statistics. The data is defined as below, and they are in the indexes of the base year 1990. All data is expressed in US dollars.

\[
Q_x = \text{Index of the volume of exports (1990=100) calculated by using the following formula} \\
Q_x = \frac{EXUS}{P_x} \\
\text{Where EXUS and Px are exports in US dollars and export price index in US dollar term respectively.}
\]

\[
Q_m = \text{Index of the volume of imports (1990=100) calculated by using the following formula;} \\
Q_m = \frac{IMUS}{P_m} \\
\text{Where IMUS and PM are imports in US dollars and import price index in US dollar term respectively.}
\]

\[
P_w = \text{index of the world export price (1990=100) calculated by using the method of Houthakker and Magee (1969) and Goldstein and Khan (1978)}
\]

where
Each country's export partners are: Japan, the US, U.K, Germany, and Netherland. \( a_{ji} \) is the weight of market \( i \) in exporter \( j \)'s (i.e. Malaysia) exports to five main export markets. \( PMx \) is the US dollar based import price index in export market \( i \) (1990=100).

\[ Y_W = \text{the trade-weighted 'world' real income, calculated as a weighted average of real incomes of five major export partners of each country. Express as an index (1990=100) facing the country.} \]

\[ Y_W = \sum_i a_{ji} Y_i \]

\[ \sum_i a_{ji} = 1; (i = 1, \ldots, 5) \]

(\text{Same as defined earlier})

\( GCI = \text{The export composition index} \)

The index is constructed as follows. The exports good is divided into four groups \( (C_1, \ldots, C_4) \).

\( C_1 = \text{Total exports of agricultural products and crude material.} \)

\( C_2 = \text{Total exports of traditional manufacturing sectors} \)

\( C_3 = \text{Total exports of scale intensive sectors} \)

\( C_4 = \text{Total exports of specialised supply and science based sectors.} \)
Following Muscatel et. al. (1995b) the export composition indexes is constructed using the formula below. The index GCI lies over interval (0,1). The weights chosen are $a_1=0$, $a_2=0.33$, $a_3=0.67$, $a_4=1$, over the interval (0,1).

$$GCI_t = \frac{\sum_{i=1}^{4} a_i c_{it}}{\sum_{i=1}^{4} c_{it}}$$
## APPENDIX B
(Appendix to Chapter 6)

### B.1. The Computation of Solvency Indices

<table>
<thead>
<tr>
<th>Year</th>
<th>Scenario 1 Debt/IMW * 5.5%</th>
<th>Scenario 2 Debt/IMW * 1.0%</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Malaysia</td>
<td></td>
</tr>
<tr>
<td>1990</td>
<td>5574.0/40422.9*5.5% = 0.76%</td>
<td>5574.0/40422.9*1.0% = 0.14%</td>
</tr>
<tr>
<td>1991</td>
<td>5899.0/46184.3*5.5% = 0.71%</td>
<td>5899.0/46184.3*1.0% = 0.13%</td>
</tr>
<tr>
<td>1992</td>
<td>2559.0/49971.7*5.5% = 0.28%</td>
<td>2559.0/49971.7*1.0% = 0.05%</td>
</tr>
<tr>
<td>1993</td>
<td></td>
<td></td>
</tr>
<tr>
<td>1994</td>
<td>4128.0/69159.3*5.5% = 0.33%</td>
<td>4128.0/69159.3*1.0% = 0.06%</td>
</tr>
<tr>
<td>1995</td>
<td>8455.2/73160.0*5.5% = 0.64%</td>
<td>8455.2/73160.0*1.0% = 0.12%</td>
</tr>
<tr>
<td>1996</td>
<td>9667.2/71434.9*5.5% = 0.74%</td>
<td>9667.2/71434.9*1.0% = 0.14%</td>
</tr>
<tr>
<td></td>
<td>Indonesia</td>
<td></td>
</tr>
<tr>
<td>1990</td>
<td>62413.0/35621.8*5.5% = 9.63%</td>
<td>62413.0/35621.8*1.0% = 1.75%</td>
</tr>
<tr>
<td>1991</td>
<td>63900.0/37852.1*5.5% = 9.30%</td>
<td>63900.0/37852.1*1.0% = 1.69%</td>
</tr>
<tr>
<td>1992</td>
<td>66284.6/37910.1*5.5% = 9.57%</td>
<td>66284.6/37910.1*1.0% = 1.74%</td>
</tr>
<tr>
<td>1993</td>
<td>60394.6/39093.0*5.5% = 8.47%</td>
<td>60394.6/39093.0*1.0% = 1.54%</td>
</tr>
<tr>
<td>1994</td>
<td>68842.4/41643.9*5.5% = 9.08%</td>
<td>68842.4/41643.9*1.0% = 1.65%</td>
</tr>
<tr>
<td>1995</td>
<td>72346.4/41763.1*5.5% = 9.51%</td>
<td>72346.4/41763.1*1.0% = 1.73%</td>
</tr>
<tr>
<td>1996</td>
<td>67084.8/40185.2*5.5% = 9.13%</td>
<td>67084.8/40185.2*1.0% = 1.66%</td>
</tr>
<tr>
<td></td>
<td>Thailand</td>
<td></td>
</tr>
<tr>
<td>1990</td>
<td>14860.0/47604.6*5.5% = 1.71%</td>
<td>14860.0/47604.6*1.0% = 0.31%</td>
</tr>
<tr>
<td>1991</td>
<td>19108.5/52104.3*5.5% = 2.04%</td>
<td>19108.5/52104.3*1.0% = 0.37%</td>
</tr>
<tr>
<td>1992</td>
<td>19550.0/57437.0*5.5% = 1.87%</td>
<td>19550.0/57437.0*1.0% = 0.34%</td>
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<tr>
<td>1993</td>
<td>24775.4/63898.4*5.5% = 2.09%</td>
<td>24775.4/63898.4*1.0% = 0.38%</td>
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<tr>
<td>1994</td>
<td>30220.0/72189.2*5.5% = 2.31%</td>
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<tr>
<td>1995</td>
<td>36230.8/73987.2*5.5% = 2.70%</td>
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<tr>
<td>1996</td>
<td>40068.9/66062.2*5.5% = 3.35%</td>
<td>40068.9/66062.2*1.0% = 0.61%</td>
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<td></td>
<td>Philippines</td>
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<tr>
<td>1990</td>
<td>29656.0/14071.7*5.5% = 11.5%</td>
<td>29656.0/14071.7*1.0% = 2.10%</td>
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<tr>
<td>1991</td>
<td>25175.7/15399.3*5.5% = 8.96%</td>
<td>25175.7/15399.3*1.0% = 1.63%</td>
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<tr>
<td>1992</td>
<td>22700.0/15628.6*5.5% = 7.98%</td>
<td>22700.0/15628.6*1.0% = 1.45%</td>
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<tr>
<td>1993</td>
<td>23328.4/17997.5*5.5% = 7.10%</td>
<td>23328.4/17997.5*1.0% = 1.29%</td>
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<tr>
<td>1994</td>
<td>22717.7/22223.9*5.5% = 5.61%</td>
<td>22717.7/22223.9*1.0% = 1.02%</td>
</tr>
<tr>
<td>1995</td>
<td>19784.3/24737.7*5.5% = 4.34%</td>
<td>19784.3/24737.7*1.0% = 0.79%</td>
</tr>
<tr>
<td>1996</td>
<td>17611.1/29181.5*5.5% = 3.30%</td>
<td>17611.1/29181.5*1.0% = 0.60%</td>
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### B.2 Actual Percentage Paid by Each Country

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<tr>
<td></td>
<td>Malaysia</td>
</tr>
<tr>
<td>1990</td>
<td>4333.0/40422.9 = 10.7%</td>
</tr>
<tr>
<td>1991</td>
<td>2780.0/46184.3 = 6.0%</td>
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<tr>
<td>1992</td>
<td>3861.5/49971.7 = 7.7%</td>
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<td>1993</td>
<td>4230.1/58721.6 = 7.2%</td>
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<tr>
<td>1994</td>
<td>5143.7/69159.3 = 7.4%</td>
</tr>
<tr>
<td>1995</td>
<td>4816.8/73160.0 = 6.6%</td>
</tr>
<tr>
<td>1996</td>
<td>6432.8/71434.9 = 9.0%</td>
</tr>
<tr>
<td>1997</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Indonesia</td>
</tr>
<tr>
<td>1990</td>
<td>9968.0/35621.8 = 27.9%</td>
</tr>
<tr>
<td>1991</td>
<td>10447.3/37852.1 = 27.8%</td>
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<td>1992</td>
<td>10647.0/37910.1 = 28.1%</td>
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<tr>
<td>1993</td>
<td>10920.2/39093.0 = 28.0%</td>
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<td>1994</td>
<td>10264.0/41643.9 = 24.6%</td>
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<td>1995</td>
<td>10729.4/41763.1 = 25.6%</td>
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<td>1996</td>
<td>13005.5/40185.2 = 32.4%</td>
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<tr>
<td>1990</td>
<td>5295.0/47604.6 = 11.1%</td>
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<tr>
<td>1991</td>
<td>4633.0/52104.3 = 8.99%</td>
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<td>1992</td>
<td>5371.8/57437.0 = 9.35%</td>
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<td>1993</td>
<td>5649.1/63898.4 = 8.84%</td>
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<td>1994</td>
<td>6566.7/72189.2 = 9.0%</td>
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<td>6612.3/73987.2 = 8.9%</td>
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<td>7191.7/66062.2 = 10.9%</td>
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<td>1997</td>
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<td>Philippines</td>
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<tr>
<td>1990</td>
<td>3590.0/14071.7 = 25.5%</td>
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<td>1991</td>
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<td>1992</td>
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<td>1996</td>
<td>2609.8/29181.5 = 8.9%</td>
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<td>1997</td>
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Appendix C

Sources for Figures and Chart.

Figure 2.1: Export Market Growth for the Four Asian Countries
International Monetary Fund (1998)

Figure 4.1: GDP Growth Rates (1991-1997)
International Monetary Fund (1998)

Figure 4.2: Investment Rates (% of GDP)

Figure 4.3: Saving Rates (% of GDP)

Figure 4.4: Inflation Rates (1991-1997)
International Monetary Fund (1998)

Figure 4.5: Real Exchange Rate (1990-1997)
JP Morgan
(Data are for the end of period. Average 1990=100)

Chart 2.1: Share of Exports products to the United States
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