The Integration of ASEAN5 Equity Markets, GDP and Trade and their Relationships with Asset Pricing

A thesis submitted in fulfilment of the requirements for the degree of

Doctor of Philosophy

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DECLARATION

I certify that except where due acknowledgement has been made, the work is that of the author alone; the work has not been submitted previously, in whole or in part, to qualify for any other academic award; the content of thesis is the result of work which has been carried out since the official commencement date of approved research program; and any editorial work, paid or unpaid, carried out by a third party is acknowledged.

Signed:

Zarina Md Nor
March 2009
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ABSTRACT

This thesis focuses on five of the founding nations of the Association of Southeast Asian Nations (ASEAN). The countries are Malaysia, Singapore, Thailand, Indonesia and the Philippines (ASEAN5). Asset pricing for the ASEAN5 equity markets is the main focus of this thesis, although we also develop vector error correction models (VECM) for GDP, trade and local equity market returns for the ASEAN5. While this allows further analysis of the robustness of asset pricing models, it also facilitates study of the fundamental links that exist within these economies.

The traditional CAPM and the four factor-model that include market, size, value and momentum effects (Fama and French, 1993; Carhart, 1997) are employed in testing the variation in size/book-to-market equity (size-BTME) and industry portfolio returns for these markets for the period from January 1990 to March 2006. Three macro factors as well as world excess returns are then added to the basic four-factor asset pricing model. These macro factors include unexpected GDP, unexpected total trade and unexpected equity market returns, which are derived from VECM or VAR estimates for ASEAN5 GDP, total trade and equity market returns. This model is referred to as the macro-factor model.

The results suggest that the explanatory power of the four-factor model consistently exceeds those of the one-factor CAPM in explaining size-BTME and industry portfolio returns. Further, the macro-factor model analysis suggests that collectively, this model does not substantially improve the explanatory power of the basic four-factor model, suggesting that the variation in portfolio returns is mostly captured by the four-factor model. There is some cross-country variation in these results. Regardless, these macro factors – taken as a group or individually – are statistically significant, particularly for Thailand and Malaysia.

In addition, the cointegration test results document evidence of long-run linkages for the equity markets within the ASEAN5. This is also true for GDP within the ASEAN5. In both cases, closer links prevail in the post-crisis period. This is not the case for trade where there is little consistent evidence of close links between the countries. Mixed results are found for different ASEAN5 trade measures where the linkages for total trade, import and exports vary substantially according to the selected period of study, whether full period, pre-crisis or post-crisis period.
Chapter 1

INTRODUCTION

1.1 Introduction

This thesis examines asset pricing within the ASEAN (Association of Southeast Asian Nations) countries. There are ten ASEAN members currently, though the focus of this thesis is on the five founding nations of ASEAN comprising Malaysia, Singapore, Thailand, Indonesia and the Philippines. Hereafter, these five countries will be known as the ASEAN5. Selection of the ASEAN5 countries to be examined in this thesis is determined by the availability of data. Figure 1 - 1 charts the ASEAN region. Based on the geographical proximity of these nations and their membership in ASEAN, it is important to analyse the determinant of asset pricing for the equity markets of these ASEAN nations.

Figure 1 - 1 ASEAN countries

Note: The ASEAN region includes Malaysia, Singapore, Thailand, Indonesia, the Philippines, Brunei Darussalam, Vietnam, Cambodia, Myanmar and Laos.

Other ASEAN members include Brunei Darussalam, Vietnam, Laos, Myanmar and Cambodia.
1.2 Contributions of the thesis

There are three contributions of this thesis, the main one being an examination of the asset pricing of the ASEAN5 equity markets using the four-factor model, which is lacking from the literature. This model is based on the three-factor model of Fama and French (1993) with an additional momentum factor as used by Carhart (1997). The size-BTME portfolio returns and industry portfolio returns for the ASEAN5 are analysed to examine the effects of market, size, value and momentum in explaining variation in portfolio returns. The inclusion of industry portfolios also adds more scope to the asset pricing tests employed in this study.

The second contribution of this thesis concerns the estimation of ASEAN5 asset pricing by expanding the factor model to include macro factors (known as the macro-factor model). The local macro factors included in this study are unexpected GDP (UGDP), unexpected total trade (UTT), unexpected market returns (URI); the study also includes the world market excess returns (WRF) as a proxy for world effects. In addition, it is important to note that three of the macro factors (UGDP, UTT and URI) used in the analysis are derived from vector error correction models (VECMs) which adjust for cointegration, or vector autoregressions (VARs) where cointegration is not evident. The analysis in this thesis differs from previous studies (for example, see Chen, Roll and Ross, 1986; Chen and Zhang, 1997), providing an important extension to asset pricing research within the ASEAN region.

The third contribution of this thesis is derived from the cointegration tests of the ASEAN5 equity market, ASEAN5 GDP and ASEAN5 trade. Even though equity markets in the ASEAN5 have been studied as a group or separately, the linkages identified between these equity markets is a worthy topic for research, particularly given the data set included in this study. Given a careful consideration of the impact of the 1997 Asian crisis, the thesis highlights variation in ASEAN5 equity market linkages both before and after the crisis, as well as providing an analysis of the full period.

Most of the literature on GDP is concerned with GDP per capita, as occurs in the gravity models or convergence studies (for example, see Cappelen, Castellacci and Verspagen, 2003; Canova, 2004; Lim and McAleer, 2004). The linkages that exist between GDP in aggregate for the ASEAN economies are rarely addressed in the literature though this is important for asset pricing. Tests for cointegration that exist between GDP within the ASEAN5 economies contribute to our understanding of the ASEAN5 economic links.
In this thesis, time series analysis of GDP (both in real and nominal US dollar GDP) along with adjustment for the 1997 Asian crisis and seasonal effects provide fairly robust evidence of the existence of long-term and short-term links in ASEAN5 GDP.

A comprehensive analysis of ASEAN5 trade linkages provides a number of insights into those links. Cointegration tests are performed for bilateral trade, ASEAN5 imports, ASEAN5 exports and ASEAN5 total trade. These analyses contribute to the literature by providing a comprehensive time series analysis of trade links that exist between the ASEAN5 countries.\(^2\) It is found that there is little evidence of strong trade links between the ASEAN5 countries.

### 1.3 Research motivation

ASEAN was formed on 8 August 1967 in Bangkok. Since its inception approximately 40 years ago, the membership of ASEAN has grown from five to ten nations. In 2006, the ASEAN region has a population of about 560 million, a combined gross domestic product of almost US$1,100 billion and a total trade of about US$1,400 billion.\(^3\) Given the role of ASEAN as one of the stabilising factors in the Southeast Asian region, the economic achievements of the member nations, their commitment to regional cooperation and their endeavours to overcome the 1997 crisis strengthen the belief that the ASEAN countries are an important regional grouping. This thesis contributes to our understanding of the ASEAN group, focusing on the ASEAN5 with particular attention paid to asset pricing and the linkages between equity markets, GDP and trade.

A further motivation for this thesis lies in the importance of emerging markets. The ASEAN5 equity markets and their economies have only recently been freed from many of the regulatory constraints that bound their economies. As such, their financial and economic characteristics are most likely different from those of developed markets and economies. This provides an important sample for verification of asset pricing models previously applied to developed markets.

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\(^2\) Most of the literature provides trade analysis using either one of these measures (for example, see Baharumshah, Lau and Fauntas, 2003; Santos-Paulino and Thirlwall, 2004; Herzer and Nowak-Lehmann, 2006).

\(^3\) [http://www.aseansec.org](http://www.aseansec.org)
1.4 Objectives of the study

There are five main objectives underlying this thesis, spread across five chapters. The first objective is to study the linkages that exist within the ASEAN5 equity markets using weekly data from January 1990 to March 2006 (Chapter 5). An examination of the role of the US, Japanese and Australian equity markets and their relationship with the ASEAN5 equity markets is also included. The second objective is to study the linkages that exist within the ASEAN5 economy GDP (Chapter 6). It is important to better understand the time series relationship that exists in ASEAN5 economic growth. The third objective is to examine the linkages existing between different trade measures within the ASEAN5 nations (Chapter 7). If there are tight links existing between ASEAN5 GDP and equity markets, is this reflected in ASEAN5 trade? The fourth objective is to test asset pricing within the individual ASEAN5 equity markets, employing the four-factor model to explain variation on equity returns (Chapter 8). The fifth objective is to analyse the effects of four additional macro factors (unexpected GDP, unexpected total trade, unexpected equity market returns and world excess market returns) on ASEAN5 asset pricing. Will the addition of key macroeconomic variables including GDP and trade, as well as equity market returns for the world and for the country, improve the explanatory power of the models?

1.5 Thesis structure

The remainder of this thesis is structured as follows. In Chapter 2, a literature review provides a brief survey of previous studies related to the subject matter of this thesis. The methodology used for analysis is explained in Chapter 3. Chapter 4 presents the time series data sets employed throughout the thesis. This is followed by an analysis of ASEAN5 equity market links in Chapter 5. The economic links between the ASEAN5 economies are examined in Chapter 6 and Chapter 7, where the linkages of GDP and trade within the ASEAN5 are the focus of study. Further, ASEAN5 asset pricing is analysed using the traditional CAPM and the four-factor model in Chapter 8. Chapter 9 extends the asset pricing analysis by testing four additional macro factors with the four-factor model. In conclusion, the key findings, research limitations and suggestions for future studies are provided in Chapter 10.
Chapter 2
LITERATURE REVIEW

2.1 Introduction

This chapter presents the literature survey for the studies included in this thesis and includes a broad survey of the literature as well as focusing on the literature that directly relates to the studies undertaken here. In this chapter, Section 2.2 surveys the literature on equity market linkages and Section 2.3 presents literature on GDP, while Section 2.4 gives a survey on trade links literature. This is followed by reviews of previous asset pricing studies included in Section 2.5.

2.2 International equity market linkages

Correlation and interdependence between equity markets have been studied in the literature. Several factors contribute to the correlation between international stock markets, such as the state of the economy, the equity market development within a country (Erb, Harvey and Viskanta, 1998) and market trends (correlation tends to increase markedly in a bear market but does not seem to increase in a bull market) (Longin and Solnik, 2001; Yang, Tapon and Sun, 2006).\footnote{The size of a national equity market may reflect its stage of development, the degree of market liquidity and the level of information cost and transaction cost associated with trading equity in that market. Thus, a large disparity in market sizes may indicate large differences in the liquidity, information costs and transaction costs between the two markets. As such, as the size differential of the two stock markets increases, the extent of their co-movement will decrease and vice-versa (Pretorius, 2002).}

Furthermore, Bekeart and Harvey (2000) suggest that correlation and beta of an emerging market increase with respect to the world market after equity market liberalisation. In theory, a liberalised equity market allows foreign investors to sell or purchase domestic securities, and domestic investors can sell or purchase foreign securities without restrictions. Liberalisation of an equity market is a gradual process and it should bring about emerging market integration with the global capital market. In cointegrated markets, assets of identical risk command the same expected return irrespective of their domicile (Bekaert and Harvey, 1997). However, liberalisation may not be enough to induce foreign investors to actually invest in the country. Home bias or other concerns,
such as lack of information on company stocks, may impede international investment (see Bekaert, 1995 and Levine and Zervos, 1996).  

Mainstream research has concentrated more on the interdependence of mature stock markets. However, there is a growing interest in the interdependence and cointegration of emerging equity markets with each other and with the developed equity markets. Emerging equity markets are an interesting topic in finance given their unique characteristics, as is the case for the ASEAN5 equity markets examined in this thesis. In general, returns for emerging equity markets are generally higher, more predictable, exhibit higher volatility than developed market returns, and have low correlations with developed market returns (Bekaert and Harvey, 1997). Moreover, emerging market returns are not normally distributed (Harvey, 1995), are skewed, and have fat tails (Bekaert and Harvey, 2002). The returns are also autocorrelated, which probably indicates that the returns in these equity markets can be predicted based on past returns (Bekaert and Harvey, 1995). Further, expected returns in emerging markets are also affected by the level of segmentation in the country itself, as well as the level of segmentation in other countries within the same region (De Joong and De Roon, 2004).

Emerging market economies that have opened their markets to achieve greater financial integration are likely to be more vulnerable to external shocks. These emerging markets have lower resistance to shocks than do mature markets (Michelfelder and Pandya, 2005), with negative shocks having more effect than positive ones (Heaney, Hooper and Jaugetis, 2002; Dungey, Fry and Martin, 2003). It is also found that emerging markets respond rather more quickly to shocks originating locally than to external shocks (Soydemir, 2000). It is shown that the transmission of equity market turmoil from one country to another is likely to increase in highly integrated markets and, with further advances in information technology, the transmission of shocks could be further accelerated (Fernandez-Izquierdo and Lafuente, 2004). Examples of shocks that have affected the financial world include the 1987 US stock market crash, the 1994 Mexican Peso devaluation (Tequila effect), the 1997 Asian crisis and the IT crash in 2000. It is interesting to note that the impacts of crises that happened in the emerging markets have, to some extent, challenged the conventional financial theories in more than one way (see Buckberg, 1995).

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5 It is suggested that home bias seems to persist for households but this bias is decreasing for financial institutions (Kearney and Lucey, 2004).
The 1997 Asian crisis has received widespread attention in the literature, given its huge impact on general financial markets. For example, Forbes and Rigobon (2002) examine stock market co-movement for nine Southeast Asian countries (including the ASEAN5) during the 1997 crisis and find high cross-market co-movement immediately after the crisis period. They, however, reject the notion of contagion but propose that the changes in co-movement are a continuation of market interdependence from the stable period. This is supported by Khalid and Kawai (2003), who brand the widely claimed contagion effect related to the 1997 crisis as an ‘overstatement’, even though Chiang, Jeon and Li (2007) find evidence of contagion in the Asian markets during early phases of the crisis. However, it is not important for this thesis whether contagion occurs or not; it is more important to acknowledge the impact of the 1997 crisis on the stock markets and economies of the ASEAN5. As such, adjustment is made to analysis in this thesis to cater for the impacts of this crisis.

Literature on international equity market linkages is presented before existing literature on the ASEAN5 equity markets is discussed, as it is important to gain some insight into the pattern of relationship between international equity markets, in particular the equity markets that are geographically closed, such as the ASEAN5. The interdependence of nine developed stock markets − Australia, Canada, France, Germany, Hong Kong, Japan, Switzerland, the UK and the US – are analysed in Eun and Shim (1989). The results show that substantial interdependence exists among these developed equity markets, with the US playing the most dominant role in influencing the other equity markets.

Kasa (1992) tests for the existence of common stochastic trends in the equity markets of the US, Japan, England, Germany, and Canada. His findings suggest that there is a single common trend driving these five developed equity markets. Recently, evidence on mature and emerging stock market interdependence is also given in Tsouma (2007).

Further, the interdependence of six major Latin American stock markets is documented by Chen, Firth and Rui (2002) between 1995 and 2000 using cointegration analysis. Three sub-periods are employed in their study and they find that the Latin American equity markets are cointegrated in all of the sub-periods, with one cointegrating

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6 They also study the 1994 Mexican crisis and the 1987 US stock market crisis.
7 In this paper, contagion is defined as a significant increase in cross-market linkages after a shock to one country or a group of countries. Alternatively, Bekaert et al. (2005) define contagion as correlation over and above what one would expect, given economic fundamentals.
8 The stock markets are for Argentina, Brazil, Chile, Colombia, Mexico and Venezuela.
vector for each period. Soydemir (2000) examines the relation of the Latin American markets with the US stock market. His study finds that significant linkages prevail between these markets and the observed level of linkages are influenced by the level of trade flows.\textsuperscript{9} The existence of equity market links among the Gulf Cooperation Council (GCC) countries over the period from 1994 to 2003\textsuperscript{10} is also documented by Al-Khazali, Darrat and Saad (2006). In similar vein, Narayan, Smyth and Nanda (2004) find that linkages exist between the stock markets of Bangladesh, India, Pakistan and Sri-Lanka, while Drakos and Kutan (2005) show that the equity markets of Turkey and Greek are linked together, primarily due to having similar trading and foreign direct investment partners.

In the European region, economic integration and the liberalisation process (1980s to 1990s) of European capital markets are found to have greater impact on market linkages than is evident for either monetary integration or the introduction of a single currency (Baele, 2005). The European equity markets have become highly integrated since 1996, which is mostly explained by the drive towards EMU, via the elimination of exchange rate volatility and uncertainty in the process of monetary unification (Fratzscher, 2002).

There are studies that examine the links of all or some of the ASEAN5 countries in relation to the other equity markets. For instance, Choudhry, Lu and Peng (2007) examine the linkages of the Far East equity markets including ASEAN5, Hong Kong, South Korea and Taiwan, with the equity markets of the US and Japan. The pre-1997 crisis, crisis and post-crisis periods are employed in this study. Their findings suggest that a significant long-run relationship prevails for all the sub-periods, with or without the US or Japanese markets included in analysis. This implies that these two larger markets may not be an essential element in the interaction among the Far East markets. However, their results indicate that the Japanese equity market is more influential than the US equity market during the crisis and in the post-crisis period. This argument is supported by Johnson and Soenen (2002) in their study of the Japanese equity market with twelve other equity markets in Asia. They find that these markets have become more integrated with the Japanese equity market over time, especially since 1994.\textsuperscript{11}

\textsuperscript{9} The countries are Brazil, Argentina and Mexico.
\textsuperscript{10} The GCC countries consist of Saudi Arabia, Kuwait, Bahrain and Oman.
\textsuperscript{11} The study includes the equity markets of Australia, China, Hong Kong, India, Indonesia, Japan, Korea, Malaysia, New Zealand, Philippines, Singapore, Taiwan and Thailand. The period of study is from 1988 to 1998.
Manning (2002) documents evidence of interdependence among a larger set of Asian stock markets, yet full convergence is not apparent among these markets. In particular, this process appears to have halted with the 1997 crisis. Furthermore, there is no change in the number of common trends found from analysis, regardless of the inclusion of the US equity market in the model, indicating that the relationship is robust. Moreover, financial integration in the Pacific Basin countries is found to be accompanied by economic integration (Phylaktis and Ravazzolo, 2002) and this is consistent with ASEAN aspirations for greater integration.

The following studies are closely related to the study included in Chapter 5 of this thesis. Literature that focuses on the linkages between the ASEAN5 equity markets is still limited and the existing studies are yet to produce consensus results. Roca, Selvanathan and Sheperd (1998) find that the ASEAN5 equity markets do not exhibit long-run linkages but these equity markets are highly correlated in the short run. They show that between 1988 and 1995, the Malaysian equity market is the most influential, while the Indonesian market exhibits limited influence on other ASEAN5 equity markets. Similarly, Ng (2002) finds no evidence of a long-run relationship among the ASEAN5 markets using monthly data for the period 1988 to 1997. Two sub-periods are employed, 1988 to 1992 and 1993 to 1997, with the results showing that the market correlations increase in the second sub-period, except for Singapore and Malaysia. Ibrahim (2005) corroborates these studies and finds no evidence of cointegration for the ASEAN5 markets with the US and Japan using the monthly data for the period 1988 to 2003, although short-run relation exists among these markets. Furthermore, he finds that the US market is more dominant in this region compared to the Japanese market.

There are, however, studies that support the existence of cointegration among the ASEAN5 markets. Sharma and Wongbangpo (2002), for instance, find cointegrating relationships among Malaysia, Singapore, Thailand, and Indonesia for the period of 1986 to 1996. Further, they suggest that the Malaysian and Singaporean equity markets are classified as ‘trend dominated markets’, while the Thailand and Indonesian equity markets are ‘cycle-dominated markets’. Click and Plummer (2005) use daily and weekly data in local currencies, US dollars and Japanese yen for the period of July 1998 to December 2002. Their results show that robust cointegrating relationships exist among ASEAN5 markets, regardless of data frequency or the index denomination used in analysis. The results obtained by Click and Plummer are supported by Azman-Saini, Azali, Habibullah and Matthews (2002) in their analysis that spans the period January 1998 to August 1999.
In addition, they identify the exogeneity of the Singaporean equity market, the prominent influence of the Malaysian equity market and also the weakness of Indonesian equity markets.¹²

Similarly, Abd. Majid, Meera and Omar (2007) support the long-run links between the ASEAN5 equity markets, as well as the links between the ASEAN5 and the US and Japanese stock markets. They also divide the full study period into pre-crisis period (January 1998 to December 1996) and post-crisis period (January 1998 to December 2006). Furthermore, their findings indicate that equity market integration is stronger in the post-crisis period with the US equity market being found to be more dominant than the Japanese market, thus supporting the findings of Ibrahim (2005). Daly (2003), however, finds mixed results based on his study of the ASEAN5, Australian, German and US equity markets from 1990 to 2001. However, he suggests that equity market integration among the ASEAN5 is somewhat stronger in the post-crisis period. Palac-McMiken (1997) concludes that the equity markets of the ASEAN5 are linked, with the exception of the Indonesian equity market, and that the Thai equity market plays the connecting role that links these ASEAN5 markets together.

In summary, previous literature shows some evidence that international equity markets are linked together, although the existence of long-run links between the ASEAN5 equity markets is still debatable. Therefore, analysis carried out in Chapter 5 provides further insight into this relationship, in particular amidst the upheaval of the 1997 crisis. Based on the linkages that emerge among the equity markets in other regions and regional groupings such as the EU and GCC, it is possible to expect the existence of long-run relationship among the ASEAN5 equity markets.

2.3 Literature on GDP

To the author’s knowledge, there is no study that considers GDP linkages among different countries per se.¹³ Studies such as convergence tests, cointegration and causality tests usually include GDP per capita as one of the variables. For example, Ahmad and Harnhirun (1995; 1996) use export per capita and GDP per capita for the ASEAN5

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¹² This conclusion is based on the results from Granger non-causality (Toda-Yamamoto test), standard Granger causality, variance decomposition and impulse response analysis of weekly data from 1988 to 1999.
¹³ Searches of ABI/Inform Global and also Google Scholar support this contention.
countries in their cointegration tests. Mozumder and Marathe (2007) examine the causality relationship between per capita electricity consumption and per capita GDP for Bangladesh.

GDP per capita is commonly used in convergence studies. For instance, Lim and McAleer (2004) test for the existence of a convergence club among the ASEAN5, and their catching up with the USA, using GDP per capita data. They find no evidence of income convergence among ASEAN5 countries, or of a catching up effect for the ASEAN5 with the USA, with the exception of Singapore. It is noted that Singapore and the Philippines diverged from the mean growth level, consistent with their economies having the highest and lowest income growth among the ASEAN5. Yet the lack of convergence does not necessarily rule out the possibility that ASEAN5 GDP countries are moving together over time, particularly in the sense of the growth rates being cointegrated. While cointegrated variables may diverge after a shock, they are eventually ‘drawn back’ towards the long-term equilibrium relationship. Such behaviour could lead to rejection of convergence, where change takes place over a reasonably long period of time. Further, GDP per capita is also used in Barro and Sala-i-Martin (1992) to test convergence for the US states, while Coudrado-Roura (2001) use it to test convergence club in the European Union, to name a few.

The study included in Chapter 6 is not concerned with measuring economic development or welfare using measures such as GDP per capita, as stated above. Instead, this chapter differs from the GDP per capita literature in its focus on aggregate GDP in investigating the linkages that exist between the ASEAN5 economies. Essentially, this analysis focuses on the links that exist between the ASEAN5 in terms of total wealth creation, rather than wealth at the individual level (GDP per capita).

2.4 Literature on trade links

There is a huge volume of literature dealing with trade issues and the relationship of international trade and economic growth has been discussed extensively in this literature. However, most cointegration studies concentrate on the long-run relationship between imports and exports for a particular country. The purpose of these studies is to determine the long-run effectiveness of a country’s macroeconomic policies and also to test the sustainability of trade imbalances. Examples of such studies can be found for Chile (Herzer and Nowak-Lehmann, 2006), Korea (Bahmani-Oskooee and Rhee, 1997), the USA (Husted, 1992), Germany, Sweden and the USA (Irandoust and Ericsson, 2004), 22 least developed countries (Narayan and Narayan, 2005), and four of the ASEAN countries
(Baharumshah, Lau and Fauntas, 2003). Furthermore, Santos-Paulino and Thirlwall (2004) estimate the effect of trade liberalisation on export growth, import growth, the balance of trade and the balance of payments for 22 developing economies from the 1970s to the late 1990s. They suggest that liberalisation stimulated import growth more than growth in exports. As a consequence, a country’s trade balance is worsened and probably leads to constraining the living standards of its population.

The gravity model is also used in testing the integration of trade. For instance, Elliot (2007) tests regional trade integration for the Caribbean Community and Common Market (CARICOM) countries. This group of countries makes a commitment to a single market union, scheduled for 2005. The results show that regional integration does not necessarily increase trade flow and probably leads to a decline in trade instead. The author also noted that economic gains from trade need the support of skilled resources, stable government and technological development. Further, Martinez-Zarzoso (2003) uses the gravity model to analyse the determinants of bilateral trade for economic blocs and areas from 1980 to 1999. The study includes the European Union (EU), North-American Free Trade Area (NAFTA), Caribbean Community (CARICOM), Centro-American Common Market (CACM) and other Mediterranean countries (MEDIT). Yet studies that include the ASEAN countries, or employ the cointegration tests for this regional group of countries, are lacking from the literature.

It is also notable that many studies examine the link between trade variables and macroeconomic variables, using cointegration tests – for example, Ahmad and Harnhirun (1996) for export and GNP for ASEAN countries, Ekanayake (1999) for real export and real GDP, and Cortinhas (2007) for real GDP and intra-industry trade. These studies test for the existence of a long-term relationship between trade and real economic variables as well as the direction of causality that exist between these variables. In addition, Kali et al. (2007) focus on the impact of trade structure (the number of trade partners and the concentration of trade among partners) on growth. The long-run relationship of aggregate import demand functions for the ASEAN5 countries is examined in Tang (2004). The results suggest that cointegration exists for Malaysia and Singapore but not for Indonesia, Thailand and the Philippines.

Further, Bekaert and Harvey (1997) found evidence that trade is important in explaining equity correlations, in particular for the emerging markets. In line with this study, Chen and Zhang (1997) examine the extent of cross-country stock market
correlation related to trade for the Pacific Basin countries. Their results suggest that stock market interdependence is positively correlated with the extent of trade where the equity markets for countries with strong economic ties tend to move together. Further, they suggest that the correlations are important in explaining cross-country average returns beyond the explanation given by the three-factor asset pricing model used in their study.

ASEAN5 is the focus of this study and therefore, it is relevant to discuss briefly the ASEAN Free Trade Area (AFTA), though no adjustment is made in the analysis carried out in Chapter 7. AFTA was made operational in January 1993; however, the purpose of this regional trade arrangement is questionable because intra-ASEAN trade is minor relative to total ASEAN trade. Indeed, the level of this trade has increased only marginally over the last two decades. For instance, in 2004 less than 10% of all trade was attributed to intra-ASEAN trade under the AFTA’s common effective preferential tariff scheme (Engammare and Lehmann, 2007). Perhaps it is because ASEAN countries have similar characteristics such that comparative advantage results in them looking elsewhere for trade (Jugurnath, Stewart and Brooks, 2006). Thus, whether the benefits of trade creation increase the welfare of the ASEAN members remains to be seen (Bowles, 1997; Sharma and Chua, 2000). Elliot and Ikemoto (2004) examine the impact of ASEAN bilateral trade flow (intra-regional and extra-regional bilateral trade) before and after the formation of AFTA. They find that trade flows are not significantly affected in the years following the signing of the AFTA, suggesting that the ASEAN countries are retaining their outward-oriented policy in trade. However, Tang (2005) finds that AFTA has contributed to the gradual, but significant, growth in trade among the member countries as well as with non-member countries. Moreover, as suggested by Bowles (2002), AFTA provides the most concrete form of regional economic arrangement, as a platform to ensure that the ASEAN countries remain competitive to attract foreign investments in the post-Cold War political economy.\textsuperscript{14}

Apart from the cointegration study of trade balance, there is no study that tests for cointegration in trade among countries, particularly the ASEAN5 countries. The focus of study in Chapter 7 is to analyse the question of whether countries that are close geographically and economically share similar variation in trade over time. Does their trading behaviour share one or more common factor/s? Therefore, the current study fills a gap in the literature by testing for different trade measure relations using cointegration and

\textsuperscript{14} In addition, Bowles also provides interesting insight into Asian regionalism in response to the 1997 crisis.
vector error correction models (VECMs) among the ASEAN5 countries. As economic integration in ASEAN involves deepening and strengthening intra-ASEAN economic interdependence, with intra-regional trade as one of the factors, analysis in this chapter presents further insight into the trade patterns within the ASEAN5.

2.5 Literature on asset pricing

This thesis in particular tests the asset pricing within the ASEAN5 equity markets. Chapters 8 and 9 are attributed for this purpose, with analysis in the latter chapter adding macroeconomic and global market factors to the asset pricing model. As such, it is important to briefly discuss asset pricing models in this section before examining existing studies on asset pricing.  

Asset pricing has been a well-researched topic in finance. The traditional asset pricing model, the Capital Asset Pricing model (CAPM) of Sharpe (1964) and Litner (1965), has been heavily scrutinised in the literature. Given the alleged weaknesses of the CAPM, in particular for its simplistic nature and empirical shortcomings, other models have emerged to improve the CAPM somewhat; they include the Arbitrage Pricing Theory (APT) of Ross (1976), the Intertemporal Capital Asset Pricing Model (ICAPM) of Merton (1973), and the Fama and French Multifactor Model (1993; 1996). However, it is interesting to note that the CAPM is still very much discussed in the literature despite the growing of other asset pricing models, oftentimes as a comparison to these newer models. This thesis focuses on asset pricing models based on the CAPM and followed by multifactor asset pricing models, as used in Fama and French (1993) and Carhart (1997).

The effect of the size of a firm on its stock market performance is well-documented in the literature. This is to be expected, given that smaller firms have higher transaction costs and less liquidity, which then lead to higher expected returns from the investment. Evidence of the size effect is found in Banz (1981) and Reinganum (1981). Banz (1981) tests the CAPM over a 40-year period on the US data and concludes that the CAPM is misspecified given the existence of size effect in explaining the returns, which is profound for small NYSE firms. This conclusion is further supported by Reinganum (1981), who also suggests that firm size effect is more prominent that earnings/price (E/P) effect.

Fama and French (1992) find that market equity and the ratio of book equity to market equity (BE/ME) capture much of the cross-section of average common stock

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15 O’Brien (April 2008) presents a comprehensive literature on asset pricing, in particular for the Australian stock market.
returns for the 1963-1990 period. The cross-sectional regression of Fama and MacBeth (1973) is used in this study for the US monthly stock market data. They note that when the tests allow for variation in beta that is unrelated to size, the relation between market beta and average return is flat. Fama and French (1993) extend their previous study by using the time series regression to test the asset pricing for common stock and bond returns. Monthly returns on NYSE, AMEX and NASDAQ stocks from 1963 through 1991 are regressed on the returns to a market portfolio of stocks and mimicking portfolios for size, book-to-market equity (BE/ME) and term-structure risk factors in returns. Firm size and book-to-market equity (BE/ME) are related to profitability. It is shown that firms with a high BE/ME (a low stock price relative to book value) tend to have low earnings on assets and vice-versa. Therefore, this relation implies that the relative profitability, as a common risk factor in returns, may explain the positive relation between BE/ME and average return. Notwithstanding, small firms can suffer a longer earnings depression than that of big firms. Thus, size has the potential to explain the common risk factor in regard to the negative relation between size and average return.

Fama and French form 25 portfolios based on size and book-to-market equity (BE/ME), namely SMN (small minus big) and HML (high minus low). The portfolio SMB is meant to mimic the risk factor in returns behaviour related to size (small and big stock with about the same weighted-average book-to-market equity). This SMB portfolios represent the monthly difference between the simple average of the returns on the three small-stock portfolios (S/L, S/M, and S/H) and the three big-stock portfolios (B/L, B/M and B/H). The portfolio HML, however, is meant to mimic the risk factor in returns related to book-to-market equity, with about the same weighted-average size. In this regard, HML is the monthly difference between the simple average of the returns on the two high-BE/ME portfolios (S/H and B/H) and the two low-BE/ME portfolios (S/L and B/L). This gives rise to the three-factor model which posits that this model is able to capture the variation in the patterns of asset returns not explained by the CAPM. In their three-factor model the market factor, firm size, and a book-to-market equity factor are shown to have explanatory power over the cross-section of returns on US stocks. In addition, their study suggests that the explanatory power of the three-factor model is higher that that of the CAPM. Further, Fama and French test their three-factor model to include earning behaviour (Fama and French, 1995) and other market anomalies (Fama and French, 1996). It is noted that Fama and French’s (1996) results indicate that the three-factor model fails to explain the continuation of short-term returns (momentum effect). Furthermore, critics
of the three-factor models have argued vigorously on the validity of the models and point out issues such as data mining, survivorship bias, and longer time for verification to affect the performance of the three-factor model (for example see Black, 1993; Kothari, Shanken and Sloan, 1995; Shumway and Warther, 1999).

Against the critics however, Fama and French’s three-factor models have been widely used in an international setting. Halliwell, Heaney and Sawicki (1999) are the first to test the Fama and French model on Australian equity market data from 1981 to 1991. While their results in general conform to Fama and French (1993), some variation exists for the book-to-market factor from Australian data. Recently, Faff (2004) extends the Halliwell et al. (1999) study on the Australian equity market. It is interesting to note that, while the results in general are favourable to the model based on asset pricing tests, evidence from the estimated risk premia is less persuasive. Negative size effect premia found in this study pose further questions for the continuation of its existence in Australian equity market, when there is some evidence that size premia have disappeared from the US market after the 1980s period and that the widespread use of size in asset pricing is unwarranted (Horowitz, Loughran and Savin, 2000; Horowitz, Loughran and Savin, 2000a).

Fama and French (1998) extends their three-factor model to 13 developed markets and 16 emerging markets for the period 1975 to 1995. The findings provide further support to the existence of a value premium for international stock markets, indicating that the return to value stocks is real. Griffin (2002) examines the usefulness of domestic, world and international versions of the Fama and French three-factor model for equity returns of Canada, Japan, the UK, and the US data from 1981 to 1995. The findings in this article do not support the notion that there are benefits to extending the Fama and French three-factor model to a global context, since the results suggest that country-specific three-factor models are more useful in explaining average stock returns than are world and international versions. Further, Griffin and Lemmon (2002) find that the three-factor model is unable to explain the large return differences between high and low book-to-market among firms with the highest distress risks.

Fama and French’s three-factor models are also tested on some of the Asian equity markets. Shum and Tang (2005) test this model on the equity markets of Singapore, Hong Kong and Taiwan from July 1986 to December 1998. They find evidence that this model is able to explain the variation of returns, consistent with the US findings. They further note
that contemporaneous market excess returns contribute most to the results, whereas the size and book-to-market equity effects are more limited. However, testing the three-factor model with lagged market excess returns changes the results substantially. Drew and Veeraraghavan (2002) test this model on the Malaysian equity market and further include the Philippines, Korea, and Hong Kong in Drew and Veeraraghavan (2003). These two studies suggest that the model is able to explain the returns for these Asian stock markets during the 1990s.

Instead of using the Fama and French three-factor model, Chui and Wei (1998) use the Fama and MacBeth (1973) procedure to analyse the relationship between expected returns and market beta, book-to-market equity and size for Malaysia, Thailand, Korea, Hong Kong and Taiwan. Their results show that between July 1977 and June 1993, the relationship between stock return and market beta is weak while size and book-to-market equity effects are more prominent in general. In addition, they note some similarities in the degree of relation between the average return and book-to-market equity with that of the average book-to-market ratio. For the Canadian equity market, the presence of size and book-to-market value effects are documented in Elfakhani, Lockwood and Zaher (1998). However, they find no relationship between average return and market beta.

The momentum strategies have also captured interest in asset pricing. De Bondt and Thaler (1985; 1987) investigate whether the overreaction hypothesis affects the stock prices on the US stock market. Stock returns over three to five years are examined and it is found that portfolios of prior losers have outperformed prior winners. It is recorded that three years after portfolio formation, losers have earned about 25% more than winners. In terms of seasonality of returns, they find that excess returns in January are related to three factors: short-term performance, long-term performance and previous year market returns. Jegadeesh and Titman (1993) examine relative strength strategies for AMEX and NYSE stocks over the period 1965 to 1989. They find that over the medium term (3-12 months), firms with high returns outperformed firms with low returns where trading strategies that buy past winners and sell past losers reap significant abnormal returns, particularly for small firms. Rouwenhorst (1998) extends the momentum study to 12 European equity markets for the period 1978 to 1995. He finds that medium-term return continuation also exists, across size deciles, in these European markets. Momentum effects for the Australian equity market are studied by Hurn and Pavlov (2003), who find evidence for the existence

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16 The profitability of 32 strategies is analysed in this study.
of short- to medium-term momentum effects although the factors contributing to these effects remain to be explained. However, recent evidence provided by Kassimatis (2008) suggests that the Fama-French factors and the momentum factor do not seem to work for the Australian market. The results also indicate that time variation in factor loadings is an important consideration when testing asset pricing models because variables included in static models may lead to misspecified systematic risk.

For the ASEAN5 equity markets, Hameed and Kusnadi (2002), McInish, Ding, Pyun and Wongchoti (2008) examine the momentum effects for Malaysia, Singapore and Thailand. They find no evidence to support the argument that trading strategies based on past returns generate profitable returns for these ASEAN markets. This conclusion is further supported by Chen and Fang (2007), who also include Indonesia in their sample.

Extending the Fama and French (1993) three-factor model and Jegadeesh and Titman’s (1993) momentum model, Carhart (1997) proposes a four-factor model. He examines the performance persistence of mutual funds in the USA for the period from January 1962 to December 1993. He proposes that the four-factor model better explains most of the variation and the pattern of portfolio returns. It is found that size and momentum carry more weight in explaining the dependent variables than book-to-market equity. However, in ASEAN equity markets, Chen and Fang (2007) find limited evidence to support Carhart’s four-factor model in preference to the Fama and French three-factor model, although both models perform better than the CAPM in explaining the returns.

There is a growing asset pricing literature dealing with the Asian region yet, to the author’s knowledge, none focuses on the ASEAN5 equity markets over the study period chosen for this study. The following studies involve countries in the ASEAN5. Drew and Veeraraghavan (2002) study the Malaysian equity market from December 1992 to December 1999. Drew and Veeraraghavan (2003) further examine the asset pricing for Malaysia and the Philippines (along with Korea and Hong Kong) from December 1993 to December 1999 using monthly data from Datastream. Both studies suggest that the Fama and French multifactor model performs better in explaining return variation in Malaysia and the Philippines compared to the CAPM. Yet both studies rely on quite short study periods.

Shum and Tang (2005) employ the Fama and French three-factor model for three equity markets, including Singapore, from July 1986 to December 1998. They conclude that the multifactor model helps in explaining the monthly return variations for the
Singapore equity market. Also, Chui and Wei (1998) use the Fama-MacBeth (1973) procedure to test the asset pricing for Malaysia and Thailand using monthly data from July 1977 to June 1993. The results for Malaysia and Thailand suggest that size effects are important in explaining the returns for both countries but book-to-market equity is not prominent in Thailand. Furthermore, no evidence of a positive relationship between market beta and stock returns is documented. These results are unexpected and probably reflect problems arising from the choice of data period, which includes major structural changes accompanying movements towards greater levels of integration (Bekaert and Harvey, 2000; 2002; 2003). Neither of these studies includes the momentum factor.

It is important to analyse the profitability of momentum-based trading strategies for the ASEAN5 as a comparison with studies in other regions. Chen and Fang (2007) extend Carhart (1997) to the stock markets of Malaysia, Singapore, Thailand and Indonesia. They use monthly stock data for the manufacturing industry obtained from the PACAP database over various sample periods. The CAPM, Fama and French three-factor model and Carhart’s four-factor model are used in analysis. They find evidence that portfolio strategies based on value and size effects are significant for these markets while momentum effects are not important. Hameed and Kusnadi (2002) examine momentum strategies for Malaysia, Singapore and Thailand employing data that includes monthly returns from the PACAP database over the period 1979 to 1994. They find little evidence to support the profitability of momentum strategies for these markets. More recently, McInish, Ding, Pyun and Wongchoti (2008) evaluate the profitability of the momentum strategies using the same countries over the period 1990 to 2000. Key market information and other exogenous variables are also considered in this study but the momentum effect is yet to be found. Therefore, a general consensus prevails from these studies – the momentum effect is not prominent for the ASEAN5 markets.

Tests of asset pricing that examine variation in returns using variables other than the traditional asset pricing factors have received some attention in the literature. Attempts include the use of various financial and macro variables to explain variation in equity returns, even though it has proven difficult to choose suitable factors. In addition, regional and global influences are also of interest in explaining variation in returns. Previous studies

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17 This study also includes Hong Kong, Korea and Taiwan. Monthly data is collected from the Pacific-Basin Capital Market (PACAP) database.
18 Other stock markets included in this study are Japan, Hong Kong and South Korea.
19 Other stock markets included in this are Hong Kong and Taiwan.
20 Japan, Taiwan and Hong Kong are also included in the sample of this study. Data, including daily returns, are derived from the PACAP database.
have attempted various factors to capture returns co-movements. For instance, Chan, Karceski and Lakonishok (1998) try to identify the sources of return covariation for the US data, regardless of whether they are priced or not, using fundamental, technical, macroeconomic and statistical factors. Their results support the factors related to market, size, past return, book-to-market, and dividend yield. However, macroeconomic factors do not seem to explain return variation, except for default premium and term premium.

Lau, Lee and McInish (2002) examine the relationship between stock returns and beta, size, earning–to-price ratio, cash flow-to-price ratio, book-to-market equity ratio and sales growth for the Singaporean and Malaysian equity markets for the period 1988 to 1996. Anomalies are found for these two markets. Furthermore, conditional relationship exists between stock returns and beta, while negative relationship prevails for size and stock returns for both equity markets. Other variables show variation in the relationship with returns across these markets.

Chen, Roll and Ross (1986) test whether risks associated with innovations in macroeconomic variables are priced, analysing data for the US market from January 1953 through November 1983. The macroeconomic variables employed in their study include industrial production, inflation, interest rate spread, bond spread, share market portfolio, consumption and oil prices. They find that these macroeconomic variables are able to explain the returns, except for market portfolio, consumption and oil price. Fama (1990) and Campbell and Mei (1993) also use industrial production in their asset return studies. Further, He and Ng (1994) examine whether size and book-to-market equity are proxies for the macroeconomic risk factors used in Chen, Roll and Ross (1986). He and Ng’s study focuses on the US market from June 1968 to December 1989. They suggest that adding size and book-to-market effects changes the results found in the Chen et al. (1986) multifactor model. Moreover, book-to-market equity tends to have greater explanatory power than size in explaining returns.

Chen (1991) examines the relation between changes in financial investment opportunities and changes in the macroeconomy from 1954 to 1986 for the US data. Their results suggest that the default spread, term spread, one-month T-bill rate, lagged industrial production growth rate and dividend-price ratio are important in explaining future market returns. Moreover, the expected excess market return is negatively related to current GNP growth but positively related to its future growth. Heaney and Hooper (1999) focus on the

21 Chan et al. (1998) also include the data for the UK and Japan. Results are robust for this out-of-sample data.
explanatory power of political risk indices, regional effects and world influences over the variation of returns in their study of Asia/Pacific equity markets, including the ASEAN5 equity markets. They suggest that from the period January 1985 to August 1997, regional and global influences are able to explain much of the variation in these equity market returns but find little evidence supporting the effect of political risk indices on returns. Furthermore, their results indicate the existence of strong ‘regionalism’ effects for markets within ASEAN, thus providing support for the inclusion of regional macro factors based on regional effects.

Bilson, Brailsford and Hooper (2001) employ four local factors as a proxy for macroeconomic variables: money supply, prices level, real activity and exchange rates. Their proxy for a global factor is the value weighted world market index. They study 20 emerging markets includes Malaysia, Thailand, Indonesia and the Philippines from January 1989 to December 1997. Unlike Heaney and Hooper (1999), they find that in general emerging markets show little sensitivity to the return on the world market index, while the exchange rate variable is the most prominent in explaining returns.

Asset pricing models that include local, regional and world factors are supported by the literature and a large variation exists for the choice of real sector variables. Most of the ASEAN5 markets have opened up in the late 1980s (see Bekaert and Harvey, 2000; Phylaktis and Ravazzolo, 2002) and therefore regional and world influences are believed to be important for ASEAN5 return variation. It is also interesting to note that Phylaktis and Ravazzolo (2002) find evidence that financial integration is accompanied by economic integration for the Pacific Basin countries.

2.6 Chapter summary

The survey of literature provided in this chapter sets a framework for the analysis carried out in this thesis, for which asset pricing test for the ASEAN5 countries is the main objective. However, studies on linkages that exist among the ASEAN5 equity markets, GDP and trade form an important extension to the four-factor asset pricing test in this thesis, as no similar studies have been done for the ASEAN5 equity markets before. As such, this thesis contributes to fill the gap in asset pricing literature.
Chapter 3

METHODOLOGY

3.1 Introduction

This chapter describes the methodology used in this thesis to test the time series data. The unit root tests, cointegration tests, vector error correction models (VECMs) used in Chapter 5, 6 and 7 as well as for asset pricing models employed in Chapter 8 and 9 are provided in the sections that follow.

3.2 Unit root tests

The unit root tests are used in testing the stationarity of the time series used in Chapters 5, 6 and 7. This test is important because regressions of non-stationary variables on each other may lead to spurious regression which probably results in misleading inferences over the estimated parameters and the degree of its association. Therefore, it is important to test for the presence of a unit root on the time series data before testing for cointegration. This study employs three unit root tests: the Augmented Dickey-Fuller (ADF) test (Dickey and Fuller, 1979), the Phillips-Perron (P-P) test (Phillips and Perron, 1988) and the KPSS test (Kwiatkowski, Phillips, Schmidt and Shin, 1992). The basic equation that underlies these tests is:

\[ \Delta x_t = \rho_0 + \rho x_{t-1} + \sum_{i=1}^{\delta} \delta_i \Delta x_{t-1} + \epsilon_t \]  

(3.1)

where \( x_t \) is variable observed of at time \( t \), \( \epsilon_t \) is the residual term, \( \rho_0, \rho \), and \( \delta_i \) are parameters of the model. The null hypothesis for each of the ADF and P-P tests is that a series is non-stationary if \( \rho = 0 \) and the process is stationary if \( \rho < 0 \). Therefore, rejection of the unit root hypothesis is necessary to support stationarity of the series. However, the null hypothesis for the KPSS test is that the series is stationary, so we require failure to reject the hypothesis where the series is stationary.
3.3 Tests for cointegration

The Johansen test (Johansen, 1988; Johansen and Juselius, 1990) is used in testing for cointegration in this thesis. The procedure has the advantage of taking into account the error structure of the underlying process as well as incorporating the short-run and long-run dynamics of a system of economic variables. As such, this procedure is able to estimate and test the equilibrium relationship among non-stationary series while simultaneously abstracting short-term deviations from equilibrium. The Johansen test is based on the model:

\[
\Delta X_t = \theta_1 + \theta_2 T + \sum_{k=1}^{K} \theta_{3k} \Delta X_{t-k} + \theta_4 X_{t-k} + \epsilon_t, \tag{3.2}
\]

where \( X_t \) is a \((p \times 1)\) vector as at time \( t \), \( \Delta \) is the change operator from time \( t-1 \) to \( t \), \( \theta_j \) is a parameter vector, and \( T \) is a time trend. The Johansen tests focus on the parameter matrix \( \theta_4 \) and the number of linearly independent vectors in this matrix. This is generally written in the form:

\[
\theta_4 = \alpha' \beta \tag{3.3}
\]

The coefficient \( \alpha \) is an \((p \times j)\) matrix of error correction term parameters and \( \beta \) is a \((j \times p)\) matrix of cointegrating vectors, with \( j \) being the number of cointegrating vectors and \( p-j \) being the number of common stochastic trends. There are five countries in the ASEAN5 analysis, therefore \( p \) is set to 5 \((p=5)\). Further, the \( \theta_3 \) term provides estimates of the temporal causality that exists between the time series variables. These are similar to traditional Granger causality estimates, although they are adjusted for the impact of longer-term effects as captured by the error correction term. The \( t \)-statistic is referred to in the discussion of temporal causality results when there is only one lag in the estimation. If there is more than one lag, Chi-square statistics are used instead. The temporal causality parameter, \( \theta_3 \), is represented by:

\[
\sum_{k=1}^{K} \theta_{3k} \Delta X_{t-k}
\]

for lag \( = k \),

\[
\begin{bmatrix}
\theta_{31} (1,1) & \theta_{31} (1,2) & \ldots & \theta_{31} (1, \rho) \\
\theta_{32} (2,1) & \theta_{32} (2,2) & \ldots & \theta_{32} (2, \rho) \\
\vdots & \vdots & \ddots & \vdots \\
\theta_{3K} (\rho,1) & \theta_{3K} (1,1) & \ldots & \theta_{3K} (\rho, \rho)
\end{bmatrix} \tag{3.4}
\]
A better understanding of the shared variation in links that exist between the ASEAN5 will provide further insight into the likelihood of integration of the ASEAN nations. Based on Click and Plummer (2005), Hafer and Kutan (1994) and Kasa (1992), complete convergence across the ASEAN5 is assumed when there are $p-1$ cointegrating vectors among $p$ series. This implies a single shared common stochastic trend such that the $p$ series are perfectly correlated over long horizons. Further, a finding of less than $p-1$ but at least one cointegrating vector implies some partial convergence of the series. If there were no cointegrating vectors, there is no shared common trend and thus no long-run convergence in the series. Further, the results for trace statistic and maximum eigenvalue statistic are presented but the cointegrating relationship is assumed based on the results from trace statistics when none is observed from maximum eigenvalue statistics (see Johansen and Juselius, 1990; Lutkepohl, Saikkonen and Trenkler, 2001; Dunis and Shannon, 2005).

The Schwarz information criterion (SC) is used to identify the number of lags for cointegration tests and vector error correction model estimation (see Irandoust and Ericsson, 2004; Herzer and Nowak-Lehmann, 2006) in the full period, pre-crisis and post-crisis period. The number of lags used for ASEAN5 equity markets (Chapter 5) is one for all three periods. The lag length used for ASEAN5 GDP (Chapter 6) is one lag for nominal and real GDP, across all study periods. The ASEAN5 trade (Chapter 7) also varies for different trade measures and periods of study. The number of lags is as follows: The first trade measure is trade balance with full period uses two lags for Malaysia, Singapore, Thailand and the Philippines, and three lags for Indonesia. The pre-crisis period uses one lag for Malaysia and two lags for Singapore, Thailand, Indonesia and the Philippines. The post-crisis period uses two lags for Malaysia, Singapore, Thailand, the Philippines, and three lags for Indonesia). The second trade measure is total trade with the full period using two lags, while the pre-crisis and post-crisis periods use one lag. The third measure is ASEAN5 imports with the full period using two lags, the pre-crisis and post-crisis periods using one lag. The fourth trade measure is ASEAN5 exports, where one lag is used for analysis of all periods.

In addition, seasonal adjustment is made to the data for ASEAN5 GDP and ASEAN5 trade, using seasonal dummy variables (denoted as S1, S2 and S3 in the tables found in Chapters 6 and 7). Adjustment for the 1997 crisis period is also necessary for the
full period analysis and the crash period dummy variables cover the period from July 1, 1997 to December 31, 1998.

3.4 Asset pricing

The following sections provide explanation on asset pricing models, the CAPM and the four-factor models, used for regressions in Chapter 8. This is followed by explanation on mimicking portfolio formation from the ASEAN5 equity markets data, according to size, book-to-market equity and momentum effects.

3.4.1 Models

The explanatory variables used in analysis in Chapter 8 include the excess return on the market portfolio and the returns on mimicking portfolios capturing size, book-to-market equity and price momentum effects. The dependent variables consist of excess returns earned on the portfolios formed on size and book-to-market equity (size-BTME). In order to capture additional variation in returns related to industry-specific influences, excess returns on industry portfolios are also included as dependent variables in the regressions. Two models employed in this and the models are the CAPM and the four-factor model including the Fama and French three factor model and the momentum adjustment of Carhart. The CAPM is defined as:

\[ R_i - R_f = \alpha + \beta (R_m - R_f) + \epsilon_i \]  

(3.5)

The four-factor model is defined as:

\[ R_i - R_f = \alpha + \beta (R_m - R_f) + sSMB_t + hHML_t + mMOM_t + \epsilon_i \]  

(3.6)

where \( R_i - R_f \) is portfolio \( i \)'s return in excess of the risk-free rate (\( R_f \)) or alternatively, industry return in excess of risk-free rate at time \( t \); \( R_m - R_f \) is market portfolio excess return at time \( t \); SMB is the excess return of small stocks over large stocks; HML is the excess return on high BTME stocks over low BTME stocks; and MOM is the excess six-month return on past Winner stocks over past Loser stocks; \( \alpha \) is a constant term, while \( \beta, s, h, \) and \( m \) are the slope coefficients from time series regression.

The Fama and French model postulates that the excess returns on portfolios are explained by the excess return on market portfolio, the difference between the return on small stocks and large stocks (SMB), and the difference between the return on portfolios of high and low book-to-market equity stocks (HML). Their studies conclude that high book-
to-market equity firms have low earnings to book equity and positive slopes on the HML factor, while low book-to-market equity firms have high earnings on book equity with negative slopes on the HML factor.

3.4.2 Portfolio formation

Following Fama and French (1992), six portfolios are formed from the intersection of two groups of stocks based on size and book-to-market equity. Size of the stocks is represented by their market value (MV, i.e. price times shares outstanding) while value/profitability is based on book-to-market equity (BTME) of the stocks. In order to form the six portfolios, stocks are divided into two groups of MV, namely small stocks (S) and big stocks (B). Stocks are further divided into three BTME groups – High (H), Medium (M) and Low (L). As such, the intersections of these MV and BTM groups produce the portfolios of S/L, S/M, S/H, B/L, B/M, and B/H.

The sample stocks in each of the ASEAN5 equity markets are ranked on size (MV). The median size for each of the ASEAN5 equity markets is used to allocate stocks to the small (S) or big (B) group. For the BTME groups, the breakpoints of the ranked BTME are as follows: L is the bottom 30%, M is the middle 40% and H is the top 30%.

Momentum portfolios are constructed by sorting the cumulative stock returns over the past two quarters and then splitting the stock returns into two groups – high returns and low returns – based on median cumulative returns.\(^{22}\) The momentum portfolios (MOM) are then formed by deducting returns from the low returns group (Losers) from the returns earned by the high returns group (Winners) for each quarter of the sample period based on previous two-quarter rankings. In this manner, the return of MOM represents the momentum premium and mimics the common risk factor related to past short-term returns.

3.5 Asset pricing and macro factors

The methodology used in Chapter 9 is similar to that of Chapter 8. The difference is that Chapter 9 extends the four-factor asset pricing models to include the prediction errors (residuals) that are used to capture the macro factors: unexpected GDP, unexpected total trade and unexpected local market returns. Further, the world excess returns are also included as a proxy for world effects. Here, unexpected local market returns, unexpected GDP and unexpected total trade are derived from VAR or VECM estimated in Chapter 4.

\(^{22}\) Rouwenhorst (1998) assigns the stocks with the top 10 percent highest past six month returns to Winners portfolios and the lowest 10 percent to the Losers portfolio.
Chapter 5, and Chapter 6 respectively. It is important to note that the prediction errors used for each of the ASEAN5 markets are adjusted for regional effects because the VAR or VECM used to estimate these values are based on the ASEAN5 countries taken jointly. The proxy for world effects is the world excess return, which is calculated as world return minus risk-free rate for each of the ASEAN5 countries.

The regression model used in Chapter 9 is an extension of the four-factor models described in equation 3.6 in Section 3.4.1:

\[
R_i - R_f = \alpha + \beta [R_m - R_f] + s \text{SMB}_t + h \text{HML}_t + m \text{MOM}_t + e_t
\]  

(3.6)

This model is expanded to include the macro factors, and now defined as:

\[
R_i - R_f = \alpha + \beta [R_m - R_f] + s \text{SMB}_t + h \text{HML}_t + m \text{MOM}_t + g \text{UGDP}_t + r \text{UTT}_t + r \text{URI}_t + w \text{WRF}_t + e_t
\]  

(3.7)

Further, each of the macro variables is tested separately with the four-factor model:

\[
R_i - R_f = \alpha + \beta [R_m - R_f] + s \text{SMB}_t + h \text{HML}_t + m \text{MOM}_t + g \text{UGDP}_t + e_t
\]  

(3.8)

\[
R_i - R_f = \alpha + \beta [R_m - R_f] + s \text{SMB}_t + h \text{HML}_t + m \text{MOM}_t + r \text{UTT}_t + e_t
\]  

(3.9)

\[
R_i - R_f = \alpha + \beta [R_m - R_f] + s \text{SMB}_t + h \text{HML}_t + m \text{MOM}_t + r \text{URI}_t + e_t
\]  

(3.10)

\[
R_i - R_f = \alpha + \beta [R_m - R_f] + s \text{SMB}_t + h \text{HML}_t + m \text{MOM}_t + w \text{WRF}_t + e_t
\]  

(3.11)

where \( R_i - R_f \) is portfolio \( i \)'s return in excess of the risk free rate (\( R_f \)) or alternatively, industry return in excess of risk free rate at time \( t \); \( R_m - R_f \) is market portfolio excess return at time \( t \); \( \text{SMB} \) is the excess return of small stocks over large stocks; \( \text{HML} \) is the excess return on high BTME stocks over low BTME stocks; and \( \text{MOM} \) is the excess six-month return on past Winner stocks over past Loser stocks; \( \text{UGDP} \) is unexpected GDP; \( \text{UTT} \) is unexpected total trade; \( \text{URI} \) is unexpected local market returns and \( \text{WRF} \) is the world excess returns. \( \alpha \) is a constant term while \( \beta, s, h, m, g, t, r, \) and \( w \) are the slope coefficients from the regressions.

It is important to note that the macro factors, excluding the world factor, are calculated in terms of unexpected changes in the variables in question. It is assumed that given rational expectations, the share market participants form expectations about variables like GDP, trade and equity market returns. As a result, the share market will react to
unexpected changes in these variables. ASEAN5-based time series models are estimated for equity market returns, GDP and trade (Chapters 5, 6 and 7) and these models are relied upon to provide quarterly predictions. The difference between the actual change and the predicted change gives rise to the unexpected macro variables that are included in the analysis that follows.

3.6 Chapter summary

This chapter presents the methodology used for data analysis in this thesis. In particular, Johansen cointegration tests and asset pricing models are described. Cointegration tests are used in Chapter 5 through Chapter 7, while asset pricing tests are the focus of Chapter 8 and Chapter 9 of this thesis.
Chapter 4
DATA

4.1 Introduction

This chapter provides the data sets used for the thesis. The data set is different for every analysis chapter and the following sections present the data employed for chapters on the links of ASEAN5 equity markets, GDP and trade. Further, data for portfolio formation used in asset pricing regressions are given in the section that follows.

4.2 Data for ASEAN5 equity markets

The data used for analysis in Chapter 5 consists of weekly indices as in Al-Kazali et al. (2006) and Azman-Saini et al. (2002). It has been argued that daily return data are preferable to lower frequency data such as weekly or monthly returns because longer horizon returns can obscure transient responses to innovations which may last just a few days. However, daily data contains considerable noise and could be affected by market features such as day-of-the-week effects.

Total return (price plus gross dividends) is chosen rather than price indices because it more accurately captures the return to equity market investments. The stock market indices are collected for each of the ASEAN5 countries, the USA, Japan and Australia. Continuously compounding returns are then calculated. Data for this study are obtained from Datastream and include both International Finance Corporation (IFC) for Malaysia, Thailand, Indonesia and the Philippines and MSCI data for Singapore, the USA, Japan and Australia. The IFC indices are particularly appropriate because they are consistently computed across the different countries and this aids comparability.

This chapter uses investable indices where available because they represent a portfolio of domestic equities that are available to foreign investors, while the IFC Global Index represents the overall market portfolio for each country (Bekaert, Harvey and Lundblad, 2003). All the indices are expressed on a US dollar basis lest the effect of currency fluctuations confound the equity market return effects (Yang et al., 2006).

The study period employed for this chapter is from January 1990 to March 2006 and in accordance with the literature the sample is divided into pre- and post-1997 crisis periods. Observations from July 1997 to June 1998 are excluded from sub-periods analysis.
to avoid the impact of the crisis. This approach is also used in Ibrahim (2005) and Chen et al. (2002) in their study of the ASEAN5 and Latin American markets respectively. The pre-crisis period in this chapter is from January 1990 to June 1997 and the post-crisis period is from July 1998 to March 2006.  

4.3 Data for ASEAN5 GDP

The analysis in Chapter 6 relies upon quarterly US dollar (USD) gross domestic product (GDP) for ASEAN5 countries, from the period of the first quarter in 1990 to the first quarter in 2006. There are two sets of data used in analysis, the first set being real GDP growth in US dollars (rUSD) and the second set being nominal GDP in US dollars (nUSD). The US dollar denominated GDP value is chosen for this study because of its relevance to international investors. Quarterly GDP data is chosen because, as noted by Abeysinghe and Rajaguru (2004), econometric studies that examine the dynamic relationship between countries will usually need quarterly data, as a minimum, to reduce the problem of temporal aggregation arising from using annual data, for example.

Datastream is the main source of the data. However, there is a small number of missing observations at the beginning of the study period for some of the countries. Countries with missing data include Malaysia (1990), Thailand (1990 to 1992), Indonesia (1990 to 1999) and the Philippines (1990 to 1992). Therefore, alternative data sets are used where available. For example, data from the IFS Database is extracted to complete the missing data for Indonesia and the Philippines but this does not provide sufficient data to fill the gaps in the Malaysian and Thailand time series. Accordingly, the missing data for Malaysia is obtained from the Corporate and User Services Division in the Department of Statistics, Malaysia, while the missing data for Thailand is extracted from the National and Economic Development Board of Thailand. In addition, some further adjustment is required to correct for differing base years, particularly for Datastream and the IFS database.

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23 Click and Plummer (2005), Choudhry et al. (2007) and Lim (in press) also choose July 1998 as the start of the post-crisis period for their study, as the devaluation of the Thai baht in July 1997 is widely regarded as the triggering event for the crisis. However, Daly (2003) chooses a post-crisis period starting from November 1, 1997 and his pre-crisis period ends September 1, 1997. Thus the crisis period in this study runs for only two months.


25 Available at [http://www.nesdb.go.th/econSocial/macro/macro_eng.php](http://www.nesdb.go.th/econSocial/macro/macro_eng.php). The data is in annual form, so interpolation of the quarterly values based on the assumption of constant change in GDP each quarter within each of the three years is needed.
The original data is expressed in local currency GDP. Nominal GDP measures in USD are calculated using foreign exchange rates between the USD and country’s local currency. Real GDP measures are calculated from the nominal measures. A GDP deflator is generally preferred for calculating real GDP but this is not available for all of the countries in the sample. As a result, the consumer price index (CPI) is used to calculate the real GDP following Haug et al. (2000). Most of the CPI data are extracted from Datastream but for Indonesia, the data from 1990 to 1995 are not available. This is obtained from the South African government economic database. For the purpose of empirical analysis, the data are transformed into logarithms.

Due to the 1997 crisis, the full sample period is divided into pre-crisis and post-crisis sub-periods. The pre-crisis period is from quarter one in 1990 to quarter two in 1997 (q1:1990 – q2:1997) and the post-crisis period is from quarter one in 1999 to quarter one in 2006 (q1:1999 – q1:2006). The post-crisis period in this chapter is slightly different from that of Chapter 5 (q3:1998 – q1:2006) because on visual analysis it is apparent that GDP takes a longer time to recover after the crisis, consistent with ‘stickiness’ in the data (Click and Plummer, 2005). Further in this chapter, different post-crisis periods are used to assess the impact of post-crash period choice.

4.4 Data for ASEAN5 trade

The trade linkages that exist among the ASEAN5 as a group are examined in Chapter 7, using three different trade measures: total trade (imports plus exports), total imports and total exports. These three trade measures are commonly found in the literature (for example Arize, 2002; Greenaway and Milner, 2002; Irandoust and Ericsson, 2004; Elliot, 2007). Data is in nominal US dollars rather than local currencies, following Herzer and Nowak-Lehmann (2006) and Irandoust and Ericsson (2004). Analysis in this chapter is conducted on the natural log of monthly trade data obtained from Datastream. The sample period ranges from January 1990 to March 2006 but due to the 1997 crisis, the sample period is also divided into pre-crisis and post-crisis sub-periods to allow for 1997 crisis impacts. The pre-crisis period is from January 1990 to June 1997 and the post-crisis period is from January 1999 to March 2006.

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26 Available at http://www.thedti.gov.za/econdb/IMFCoNINDONESIACPICHA.html
27 MacDonald and Taylor (1991) note that base periods are irrelevant where data are transformed to logarithms.
28 Trade data in nominal value is used instead of real value because analysis in Chapter 9 will require the use of nominal trade value.
4.5 ASEAN5 asset pricing

The data used for Chapters 8 and 9 focuses on all available stocks in ASEAN5 equity markets, for the period from January 1990 to March 2006. Data on month-end asset prices, market value (MV), book-to-market equity (BTME) and industry returns are collected from Datastream. Price indices (PI) expressed in local currency are collected for the ASEAN5 markets. Risk-free rates are obtained from the IFS database with the three-month Treasury bill rates for Singapore, Malaysia and the Philippines, the three-month money market rate for Thailand and the three-month deposit rate for Indonesia (from Datastream).29

Quarterly returns are used in analysis for this chapter, although monthly data is evident in the literature (for example Drew and Veeraraghavan, 2002; Drew and Veeraraghavan, 2003; Shum and Tang, 2005; Chen and Fang, 2007). For momentum portfolios, monthly data is used in Hameed and Kusnadi (2002) and Rouwenhorst (1998), while weekly data is used in McInish et al. (2008). This study focuses on quarterly data to minimise the effect of thin trading and also to provide consistency with the analysis of macro variables in asset pricing. This also provides a test of the consistency of the asset pricing models across different choices of return period.

The number of stocks included in this chapter include 930 stocks for Malaysia, 630 stocks for Singapore, 517 stocks for Thailand, 448 stocks for Indonesia and 363 stocks for the Philippines. Over the study period (January 1990 to March 2006), the average number of stocks for each year is 493.64 stocks for Malaysia, 277.27 stocks for Singapore, 296.65 stocks for Thailand, 261.02 stocks for Indonesia and 244.56 stocks for the Philippines. Delisted companies are included to avoid survivorship bias (Carhart, 1997; Shum and Tang, 2005).

4.6 Chapter summary

This chapter presents all the data sets used for analysis from Chapter 5 through to Chapter 9. As there is a different study for each of the analysis chapters, the data set used differs accordingly. However, adjustment is made where necessary to acknowledge the impact of the 1997 crisis on the analysis in the chapters that follow.

29 As in Drew and Veeraraghavan (2002).
Chapter 5

ASEAN5 EQUITY MARKET LINKAGES

5.1 Introduction

The integration of the Association of Southeast Asian Nations’ (ASEAN) financial markets is an important goal towards realising an ASEAN Economic Community. Stability in each country’s financial system is generally recognised as a precondition for maintaining the momentum towards achieving ASEAN economic integration and so policy initiatives to further integrate member equity markets seem appropriate for meeting this goal. However, the Asian 1997 crisis marked a setback in the moves towards integration. Consequently, increasing the level of capital market efficiency in ASEAN financial markets has become even more important since the crisis. If the stock markets are interdependent, then there is a need for policy coordination among ASEAN member countries to mitigate the impact of financial fluctuations. Indeed, Sharma and Wongbangpo (2002), argue that efforts towards greater policy coordination and the removal of trade and investment barriers are essential if ASEAN is to exploit the advantages of greater economic and financial interdependence.

ASEAN leaders have discussed the feasibility of an ASEAN single currency with the objective of achieving financial stability in the region and possibly lower capital costs for domestic firms. ASEAN leaders have also studied the path taken by the European Union in forming their monetary union. However, wholesale importation of the European approach is not suitable for ASEAN due to inherent differences between these two regions, in particular the differences in economic development between the ASEAN members (Bunyaaratavej and Hahn, 2003). Likewise, differences in equity market development among the ASEAN countries complicate the ASEAN-wide financial integration process.

The issue of equity market linkages and interdependence among the ASEAN equity markets is the focus of this chapter. Following Ng (2002), this study defines the term ‘linkages of stock markets’ in terms of co-movements in national stock market returns and the main purpose of this chapter is to investigate the linkages that exist among the equity markets of the ASEAN5. These markets are bound by, and share the aspirations of, ASEAN. These equity markets are geographically close and have undergone substantial

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30 This issue is also discussed in Click and Plummer (2005) and at http://www.aseansec.org/16014.htm.
financial liberalisation (e.g. the opening up of the financial markets to foreign investors) since the late 1980s and early 1990s. It is expected that these markets should have become more closely linked over time (Bekaert and Harvey, 2000; Phylaktis and Ravazzolo, 2002). This chapter extends the work of Roca et al. (1998), Azman-Saini et al. (2002), Ng (2002), Daly (2003) and Click and Plummer (2005). This study also expands upon the work of Chen et al. (2002), although focusing on ASEAN5 instead of Latin American equity markets.

The present analysis extends the existing empirical literature in three ways. First, this study tests for patterns in linkages that exist between stock markets of the ASEAN5 from January 1990 to March 2006, using correlation analysis, cointegration tests and error correction models. Therefore, a more recent period is used in comparison with previous studies. For instance, Click and Plummer (2005) employ the period of July 1998 to December 2002 to study the ASEAN5 equity market linkages.

Second, this study examines the impact of the 1997 Asian crisis by determining whether there are differences in the number of cointegrating vectors and common trends that exist in the pre-crisis and post crisis periods. More importantly, this study allows for a reasonable length for the crisis period – i.e. one year – to capture the possible change in the level of cointegrating relationships among the equity markets.32

Third, this study extends cointegration analysis beyond the ASEAN5 markets, with the inclusion of three developed equity markets (the USA, Japan and Australia) in order to investigate the impact of developed markets on ASEAN5 equity market returns. The rationale for including these major regional markets as well as the US market lies with conventional finance theory, the Capital Asset Pricing Model (CAPM). The CAPM proposes that securities returns are linearly related to the returns earned on the market portfolio of risky assets. Accordingly, securities in the market are priced so that their expected return compensates investors for their risk relative to the market (see Solnik, 1974). In addition, the inclusion of the Australian equity market marks one contribution of this study to the literature, given the limited studies dealing with the impact of Australia on Asian equity markets.


32 For example, Daly (2003) employs only a one-month (October 1997) crisis period; Chen et al. (2002) denote November 1997 to August 1998 (10 months) as the crisis period, while Jang and Sul (2002) use June 1997 to January 1998 (eight months) as the crisis period.
Three research questions are pertinent to this chapter. Question 1: Are the equity markets of the ASEAN5 cointegrated during the pre-crisis and post-crisis periods? If they are, then how do these relationships change after the crisis? Question 2: Do global equity market returns have a significant impact on the equity returns of the ASEAN5 markets? Question 3: What are the patterns in causality among the equity markets in this study, and do the patterns change after the 1997 crisis? These questions have important implications for both individual investor portfolio allocation decisions and for policy-makers at national and ASEAN-wide levels.

Amidst the growing literature dealing with the integration of developed and emerging equity markets across the world, the literature on equity market relationships in formal regional groupings is limited. As such, by examining the correlation and the level of integration between the ASEAN5 equity markets, this chapter contributes to the international equity market literature. In this study, weekly equity market returns from investable index data for the period 1990 to 2006 are analysed. Also, recognising the severe impact of the 1997 Asian crisis, the sample is divided into a pre-crisis period and post-crisis period. The full period analysis is included for completeness, though this analysis is highly sensitive to the impact of structural changes arising from the Asian crisis.

Notwithstanding the global influences on the ASEAN5 markets, market returns from three developed markets are included in model estimations. The initial results point toward higher temporal correlation among the ASEAN5 markets after the crisis period, except for the Malaysian equity market. The cointegration tests, however, indicate the existence of only one cointegrating relationship in both the pre-crisis and post-crisis period. As such, the ASEAN5 equity markets share only one long-term relationship in both the pre-crisis and post-crisis period, suggesting that these markets share four common stochastic trends regardless of the crisis. Similar results are obtained when using more complex models. The equity markets of the ASEAN5 are therefore cointegrated but they are not driven by a single stochastic trend.

The literature review, methodology and data sections of this chapter are discussed in Chapters 2, 3 and 4 of this thesis. The remaining of this chapter is organised as follows. Section 5.2 presents the results and discussion of the main findings of the chapter, while Section 5.3 presents some concluding remarks on the findings reported in this chapter.

33 For example, when the ASEAN5 are combined with the USA, Japan and Australia in one VAR model and when the ASEAN5 are combined with the Japanese and Australian equity markets in the VAR model while the US market returns are included as an exogenous variable.
5.2 Results and discussion

The following sections present preliminary results on the statistical characteristics for the time series data employed in this chapter. Further, the main results on cointegration and VECMs are presented, accompanied by their relevant discussions.

5.2.1 Statistical characteristics of the series

Table 5-1 provides summary statistics of weekly continuously compounded returns for the ASEAN5, the USA, Japan and Australia. The average returns for the ASEAN5 in the pre-crisis period range from 0 percent to 0.37 percent and between -0.34 percent and 0.46 percent in the post-crisis period. There is little change in the average returns for Malaysia and Singapore, while the returns decrease over the period for both Thailand and the Philippines but there is evidence of an increase in returns for Indonesian equity market in the post-crisis period.

The standard deviation of returns for the ASEAN5 is generally higher in the post-crisis period (2.9 percent to 6.2 percent) than in the pre-crisis period (1.9 percent to 4.1 percent). It appears that markets in Thailand, Indonesia and the Philippines exhibit higher volatility compared to those in Malaysia and Singapore. This is consistent with the fact that these latter markets are more developed than the others. Yet, higher volatility seems to be the norm for almost all of the markets in the post-crisis period, most notably for Indonesia. This is consistent with Ibrahim (2005). The Singaporean stock market, known as one of the ‘Asian Tigers’, exhibits the most stable returns among the ASEAN5 stock markets.

During the pre-crisis period, the US exhibits the greatest returns of the three developed markets (0.36 percent), followed by Australia and Japan. After the crisis, Australian returns remain unchanged but Japanese returns double, while US returns fall to one-sixth of their former value. The standard deviation of the US returns increases over the period, but the standard deviation of the Japanese market remains the largest of the three developed markets across both sub-periods. The drop in average returns and the increase in volatility observed for the US in the post-crisis period are probably due to the negative impact of the IT crisis in 2000. Still, emerging stock returns and volatility are comparatively higher than those of mature stock markets.  

---

34 In general, the characteristics of emerging market returns can be summarised as having higher average returns, low correlations with developed markets returns, could be predicted based on past returns, and
### Table 5-1 Descriptive statistics of market returns

<table>
<thead>
<tr>
<th></th>
<th>a. Full period</th>
<th>b. Pre-crisis period</th>
<th>c. Post-crisis period</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Mean</td>
<td>Median</td>
<td>Maximum</td>
</tr>
<tr>
<td>Malaysia</td>
<td>0.0008</td>
<td>0.0014</td>
<td>0.3615</td>
</tr>
<tr>
<td>Singapore</td>
<td>0.0016</td>
<td>0.0016</td>
<td>0.1570</td>
</tr>
<tr>
<td>Thailand</td>
<td>-0.0003</td>
<td>0.0000</td>
<td>0.2147</td>
</tr>
<tr>
<td>Indonesia</td>
<td>-0.0001</td>
<td>0.0008</td>
<td>0.4927</td>
</tr>
<tr>
<td>Philippines</td>
<td>0.0006</td>
<td>0.0009</td>
<td>0.1712</td>
</tr>
<tr>
<td>US</td>
<td>0.0022</td>
<td>0.0032</td>
<td>0.0753</td>
</tr>
<tr>
<td>Japan</td>
<td>0.0006</td>
<td>0.0028</td>
<td>0.0876</td>
</tr>
<tr>
<td>Australia</td>
<td>0.0026</td>
<td>0.0014</td>
<td>0.3316</td>
</tr>
</tbody>
</table>

Note: Obs indicates the number of observations.

### Correlations

Table 5-2 presents the pairwise correlation coefficients among the ASEAN5 equity markets. In general, intra-regional correlations tend to be higher than inter-regional correlations, consistent with Eun and Shim (1989) and Pretorius (2002). During the pre-crisis period, the highest pairwise return correlation is recorded between Malaysia and Singapore. Yet, after the crisis, this correlation drops from 59.2 percent to 26.8 percent which is more than half from the pre-crisis levels. A drop in return correlation is also recorded by Daly (2003) and Abd. Majid et al. (2007), although the recorded drop in the latter study is smaller (69 percent to 49.8 percent) than recorded in this chapter.

returns tend to be much more dispersed (more volatile) than for the developed market returns (Bekeart & Harvey, 1997;1995).
Table 5 - 2 Correlation matrix of equity market returns

<table>
<thead>
<tr>
<th></th>
<th>Full period</th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Malaysia</td>
<td>Singapore</td>
<td>Thailand</td>
<td>Indonesia</td>
<td>Philippines</td>
<td>US</td>
<td>Japan</td>
</tr>
<tr>
<td>Singapore</td>
<td>0.518</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Thailand</td>
<td>-0.006</td>
<td>-0.014</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Indonesia</td>
<td>0.446</td>
<td>0.473</td>
<td>0.069</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Philippines</td>
<td>0.426</td>
<td>0.448</td>
<td>-0.081</td>
<td>0.476</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>US</td>
<td>0.176</td>
<td>0.346</td>
<td>-0.072</td>
<td>0.150</td>
<td>0.213</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Japan</td>
<td>0.226</td>
<td>0.371</td>
<td>-0.029</td>
<td>0.169</td>
<td>0.166</td>
<td>0.228</td>
<td></td>
</tr>
<tr>
<td>Australia</td>
<td>0.237</td>
<td>0.419</td>
<td>-0.086</td>
<td>0.237</td>
<td>0.280</td>
<td>0.383</td>
<td>0.333</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th></th>
<th>Pre-crisis period</th>
<th></th>
<th></th>
<th></th>
<th></th>
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<th></th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Malaysia</td>
<td>Singapore</td>
<td>Thailand</td>
<td>Indonesia</td>
<td>Philippines</td>
<td>US</td>
<td>Japan</td>
</tr>
<tr>
<td>Singapore</td>
<td>0.592</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Thailand</td>
<td>-0.020</td>
<td>-0.082</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Indonesia</td>
<td>0.391</td>
<td>0.288</td>
<td>0.022</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Philippines</td>
<td>0.382</td>
<td>0.340</td>
<td>-0.139</td>
<td>0.425</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>US</td>
<td>0.098</td>
<td>0.217</td>
<td>-0.084</td>
<td>0.027</td>
<td>0.088</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Japan</td>
<td>0.178</td>
<td>0.303</td>
<td>0.007</td>
<td>-0.012</td>
<td>0.020</td>
<td>0.209</td>
<td></td>
</tr>
<tr>
<td>Australia</td>
<td>0.153</td>
<td>0.253</td>
<td>0.008</td>
<td>0.080</td>
<td>0.116</td>
<td>0.270</td>
<td>0.186</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th></th>
<th>Post-crisis period</th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Malaysia</td>
<td>Singapore</td>
<td>Thailand</td>
<td>Indonesia</td>
<td>Philippines</td>
<td>US</td>
<td>Japan</td>
</tr>
<tr>
<td>Singapore</td>
<td>0.268</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Thailand</td>
<td>-0.003</td>
<td>-0.047</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Indonesia</td>
<td>0.202</td>
<td>0.394</td>
<td>0.080</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Philippines</td>
<td>0.244</td>
<td>0.377</td>
<td>-0.091</td>
<td>0.393</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>US</td>
<td>0.19</td>
<td>0.411</td>
<td>-0.126</td>
<td>0.135</td>
<td>0.245</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Japan</td>
<td>0.263</td>
<td>0.408</td>
<td>-0.033</td>
<td>0.277</td>
<td>0.242</td>
<td>0.269</td>
<td></td>
</tr>
<tr>
<td>Australia</td>
<td>0.27</td>
<td>0.496</td>
<td>-0.123</td>
<td>0.287</td>
<td>0.372</td>
<td>0.456</td>
<td>0.418</td>
</tr>
</tbody>
</table>

The post-crisis correlation coefficient value is similar to that found in Click and Plummer (2005), which is 25 percent. This might be attributable in part to the reintroduction of currency and capital controls instituted by the Malaysian government in September 1998 to curb the capital flight associated with the Asian crisis (Click and Plummer, 2005 and Ibrahim, 2005). This may have led to decreases in Malaysian correlations with other ASEAN5 markets in the post-crisis period.

Overall, the correlation coefficients for all the markets except for Malaysia increase after the crisis.\(^{35}\) Similarly, other than for Thailand, all the ASEAN5 return correlations increase with the developed markets returns after the crisis. This result is consistent with Daly (2003) in relation to the ASEAN5 with the Australian and US returns, suggesting that the ASEAN5 equity markets have become more integrated with each other, as well as with global markets, following the crisis.

\(^{35}\) Daly (2003) finds that correlation coefficients for Singapore with other markets also decrease after the crisis. This might be due to a different post-crisis period employed in his study.
The pairwise correlations results for the ASEAN5 suggest that there are some similarities between the markets’ fundamentals (Chiang et al., 2007). In general, the more integration that exists between a pair of economies, the more strongly the stock market movements in one country would be correlated with those in the other country (Eun and Shim, 1989). While various economic variables such as inflation, interest rates and trade have been studied in regard to this issue, trade is regarded as the most important factor underlying stock market correlations (Bekaert and Harvey, 1997; Chen and Zhang, 1997; Soydemir, 2000).

**Autocorrelations**

Autocorrelation coefficients are calculated prior to testing for the existence of a unit root in a series. Table 3 reports sample autocorrelations of the log of the equity market indices and their returns (the differences in log of the stock index). The results show that the autocorrelations for the log indices values die off very slowly, suggesting that the indices are possibly non-stationary processes. As such, autocorrelations of the returns for the ASEAN5 die off more rapidly than the index series. In combination, these results suggest that the log indices follow an $I(1)$ process while the return series are stationary processes.

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36 In Eun & Shim (1989) this point is supported by the unusually high correlation of the US and Canadian national stock markets.

37 See Pretorius (2002) for a brief survey of stock market independence.
### Table 5 - Autocorrelations

#### a. Full period

<table>
<thead>
<tr>
<th></th>
<th>AR1</th>
<th>AR2</th>
<th>AR3</th>
<th>AR4</th>
<th>AR5</th>
<th>AR6</th>
<th>Prob</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Malaysia</strong></td>
<td>0.994</td>
<td>0.988</td>
<td>0.981</td>
<td>0.973</td>
<td>0.966</td>
<td>0.958</td>
<td>0.000</td>
</tr>
<tr>
<td><strong>Returns</strong></td>
<td>0.083</td>
<td>0.066</td>
<td>-0.036</td>
<td>0.068</td>
<td>0.047</td>
<td>0.123</td>
<td>0.000</td>
</tr>
<tr>
<td><strong>Singapore</strong></td>
<td>0.985</td>
<td>0.970</td>
<td>0.955</td>
<td>0.939</td>
<td>0.924</td>
<td>0.910</td>
<td>0.000</td>
</tr>
<tr>
<td><strong>Returns</strong></td>
<td>0.067</td>
<td>0.078</td>
<td>-0.039</td>
<td>-0.007</td>
<td>0.058</td>
<td>0.030</td>
<td>0.051</td>
</tr>
<tr>
<td><strong>Thailand</strong></td>
<td>0.997</td>
<td>0.994</td>
<td>0.990</td>
<td>0.986</td>
<td>0.982</td>
<td>0.978</td>
<td>0.000</td>
</tr>
<tr>
<td><strong>Returns</strong></td>
<td>0.148</td>
<td>0.015</td>
<td>0.042</td>
<td>-0.002</td>
<td>0.070</td>
<td>-0.047</td>
<td>0.000</td>
</tr>
<tr>
<td><strong>Indonesia</strong></td>
<td>0.993</td>
<td>0.988</td>
<td>0.981</td>
<td>0.974</td>
<td>0.966</td>
<td>0.958</td>
<td>0.000</td>
</tr>
<tr>
<td><strong>Returns</strong></td>
<td>0.164</td>
<td>0.036</td>
<td>0.025</td>
<td>0.072</td>
<td>0.057</td>
<td>-0.028</td>
<td>0.000</td>
</tr>
<tr>
<td><strong>Philippines</strong></td>
<td>0.997</td>
<td>0.994</td>
<td>0.990</td>
<td>0.986</td>
<td>0.982</td>
<td>0.978</td>
<td>0.000</td>
</tr>
<tr>
<td><strong>Returns</strong></td>
<td>0.146</td>
<td>0.071</td>
<td>0.044</td>
<td>0.008</td>
<td>0.007</td>
<td>0.028</td>
<td>0.000</td>
</tr>
<tr>
<td><strong>US</strong></td>
<td>0.995</td>
<td>0.990</td>
<td>0.985</td>
<td>0.980</td>
<td>0.976</td>
<td>0.971</td>
<td>0.000</td>
</tr>
<tr>
<td><strong>Returns</strong></td>
<td>0.057</td>
<td>-0.004</td>
<td>-0.050</td>
<td>-0.045</td>
<td>0.069</td>
<td>-0.060</td>
<td>0.004</td>
</tr>
<tr>
<td><strong>Japan</strong></td>
<td>0.982</td>
<td>0.967</td>
<td>0.950</td>
<td>0.934</td>
<td>0.916</td>
<td>0.898</td>
<td>0.000</td>
</tr>
<tr>
<td><strong>Returns</strong></td>
<td>0.065</td>
<td>-0.003</td>
<td>0.035</td>
<td>0.018</td>
<td>-0.041</td>
<td>0.062</td>
<td>0.073</td>
</tr>
<tr>
<td><strong>Australia</strong></td>
<td>0.990</td>
<td>0.980</td>
<td>0.969</td>
<td>0.959</td>
<td>0.948</td>
<td>0.938</td>
<td>0.000</td>
</tr>
<tr>
<td><strong>Returns</strong></td>
<td>0.068</td>
<td>0.034</td>
<td>-0.026</td>
<td>-0.029</td>
<td>-0.028</td>
<td>-0.024</td>
<td>0.380</td>
</tr>
</tbody>
</table>

#### b. Pre-crisis period

<table>
<thead>
<tr>
<th></th>
<th>AR1</th>
<th>AR2</th>
<th>AR3</th>
<th>AR4</th>
<th>AR5</th>
<th>AR6</th>
<th>Prob</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Malaysia</strong></td>
<td>0.995</td>
<td>0.989</td>
<td>0.982</td>
<td>0.976</td>
<td>0.970</td>
<td>0.965</td>
<td>0.000</td>
</tr>
<tr>
<td><strong>Returns</strong></td>
<td>0.046</td>
<td>-0.080</td>
<td>-0.079</td>
<td>0.012</td>
<td>0.056</td>
<td>0.065</td>
<td>0.062</td>
</tr>
<tr>
<td><strong>Singapore</strong></td>
<td>0.994</td>
<td>0.989</td>
<td>0.982</td>
<td>0.975</td>
<td>0.969</td>
<td>0.963</td>
<td>0.000</td>
</tr>
<tr>
<td><strong>Returns</strong></td>
<td>0.138</td>
<td>0.004</td>
<td>-0.056</td>
<td>0.006</td>
<td>0.032</td>
<td>0.099</td>
<td>0.068</td>
</tr>
<tr>
<td><strong>Thailand</strong></td>
<td>0.992</td>
<td>0.982</td>
<td>0.972</td>
<td>0.962</td>
<td>0.952</td>
<td>0.941</td>
<td>0.000</td>
</tr>
<tr>
<td><strong>Returns</strong></td>
<td>0.021</td>
<td>-0.064</td>
<td>0.120</td>
<td>0.018</td>
<td>0.076</td>
<td>-0.013</td>
<td>0.179</td>
</tr>
<tr>
<td><strong>Indonesia</strong></td>
<td>0.989</td>
<td>0.978</td>
<td>0.966</td>
<td>0.952</td>
<td>0.939</td>
<td>0.924</td>
<td>0.000</td>
</tr>
<tr>
<td><strong>Returns</strong></td>
<td>0.113</td>
<td>0.085</td>
<td>-0.005</td>
<td>0.095</td>
<td>0.028</td>
<td>-0.007</td>
<td>0.064</td>
</tr>
<tr>
<td><strong>Philippines</strong></td>
<td>0.996</td>
<td>0.991</td>
<td>0.986</td>
<td>0.980</td>
<td>0.974</td>
<td>0.968</td>
<td>0.000</td>
</tr>
<tr>
<td><strong>Returns</strong></td>
<td>0.087</td>
<td>0.073</td>
<td>-0.016</td>
<td>0.013</td>
<td>0.020</td>
<td>0.062</td>
<td>0.243</td>
</tr>
<tr>
<td><strong>US</strong></td>
<td>0.989</td>
<td>0.979</td>
<td>0.968</td>
<td>0.956</td>
<td>0.946</td>
<td>0.936</td>
<td>0.000</td>
</tr>
<tr>
<td><strong>Returns</strong></td>
<td>0.039</td>
<td>0.027</td>
<td>-0.009</td>
<td>-0.110</td>
<td>0.047</td>
<td>0.052</td>
<td>0.241</td>
</tr>
<tr>
<td><strong>Japan</strong></td>
<td>0.973</td>
<td>0.947</td>
<td>0.920</td>
<td>0.891</td>
<td>0.862</td>
<td>0.832</td>
<td>0.000</td>
</tr>
<tr>
<td><strong>Returns</strong></td>
<td>0.025</td>
<td>0.044</td>
<td>0.004</td>
<td>0.266</td>
<td>-0.076</td>
<td>0.068</td>
<td>0.600</td>
</tr>
<tr>
<td><strong>Australia</strong></td>
<td>0.991</td>
<td>0.983</td>
<td>0.974</td>
<td>0.964</td>
<td>0.955</td>
<td>0.945</td>
<td>0.000</td>
</tr>
<tr>
<td><strong>Returns</strong></td>
<td>0.061</td>
<td>0.108</td>
<td>-0.044</td>
<td>0.012</td>
<td>-0.069</td>
<td>0.013</td>
<td>0.228</td>
</tr>
</tbody>
</table>

#### c. Post-crisis period

<table>
<thead>
<tr>
<th></th>
<th>AR1</th>
<th>AR2</th>
<th>AR3</th>
<th>AR4</th>
<th>AR5</th>
<th>AR6</th>
<th>Prob</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Malaysia</strong></td>
<td>0.977</td>
<td>0.950</td>
<td>0.923</td>
<td>0.895</td>
<td>0.868</td>
<td>0.838</td>
<td>0.000</td>
</tr>
<tr>
<td><strong>Returns</strong></td>
<td>0.128</td>
<td>-0.034</td>
<td>-0.049</td>
<td>0.040</td>
<td>0.002</td>
<td>0.148</td>
<td>0.007</td>
</tr>
<tr>
<td><strong>Singapore</strong></td>
<td>0.972</td>
<td>0.944</td>
<td>0.917</td>
<td>0.888</td>
<td>0.860</td>
<td>0.832</td>
<td>0.000</td>
</tr>
<tr>
<td><strong>Returns</strong></td>
<td>0.011</td>
<td>0.094</td>
<td>0.001</td>
<td>0.008</td>
<td>0.058</td>
<td>0.020</td>
<td>0.354</td>
</tr>
<tr>
<td><strong>Thailand</strong></td>
<td>0.981</td>
<td>0.963</td>
<td>0.943</td>
<td>0.922</td>
<td>0.900</td>
<td>0.878</td>
<td>0.000</td>
</tr>
<tr>
<td><strong>Returns</strong></td>
<td>0.166</td>
<td>0.060</td>
<td>-0.101</td>
<td>0.272</td>
<td>-0.032</td>
<td>-0.028</td>
<td>0.011</td>
</tr>
<tr>
<td><strong>Indonesia</strong></td>
<td>0.974</td>
<td>0.948</td>
<td>0.922</td>
<td>0.896</td>
<td>0.871</td>
<td>0.843</td>
<td>0.000</td>
</tr>
<tr>
<td><strong>Returns</strong></td>
<td>0.095</td>
<td>0.065</td>
<td>-0.002</td>
<td>0.105</td>
<td>0.010</td>
<td>-0.010</td>
<td>0.154</td>
</tr>
<tr>
<td><strong>Philippines</strong></td>
<td>0.988</td>
<td>0.975</td>
<td>0.961</td>
<td>0.946</td>
<td>0.930</td>
<td>0.916</td>
<td>0.000</td>
</tr>
<tr>
<td><strong>Returns</strong></td>
<td>0.178</td>
<td>0.101</td>
<td>0.084</td>
<td>-0.012</td>
<td>-0.038</td>
<td>-0.028</td>
<td>0.000</td>
</tr>
<tr>
<td><strong>US</strong></td>
<td>0.978</td>
<td>0.958</td>
<td>0.939</td>
<td>0.919</td>
<td>0.902</td>
<td>0.885</td>
<td>0.000</td>
</tr>
<tr>
<td><strong>Returns</strong></td>
<td>0.027</td>
<td>-0.003</td>
<td>-0.084</td>
<td>-0.002</td>
<td>0.067</td>
<td>-1.066</td>
<td>0.083</td>
</tr>
<tr>
<td><strong>Japan</strong></td>
<td>0.982</td>
<td>0.966</td>
<td>0.951</td>
<td>0.936</td>
<td>0.919</td>
<td>0.900</td>
<td>0.000</td>
</tr>
<tr>
<td><strong>Returns</strong></td>
<td>0.055</td>
<td>-0.023</td>
<td>0.052</td>
<td>0.021</td>
<td>-0.047</td>
<td>0.088</td>
<td>0.148</td>
</tr>
<tr>
<td><strong>Australia</strong></td>
<td>0.978</td>
<td>0.957</td>
<td>0.935</td>
<td>0.914</td>
<td>0.891</td>
<td>0.868</td>
<td>0.000</td>
</tr>
<tr>
<td><strong>Returns</strong></td>
<td>0.043</td>
<td>0.007</td>
<td>-0.028</td>
<td>-0.036</td>
<td>-0.011</td>
<td>-0.049</td>
<td>0.910</td>
</tr>
</tbody>
</table>

Note: AR1 refers to correlation between values at time \( t \) and value at time \( t-1 \). Prob is the probability obtained from the Box-Ljung test for serial correlation in the correlation coefficients for AR1 through AR6.
5.2.2 Unit root tests

It is important to test for stationarity of the series before proceeding with cointegration tests. In this study, three unit root tests are employed: the Augmented Dickey-Fuller (ADF), the Phillips-Perron (PP), and the Kwiatkowski-Phillips-Schmidt-Shin (KPSS) tests. The null hypothesis for both the ADF and PP tests is that the series is non-stationary if $\rho = 0$, and stationary if $\rho < 0$. The null hypothesis for the KPSS test, however, is that the series is stationary, so that the failure to reject the null hypothesis is consistent with a series being stationary.

The results in Table 5-4 show that the share market returns for the ASEAN5 are stationary for all three tests. Thus, for the ADF and the PP tests, the null hypothesis of a unit root is rejected and suggests that share markets returns are all stationary processes. For the KPSS test, the results support the null hypothesis that the share market returns for the ASEAN5 are all $I(0)$ processes.
Table 5 - 4 Unit root tests

<table>
<thead>
<tr>
<th></th>
<th>ADF</th>
<th>PP</th>
<th>KPSS</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Levels</td>
<td>1st differences</td>
<td>Levels</td>
</tr>
<tr>
<td></td>
<td>Lags</td>
<td>Probability</td>
<td>lags</td>
</tr>
<tr>
<td><strong>Full Period</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Malaysia</td>
<td>0</td>
<td>0.8237</td>
<td>0</td>
</tr>
<tr>
<td>Singapore</td>
<td>0</td>
<td>0.7840</td>
<td>0</td>
</tr>
<tr>
<td>Thailand</td>
<td>2</td>
<td>0.9023</td>
<td>1</td>
</tr>
<tr>
<td>Indonesia</td>
<td>2</td>
<td>0.8942</td>
<td>1</td>
</tr>
<tr>
<td>Philippines</td>
<td>2</td>
<td>0.8585</td>
<td>1</td>
</tr>
<tr>
<td>US</td>
<td>1</td>
<td>0.9397</td>
<td>0</td>
</tr>
<tr>
<td>Japan</td>
<td>0</td>
<td>0.5687</td>
<td>0</td>
</tr>
<tr>
<td>Australia</td>
<td>0</td>
<td>0.5164</td>
<td>0</td>
</tr>
<tr>
<td><strong>Pre-crisis period</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Malaysia</td>
<td>0</td>
<td>0.6455</td>
<td>0</td>
</tr>
<tr>
<td>Singapore</td>
<td>0</td>
<td>0.8447</td>
<td>1</td>
</tr>
<tr>
<td>Thailand</td>
<td>0</td>
<td>0.9946</td>
<td>0</td>
</tr>
<tr>
<td>Indonesia</td>
<td>0</td>
<td>0.2325</td>
<td>1</td>
</tr>
<tr>
<td>Philippines</td>
<td>0</td>
<td>0.5624</td>
<td>0</td>
</tr>
<tr>
<td>US</td>
<td>0</td>
<td>0.8732</td>
<td>0</td>
</tr>
<tr>
<td>Japan</td>
<td>0</td>
<td>0.1472</td>
<td>0</td>
</tr>
<tr>
<td>Australia</td>
<td>0</td>
<td>0.1420</td>
<td>0</td>
</tr>
<tr>
<td><strong>Post-crisis period</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Malaysia</td>
<td>2</td>
<td>0.2194</td>
<td>1</td>
</tr>
<tr>
<td>Singapore</td>
<td>0</td>
<td>0.8937</td>
<td>0</td>
</tr>
<tr>
<td>Thailand</td>
<td>2</td>
<td>0.6987</td>
<td>1</td>
</tr>
<tr>
<td>Indonesia</td>
<td>0</td>
<td>0.8107</td>
<td>0</td>
</tr>
<tr>
<td>Philippines</td>
<td>2</td>
<td>0.9347</td>
<td>1</td>
</tr>
<tr>
<td>US</td>
<td>0</td>
<td>0.7800</td>
<td>0</td>
</tr>
<tr>
<td>Japan</td>
<td>0</td>
<td>0.9336</td>
<td>0</td>
</tr>
<tr>
<td>Australia</td>
<td>0</td>
<td>0.9040</td>
<td>0</td>
</tr>
</tbody>
</table>

Note: The lag length in the ADF and the bandwidth in both PP and KPSS tests are automatically chosen by the statistical package. * indicates significance at the 5% level. In this table Levels and 1st differences refer to unit root tests performed at levels and first differences of the time series, respectively.
5.2.3 ASEAN5 cointegration tests

The Johansen cointegration test is used to identify the number of cointegrating vectors among the ASEAN5 equity markets. This procedure has the advantage of taking into account the error structure of the underlying process, that also incorporates different short- and long-run dynamics of a system (Chen et al., 2002).

The empirical results for the Johansen test are presented in Table 5, Panel A (ASEAN5), Panel B (ASEAN5 and the US, Japan and Australia) and Panel C (ASEAN5 with Japan and Australia in the VAR and with the US returns included as an exogenous variable). The results for the ASEAN5 reported in Panel A show that only one cointegrating vector exists for the full, pre-crisis (for trace statistics) and post-crisis periods, consistent with the existence of one long-run relationship in the system. This also suggests that there are four common stochastic trends prevail among the ASEAN5 stock markets, regardless of sample period chosen. In particular, the pre-crisis period finding of one cointegrating vector is consistent with Daly (2003) even though he uses daily data in his analysis. The pre-crisis period employed in his study is quite similar to the current study which is from April 1, 1990 to September 1, 1997.

In addition, Sharma and Wongbangpo (2002) also find one cointegrating vector from their study; however, the Philippines is excluded from the analysis and their pre-crisis period is from January 1986 to December 1996.

---

The US is tested as an exogenous variable in Panel C given the lack of significance coefficient for the US found in the VECMs results presented in Table 5-8, for all periods.
## Table 5 - Johansen’s cointegration test results

<table>
<thead>
<tr>
<th>H₀</th>
<th>Hₐ</th>
<th>Full period</th>
<th>Pre-crisis period</th>
<th>Post-crisis period</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>Eigenvalues</td>
<td>λ_max</td>
<td>λ_trace</td>
</tr>
<tr>
<td>Panel A</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>ASEAN5</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>r = 0 r &gt; 0</td>
<td>0.0529</td>
<td>43.8735*</td>
<td>84.0648*</td>
<td>0.0768</td>
</tr>
<tr>
<td>r ≤ 1 r &gt; 1</td>
<td>0.0282</td>
<td>23.1289</td>
<td>40.1913</td>
<td>0.0629</td>
</tr>
<tr>
<td>r ≤ 2 r &gt; 2</td>
<td>0.0127</td>
<td>10.3676</td>
<td>17.0624</td>
<td>0.0444</td>
</tr>
<tr>
<td>r ≤ 3 r &gt; 3</td>
<td>0.0080</td>
<td>6.5101</td>
<td>6.6948</td>
<td>0.0148</td>
</tr>
<tr>
<td>r ≤ 4 r = 4</td>
<td>0.0002</td>
<td>0.1847</td>
<td>0.1847</td>
<td>0.0015</td>
</tr>
<tr>
<td>Panel B</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>ASEAN5 + US, Japan and Australia</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>r = 0 r &gt; 0</td>
<td>0.0688</td>
<td>57.5747*</td>
<td>177.9139*</td>
<td>0.1230</td>
</tr>
<tr>
<td>r ≤ 1 r &gt; 1</td>
<td>0.0412</td>
<td>33.9967</td>
<td>120.3392</td>
<td>0.1135</td>
</tr>
<tr>
<td>r ≤ 2 r &gt; 2</td>
<td>0.0403</td>
<td>33.2670</td>
<td>86.3425</td>
<td>0.0625</td>
</tr>
<tr>
<td>r ≤ 3 r &gt; 3</td>
<td>0.0298</td>
<td>24.4527</td>
<td>53.0755</td>
<td>0.0601</td>
</tr>
<tr>
<td>r ≤ 4 r &gt; 4</td>
<td>0.0147</td>
<td>11.9281</td>
<td>28.6228</td>
<td>0.0330</td>
</tr>
<tr>
<td>r ≤ 5 r &gt; 5</td>
<td>0.0100</td>
<td>8.1487</td>
<td>16.6947</td>
<td>0.0250</td>
</tr>
<tr>
<td>r ≤ 6 r &gt; 6</td>
<td>0.0097</td>
<td>7.8544</td>
<td>8.5460</td>
<td>0.0188</td>
</tr>
<tr>
<td>r = 7 r = 7</td>
<td>0.0009</td>
<td>0.6916</td>
<td>0.6916</td>
<td>0.0051</td>
</tr>
<tr>
<td>Panel C</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>ASEAN5 + Japan and Australia + US returns</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>r = 0 r &gt; 0</td>
<td>0.0618</td>
<td>51.5370*</td>
<td>139.3886*</td>
<td>0.1174</td>
</tr>
<tr>
<td>r ≤ 1 r &gt; 1</td>
<td>0.0411</td>
<td>33.8824</td>
<td>87.8516</td>
<td>0.0861</td>
</tr>
<tr>
<td>r ≤ 2 r &gt; 2</td>
<td>0.0308</td>
<td>25.2936</td>
<td>53.9692</td>
<td>0.0609</td>
</tr>
<tr>
<td>r ≤ 3 r &gt; 3</td>
<td>0.0166</td>
<td>13.5332</td>
<td>28.6756</td>
<td>0.0523</td>
</tr>
<tr>
<td>r ≤ 4 r &gt; 4</td>
<td>0.0096</td>
<td>7.8103</td>
<td>15.1424</td>
<td>0.0246</td>
</tr>
<tr>
<td>r ≤ 5 r &gt; 5</td>
<td>0.0088</td>
<td>7.1036</td>
<td>7.3321</td>
<td>0.0137</td>
</tr>
<tr>
<td>r = 6 r = 6</td>
<td>0.0003</td>
<td>0.2285</td>
<td>0.2285</td>
<td>0.0029</td>
</tr>
</tbody>
</table>

Note: The critical values are taken from MacKinnon-Haug-Michelis (1999). r represents the number of cointegrating vectors. H₀ and Hₐ refer to the null and alternative hypotheses respectively. * denotes rejection of the hypothesis at the 5% level.
It is noted that Roca et al. (1998), Ibrahim (2005) and Ng (2002) find no cointegrating relationship among the ASEAN5 equity markets prior to the crisis. Despite using weekly data, Roca et al. focus on the period from 1988 to 1995 and choose nine lags for their VAR model. Ibrahim (2005) uses monthly data that is taken from www.econstats.com with the pre-crisis period spanning from January 1988 to June 1997. Ng (2002) also uses monthly data with two pre-crisis sub-periods, 1988-1992 and 1993-1997, which raises a concern given that the second sub-period analysis includes the 1997 crisis period. Thus, the differences between the results of these three studies are probably due to the differences in model specification.

Post-crisis period results show the existence of one cointegrating vector among the ASEAN5 equity markets. These results are consistent with those of Click and Plummer (2005), Azman-Saini et al. (2005), and Daly (2003). Ibrahim (2003), however, finds no evidence of a cointegrating relationship for this period, using a post-crisis period of July 1997 to December 2003.

Further, the choice of developed market returns included in the analysis has little impact on the equity market linkages existing within the ASEAN5 where the number of cointegrating vectors remains unchanged (one cointegrating vector found in Panels A, B, and C). As such, the results are consistent with previous studies that indicate the inclusion of developed stock markets, such as the US and Japan, does not change the number of cointegrating relationships evident in a particular regional equity market group (see Ibrahim, 2005; Choudhry et al., 2007). In general, the consistency of the pre-crisis and post-crisis period results lends support to Phylaktis and Ravazzolo (2002), who suggest that the Asian countries were already financially and economically cointegrated prior to the crisis, thus the level of integration remains after the crisis.

The cointegration results reported in this study imply that the equity markets of the ASEAN5 are partially cointegrated, or, as suggested by Click and Plummer (2005), these equity markets are integrated in an economic sense. The existing linkages indicate that the stock price movements in one equity market may predict the stock price movements in other markets (Sharma and Wongbangpo, 2002). The co-movements of asset prices also suggest the presence of underlying exogenous influences (Chen et al., 1986) that is probably enhanced by the globalisation of national equity markets, in particular through efficient information sharing and free accessibility to markets by foreign investors (Chen et al., 2002).
5.2.4 The vector error correction models (VECMs)

The vector error correction model results provide further insight into the linkages that exist between the ASEAN5 equity markets. When the variables are cointegrated, short-term deviations from the long-run equilibrium will feed back into changes in the dependent variable, in order to ensure a return towards the long-run equilibrium (Chen et al., 2002). The speed of adjustment term captures this effect ($\theta_3$ term in equation 3.4). The significant $t$-tests for the speed of adjustment coefficients indicate the existence of long-run causal effects. The results of VECM analysis are presented in Tables 5-6, 5-7, 5-8 and 5-9.39

**Speed of adjustment effects for ASEAN5**

Table 5-6 exhibits the results for the ASEAN5 speed of adjustment coefficients. For the full period, all of the speeds of adjustment coefficients are statistically significant. However, in the pre-crisis period, significant coefficients are found only for Singapore, Thailand and the Philippines. The coefficient for the Philippines remains significant in the post-crisis period, along with the Indonesian market. Speed of adjustment parameters indicate that Malaysia is exogenous in both pre-crisis and post-crisis periods, while Singapore and Thailand are exogenous in the post-crisis period. In this period, Indonesia and the Philippines appear to bear the adjustment towards equilibrium.

<table>
<thead>
<tr>
<th>Table 5 - 6 Speed of adjustment parameters for ASEAN5 VECMs</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Full period</strong></td>
</tr>
<tr>
<td>Cointegrating vector</td>
</tr>
<tr>
<td>CIV 1</td>
</tr>
<tr>
<td></td>
</tr>
<tr>
<td><strong>Pre-crisis period</strong></td>
</tr>
<tr>
<td>Cointegrating vector</td>
</tr>
<tr>
<td>CIV 1</td>
</tr>
<tr>
<td></td>
</tr>
<tr>
<td><strong>Post-crisis period</strong></td>
</tr>
<tr>
<td>Cointegrating vector</td>
</tr>
<tr>
<td>CIV 1</td>
</tr>
<tr>
<td></td>
</tr>
</tbody>
</table>

Note: CIV denotes the number of cointegrating vectors. * indicates 5% level of significance; + indicates 10% level of significance. Values in parentheses indicate t-statistics.

39 The existence of long-run linkages within the ASEAN5 equity markets is robust to the choice of type of index data used. This relationship persists when global index data is used. However, there is some variation in the number of cointegrating vectors. The results are available upon request.
Temporal causality for ASEAN5

The short-run causal relationship is represented by temporal causality estimates. The temporal causality refers to the impact of lagged returns on present returns and the results for the ASEAN5 are presented in Table 5-7. Panel A reports the results for the full period where Singapore appears to be independent of the other four markets, while the remaining four markets are affected by at least one other market. This period exhibits a number of bi-directional causal linkages. This result may be driven by the crisis period, as interaction generally strengthens during major crisis periods (see Arshanapalli and Doukas, 1993; Masih and Rumi, 1997; Pretorius, 2002). As such, it is important to determine whether these links are also evident in both the pre-crisis and post-crisis periods.

The ASEAN5 equity markets do not exhibit strong causal relationships in the pre-crisis period (Panel B) when most of the significant relationships are unidirectional, except for Malaysia and Indonesia. Singapore, the most developed market among the ASEAN5, does not explain the movements in any other markets, though there is some evidence that the Philippines returns explain Singapore equity returns. This is consistent with Azman-Saini et al. (2002) and Roca et al. (1998) and the latter attribute this scenario to significant investments made by Singapore in the Philippines. Thailand and Malaysia equity returns lead Indonesian returns but Indonesia returns explain only the Malaysian returns. The Philippines market return is not explained by other markets, though it does explain the returns for Thailand, Indonesia and Singapore. In the post-crisis period (Panel C), causal relationships are mostly unidirectional, though a bi-directional link does exist between Singapore and the Philippines. Furthermore, Indonesia equity return is almost unrelated with the other ASEAN5 equity market returns.

### Table 5-7 Temporal causality results for ASEAN5

<table>
<thead>
<tr>
<th>Panel A. Full period</th>
<th>Market Explained (t)</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Explanatory Markets (t-1)</strong></td>
<td>Malaysia</td>
</tr>
<tr>
<td>Malaysia</td>
<td>-0.0286</td>
</tr>
<tr>
<td></td>
<td>(-0.6649)</td>
</tr>
<tr>
<td>Singapore</td>
<td>-0.0517</td>
</tr>
<tr>
<td></td>
<td>(-0.7721)</td>
</tr>
<tr>
<td>Thailand</td>
<td>0.1004*</td>
</tr>
<tr>
<td></td>
<td>(2.6714)</td>
</tr>
<tr>
<td>Indonesia</td>
<td>0.0190</td>
</tr>
<tr>
<td></td>
<td>(0.7173)</td>
</tr>
<tr>
<td>Philippines</td>
<td>-0.0265</td>
</tr>
<tr>
<td></td>
<td>(-0.6420)</td>
</tr>
<tr>
<td>R-squared</td>
<td>0.0421</td>
</tr>
<tr>
<td>F-statistic</td>
<td>5.8620*</td>
</tr>
</tbody>
</table>

**Note:** The table includes t-values and p-values for each coefficient, with an asterisk (*) indicating significance at the 5% level.
Panel B. Pre-crisis period

<table>
<thead>
<tr>
<th>Explanatory Markets (t-1)</th>
<th>Malaysia</th>
<th>Singapore</th>
<th>Thailand</th>
<th>Indonesia</th>
<th>Philippines</th>
</tr>
</thead>
<tbody>
<tr>
<td>Malaysia</td>
<td>0.1284**</td>
<td>0.0352</td>
<td>-0.1317</td>
<td>-0.0143**</td>
<td>0.0927</td>
</tr>
<tr>
<td></td>
<td>(1.8446)</td>
<td>(0.7082)</td>
<td>(-1.2666)</td>
<td>(-0.1687)</td>
<td>(0.9260)</td>
</tr>
<tr>
<td>Singapore</td>
<td>0.0237</td>
<td>-0.0177</td>
<td>0.1036</td>
<td>0.0876</td>
<td>-0.0015</td>
</tr>
<tr>
<td></td>
<td>(0.2483)</td>
<td>(-0.2601)</td>
<td>(0.7276)</td>
<td>(0.7550)</td>
<td>(-0.0109)</td>
</tr>
<tr>
<td>Thailand</td>
<td>0.0629</td>
<td>0.0049</td>
<td>0.0692</td>
<td>0.1600*</td>
<td>0.0492</td>
</tr>
<tr>
<td></td>
<td>(1.5437)</td>
<td>(0.1680)</td>
<td>(1.1367)</td>
<td>(3.2233)</td>
<td>(0.8393)</td>
</tr>
<tr>
<td>Indonesia</td>
<td>-0.1116*</td>
<td>-0.0373</td>
<td>-0.0983</td>
<td>-0.0209</td>
<td>-0.0391</td>
</tr>
<tr>
<td></td>
<td>(-2.2748)</td>
<td>(-1.0641)</td>
<td>(-1.3420)</td>
<td>(-0.3495)</td>
<td>(-0.5544)</td>
</tr>
<tr>
<td>Philippines</td>
<td>0.0666</td>
<td>0.0493*</td>
<td>0.1709*</td>
<td>0.0988*</td>
<td>0.0080</td>
</tr>
<tr>
<td></td>
<td>(1.5911)</td>
<td>(1.6506)</td>
<td>(2.7321)</td>
<td>(1.9365)</td>
<td>(0.1322)</td>
</tr>
</tbody>
</table>

R-squared 0.0594 0.0510 0.0456 0.0841 0.0778
F-statistic 3.6327* 3.0895* 2.7460 5.2809* 4.8493*

Panel C. Post-crisis period

<table>
<thead>
<tr>
<th>Explanatory Markets (t-1)</th>
<th>Malaysia</th>
<th>Singapore</th>
<th>Thailand</th>
<th>Indonesia</th>
<th>Philippines</th>
</tr>
</thead>
<tbody>
<tr>
<td>Malaysia</td>
<td>0.0046</td>
<td>0.0596</td>
<td>-0.0204</td>
<td>-0.0506</td>
<td>-0.0608</td>
</tr>
<tr>
<td></td>
<td>(0.0878)</td>
<td>(1.4027)</td>
<td>(-0.2928)</td>
<td>(-0.5735)</td>
<td>(-1.1366)</td>
</tr>
<tr>
<td>Singapore</td>
<td>0.2240*</td>
<td>0.0088</td>
<td>0.1311</td>
<td>0.0627</td>
<td>0.1399*</td>
</tr>
<tr>
<td></td>
<td>(2.9457)</td>
<td>(0.1414)</td>
<td>(1.2831)</td>
<td>(0.4854)</td>
<td>(1.7860)</td>
</tr>
<tr>
<td>Thailand</td>
<td>-0.0367</td>
<td>-0.0014</td>
<td>-0.0693</td>
<td>-0.0272</td>
<td>0.0720</td>
</tr>
<tr>
<td></td>
<td>(-0.7242)</td>
<td>(-0.0338)</td>
<td>(-1.0191)</td>
<td>(-0.3168)</td>
<td>(1.3806)</td>
</tr>
<tr>
<td>Indonesia</td>
<td>0.0538</td>
<td>-0.0051</td>
<td>-0.1033*</td>
<td>0.0286</td>
<td>0.0142</td>
</tr>
<tr>
<td></td>
<td>(1.5846)</td>
<td>(-0.1833)</td>
<td>(-2.2661)</td>
<td>(0.4965)</td>
<td>(0.4062)</td>
</tr>
<tr>
<td>Philippines</td>
<td>-0.0405</td>
<td>0.1107*</td>
<td>0.1814*</td>
<td>0.0471</td>
<td>0.0288</td>
</tr>
<tr>
<td></td>
<td>(-0.7244)</td>
<td>(2.4205)</td>
<td>(2.4166)</td>
<td>(0.4961)</td>
<td>(0.5011)</td>
</tr>
</tbody>
</table>

R-squared 0.0389 0.0298 0.0291 0.0781 0.0772
F-statistic 2.6869 2.0401 1.9880 5.6169* 5.5523*

Note: CIV denotes the number of cointegrating vectors. * indicates 5% level of significance; + indicates 10% level of significance. Values in parentheses indicate t-statistics.

Taken together, the temporal causality results for all periods indicate that the individual ASEAN5 equity markets are most probably affected more by international sources of random shocks rather than from shocks arising from within ASEAN5 itself. This is consistent with the arguments proposed by Phylaktis and Ravazzolo (2002) who claim that economic integration leads to financial integration. As the ASEAN5 countries trade more with economies outside the ASEAN5, their equity markets may become more responsive to shocks originating from their non-ASEAN5 trading partners than from within the ASEAN5. For the ASEAN5 countries, their principal trading partners include the US, Japan and China.40 As a result, shocks that come from these countries may carry greater weight in explaining the movements in ASEAN5 equity markets.

Speed of adjustment effects for ASEAN5 + US + Japan + Australia

The results are presented in Table 5-8. The full period results shown in Panel A indicate that all the markets except Singapore and the US exhibit statistically significant speed of adjustment. The speed of adjustment results in the pre-crisis period (Panel B) show that coefficients for Indonesia, the Philippines and Australia are statistically significant. The post-crisis period results presented in Panel C documents statistically significant speed of adjustment coefficients for Malaysia, Indonesia, the Philippines and Japan.

Table 5-8 Speed of adjustment parameters for ASEAN5 + USA + Japan + Australia

<table>
<thead>
<tr>
<th></th>
<th>Panel A. Full period</th>
<th>Panel B. Pre-crisis period</th>
<th>Panel C. Post-crisis period</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Malaysia</td>
<td>Singapore</td>
<td>Thailand</td>
</tr>
<tr>
<td>CIV 1</td>
<td>-0.0251*</td>
<td>-0.0032</td>
<td>-0.0222*</td>
</tr>
<tr>
<td></td>
<td>(-4.4747)</td>
<td>(-0.8155)</td>
<td>(-3.2504)</td>
</tr>
<tr>
<td></td>
<td>Malaysia</td>
<td>Singapore</td>
<td>Thailand</td>
</tr>
<tr>
<td>CIV 1</td>
<td>0.0025</td>
<td>0.0014</td>
<td>0.0156</td>
</tr>
<tr>
<td></td>
<td>(0.3372)</td>
<td>(0.2511)</td>
<td>(1.3894)</td>
</tr>
<tr>
<td></td>
<td>Malaysia</td>
<td>Singapore</td>
<td>Thailand</td>
</tr>
<tr>
<td>CIV 1</td>
<td>-0.0285*</td>
<td>0.0105</td>
<td>-0.0142</td>
</tr>
<tr>
<td></td>
<td>(-2.8284)</td>
<td>(1.2621)</td>
<td>(-1.0406)</td>
</tr>
</tbody>
</table>

Note: CIV denotes the number of cointegrating vectors. * indicates 5% level of significance; ** indicates 10% level of significance. Values in parentheses indicate t-statistics.

Speed of adjustment effects for ASEAN5 + Japan and Australia + US returns (as an exogenous variable).

The results are presented in Table 5-9 where the full period results shown in Panel A indicate that all the markets except Singapore exhibit statistically significant speed of adjustment. Some variation exists for the pre-crisis period (Panel B) and post-crisis period (Panel C). However, in all of the three periods, Singapore is exogenous.
Table 5 - 9 Speed of adjustment parameters for ASEAN5 + Japan and Australia + US returns (as an exogenous variable)

<table>
<thead>
<tr>
<th>Panel A. Full period</th>
<th>Malaysia</th>
<th>Singapore</th>
<th>Thailand</th>
<th>Indonesia</th>
<th>Philippines</th>
<th>Japan</th>
<th>Australia</th>
</tr>
</thead>
<tbody>
<tr>
<td>CIV 1</td>
<td>-0.02691*</td>
<td>-0.0052</td>
<td>-0.0235*</td>
<td>-0.0402*</td>
<td>-0.0271*</td>
<td>-0.0120*</td>
<td>-0.0071*</td>
</tr>
<tr>
<td></td>
<td>(-4.8567)</td>
<td>(-1.3952)</td>
<td>(-3.4939)</td>
<td>(-4.4601)</td>
<td>(-4.8126)</td>
<td>(-2.8886)</td>
<td>(-2.4833)</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Panel B. Pre-crisis period</th>
<th>Malaysia</th>
<th>Singapore</th>
<th>Thailand</th>
<th>Indonesia</th>
<th>Philippines</th>
<th>Japan</th>
<th>Australia</th>
</tr>
</thead>
<tbody>
<tr>
<td>CIV 1</td>
<td>0.0022</td>
<td>-0.0010</td>
<td>0.0077+</td>
<td>0.0082*</td>
<td>0.0152*</td>
<td>-0.0013</td>
<td>0.0086*</td>
</tr>
<tr>
<td></td>
<td>(0.8091)</td>
<td>(-0.5013)</td>
<td>(1.9159)</td>
<td>(2.5250)</td>
<td>(3.8902)</td>
<td>(-0.4628)</td>
<td>(4.4373)</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Panel C. Post-crisis period</th>
<th>Malaysia</th>
<th>Singapore</th>
<th>Thailand</th>
<th>Indonesia</th>
<th>Philippines</th>
<th>Japan</th>
<th>Australia</th>
</tr>
</thead>
<tbody>
<tr>
<td>CIV 1</td>
<td>-0.0265*</td>
<td>0.0104</td>
<td>-0.0138</td>
<td>-0.0916*</td>
<td>-0.0362*</td>
<td>-0.0243*</td>
<td>-0.0054</td>
</tr>
<tr>
<td></td>
<td>(-2.7848)</td>
<td>(1.4135)</td>
<td>(-1.0804)</td>
<td>(-5.5112)</td>
<td>(-3.6801)</td>
<td>(-2.9163)</td>
<td>(-0.9005)</td>
</tr>
</tbody>
</table>

Note: CIV denotes the number of cointegrating vectors. * indicates 5% level of significance; + indicates 10% level of significance. Values in parentheses indicate t-statistics.

Temporal causality

Table 5-10 presents the temporal causality for the ASEAN5, US, Japan and Australia. The full period results (Panel A) show that the US equity market is found to explain the movement in the developed markets of Japan, Australia and Singapore for the full period but does not explain movements in other ASEAN5 markets. The Japanese equity market does not explain innovations in other equity markets although it is affected by innovations from the Singaporean, Indonesian and US equity markets. The Australian returns lead the Singaporean, Thai and Indonesian returns, though among the ASEAN5 this equity market is affected only by Indonesian market movements. Among the ASEAN5 equity markets, it appears that Singapore is most responsive to movements in the US equity market, which probably indicates that a strong link exists between the equity markets of Singapore and the US that could be explained by their close economic ties via trade relations and the presence of the US MNCs in Singapore.41

It appears that the results for the pre-crisis period (Panel B) and post-crisis period (Panel C) show some variation on the influence of these three developed markets on the equity markets of the ASEAN5. The US equity markets seems to have stronger influence on the ASEAN5 markets in the pre-crisis period but in the post-crisis period only Singapore is driven by returns on the US. It is interesting to note that the Japanese and Australian equity markets have limited impacts on the ASEAN5 returns in these two sub-periods.

41 Refer to Leung (2007) for an informative discussion on Singapore and its MNCs.
Table 5 - 10 Temporal causality for ASEAN5, US, Japan and Australia

Panel A. Full period

<table>
<thead>
<tr>
<th>Explanatory Markets (t-1)</th>
<th>Market Explained (t)</th>
<th>Malaysia</th>
<th>Singapore</th>
<th>Thailand</th>
<th>Indonesia</th>
<th>Philippines</th>
<th>US</th>
<th>Japan</th>
<th>Australia</th>
</tr>
</thead>
<tbody>
<tr>
<td>Malaysia</td>
<td>-0.0176</td>
<td>0.0133</td>
<td>0.0006</td>
<td>-0.1436*</td>
<td>0.0062</td>
<td>0.0063</td>
<td>0.0282</td>
<td>0.0182</td>
<td>-0.0304</td>
</tr>
<tr>
<td>(0.4096)</td>
<td>(0.4432)</td>
<td>(-0.0108)</td>
<td>(-2.0562)</td>
<td>(0.1410)</td>
<td>(0.2865)</td>
<td>(0.8754)</td>
<td>(-1.2923)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Singapore</td>
<td>-0.0956</td>
<td>-0.1332*</td>
<td>-0.0881</td>
<td>-0.1933*</td>
<td>0.0506</td>
<td>-0.0075</td>
<td>-0.1143*</td>
<td>-0.0367</td>
<td></td>
</tr>
<tr>
<td>(1.3277)</td>
<td>(-2.6462)</td>
<td>(-1.0017)</td>
<td>(-1.7065)</td>
<td>(0.6839)</td>
<td>(-0.2015)</td>
<td>(-2.1225)</td>
<td>(-0.9312)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Thailand</td>
<td>0.1021*</td>
<td>0.0309</td>
<td>0.0095</td>
<td>0.1548</td>
<td>0.1001*</td>
<td>0.0135</td>
<td>0.0095</td>
<td>0.0219</td>
<td></td>
</tr>
<tr>
<td>(2.7050)</td>
<td>(1.1687)</td>
<td>(0.2053)</td>
<td>(2.5269)</td>
<td>(2.5801)</td>
<td>(0.6957)</td>
<td>(-0.3378)</td>
<td>(1.0613)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Indonesia</td>
<td>0.0182</td>
<td>0.0013</td>
<td>-0.1077*</td>
<td>-0.0399</td>
<td>-0.0034</td>
<td>-0.0351*</td>
<td>-0.0246*</td>
<td></td>
<td></td>
</tr>
<tr>
<td>(0.6866)</td>
<td>(-0.0711)</td>
<td>(-3.3287)</td>
<td>(-2.7403)</td>
<td>(-1.4664)</td>
<td>(-0.2460)</td>
<td>(-1.7717)</td>
<td>(-1.6962)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Philippines</td>
<td>-0.0330</td>
<td>0.0386</td>
<td>0.1394*</td>
<td>0.0107</td>
<td>-0.0341</td>
<td>-0.0008</td>
<td>-0.0232</td>
<td>0.0156</td>
<td></td>
</tr>
<tr>
<td>(0.7952)</td>
<td>(1.3304)</td>
<td>(2.7483)</td>
<td>(0.1594)</td>
<td>(0.7978)</td>
<td>(0.3666)</td>
<td>(-0.7475)</td>
<td>(0.6878)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>R-squared</td>
<td>0.0467</td>
<td>0.0294</td>
<td>0.0434</td>
<td>0.0560</td>
<td>0.0482</td>
<td>0.0166</td>
<td>0.0456</td>
<td>0.0424</td>
<td></td>
</tr>
<tr>
<td>F-statistic</td>
<td>4.3409*</td>
<td>2.6854</td>
<td>4.0256*</td>
<td>5.2593*</td>
<td>4.4916*</td>
<td>1.4972</td>
<td>4.2386*</td>
<td>3.9218*</td>
<td></td>
</tr>
</tbody>
</table>

Note: * indicates 5% level of significance; + indicates 10% level of significance. Values in parentheses indicate t-statistics.

Panel B. Pre-crisis period

<table>
<thead>
<tr>
<th>Explanatory Markets (t-1)</th>
<th>Market Explained (t)</th>
<th>Malaysia</th>
<th>Singapore</th>
<th>Thailand</th>
<th>Indonesia</th>
<th>Philippines</th>
<th>US</th>
<th>Japan</th>
<th>Australia</th>
</tr>
</thead>
<tbody>
<tr>
<td>Malaysia</td>
<td>0.1422*</td>
<td>0.0516</td>
<td>-0.1190</td>
<td>0.0078</td>
<td>0.1056</td>
<td>0.0082</td>
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Table 5-10 Temporal causality for ASEAN5, US, Japan and Australia (continued)

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Note: * indicates 5% level of significance; + indicates 10% level of significance. Values in parentheses indicate t-statistics.

Table 5-11 provides the temporal causality results for the ASEAN5, Japan and Australia with the US returns estimated as an exogenous variable. In general, it demonstrates that the Japanese and Australian equity markets show small variation from the results reported previously in Table 5-10. The influence of these two markets on the ASEAN5 equity markets is limited and this is particularly true of the Japanese market for all three periods. It is noted that the US equity market influence is more prominent on the ASEAN5 equity markets in all three periods, with the influence becoming stronger in the post-crisis period, consistent with Abd. Majid et al. (2007). As the US equity market is generally viewed as a proxy for the world market, it is reasonable to suggest that the ASEAN5 equity markets conform to the international CAPM, in the sense that these equity market returns are correlated with world market returns.
Table 5 - 11 Temporal causality for ASEAN5 + Japan and Australia + US returns (as an exogenous variable)

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<th>Market Explained (t)</th>
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<th>Thailand</th>
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<th>Philippines</th>
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Panel B. Pre-crisis period

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Note: * indicates 5% level of significance; + indicates 10% level of significance. Values in parentheses indicate t-statistics.
Table 5 - 11Temporal causality for ASEAN5 + Japan and Australia + US returns (continued)

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Note: * indicates 5% level of significance; + indicates 10% level of significance. Values in parentheses indicate t-statistics.

5.3 Conclusion

ASEAN5 stock markets have experienced the ‘Asian Miracle’ phase, survived the 1997 crisis, and are now re-building their position and strength in the region. The equity markets of the ASEAN5 represent different levels of market development; thus, it is interesting examine the short-run and long-run linkages within these equity markets, as well as their relations with the developed markets of the US, Japan and Australia.

The results from the Pearson correlation suggest that ASEAN5 market correlation increased after the 1997 crisis, except for Malaysia. Capital controls may explain the reduction observed for the Malaysian equity market relative to other ASEAN5 equity markets (Click & Plummer, 2005). Further, the results from cointegration analysis show that these five equity markets share a long-term equilibrium relationship with each other. This relationship remains with the inclusion of the US, Japanese and Australian equity markets in the analysis. While the Japanese and Australian equity market returns provide limited influence on the ASEAN5 equity markets, a more prominent effect is recorded for
the US equity market, in particular when the US returns are tested as an exogenous variable to the system. Therefore, the finding suggests that the ASEAN5 equity markets follow the theoretical rational of the international CAPM.

While there are some exceptions reported in the literature, evidence presented in this chapter indicates that a substantial amount of interdependence and co-movement exists among the ASEAN5 national markets. As such, the results from this chapter lend support to previous studies such as those by Click and Plummer (2005), Daly (2003), Sharma and Wongbangpo (2002) and Azman-Saini et al. (2002).

As suggested by this chapter, the ASEAN5 equity markets exhibit partial convergence. As an integrated market provides an access to decreased transaction costs and capital costs, further efforts towards ASEAN equity market integration may be of interest. Also, Click and Plummer (2005) have highlighted the importance of capital market efficiency in Southeast Asia since the 1997 crisis. As such, improvement in surveillance mechanisms to detect early signs of possible crises and coordination among ASEAN members to mitigate the impact of financial fluctuations in the future may be beneficial (Sharma and Wongbangpo, 2002).

Information on the degree of equity market linkages within the ASEAN5 equity markets is one of the important factors considered in an investment portfolio made by investors (Roca et al., 1998). It has been argued that the existence of cointegration in ASEAN5 markets may limit the potential for risk diversification. Nevertheless, it is important to remember that the ASEAN5 markets are partially cointegrated, which means that the diversification benefits are probably reduced but not eliminated.
Chapter 6

ASEAN5 GDP LINKS

6.1 Introduction

From the mid 1960s through to the 1997 crisis, the economies of East Asia saw such rapid growth that it was dubbed the ‘Asian Miracle’. While the renowned economist Paul Krugman (1994) attributes this growth to the mobilisation of resources as in the case of Soviet Union, Skousen (1996) challenges this idea and instead attributes the rapid development to market-friendly orientation, macroeconomic stability, openness to global technology and foreign capital. Likewise, foreign trade brings about the diffusion of new products and technologies, while international investment brings greater technological and organisational improvements (Lim and McAleer, 2004) to these new economies. Regardless of the source of this growth, the standard of living and prosperity in these economies also increased dramatically over the period.

This chapter, rather than concentrating on the economic growth for all economies in East Asia, gives attention to the ASEAN5 economies. These economies have shown impressive growth rates for almost four decades, with average annual growth rates ranging between 4.0 percent and 4.8 percent for all the countries except the Philippines (0.8 percent). These GDP growth rates exceed those of most developed countries over the same period \(^{42}\) and it is unfortunate that the economic and social prosperity of these nations was disturbed by the 1997 Asian crisis.

The motivation for this chapter lies with the aspiration of ASEAN to achieve the establishment of an ASEAN Community by 2020. ASEAN-wide economic and financial integration is at the centre of this goal. The proposed community is hoped to promote more intra-ASEAN and inter-ASEAN trade, as well as greater investment opportunities amidst the prevailing trend of globalisation and regionalisation of the world economy (see Lloyd and Smith, 2004). In order to assess the feasibility of ASEAN integration, it is important to test for co-movement in GDP growth rates among the ASEAN5 countries. If there is no

long-term relationship evident in the GDP growth of these countries, then economic integration could be difficult to establish and probably unsustainable in the longer term.

The objective of this study is to examine possible links in GDP growth of the ASEAN5. For this reason, the GDP measure is used instead of GDP per capita, which measures the wealth of a nation at an individual level. There is little research dealing with this aspect of GDP linkages across the ASEAN countries even though it is an important area of research (Frankel and Rose, 1998; Kose and Yi, 2001). There are at least two reasons to expect cointegration in ASEAN GDP, the first being the international trade relationship that exists between these economies. In particular, bilateral trade relationships serve as a natural means of coordinating economic development between countries involved in international trade activities. Second, membership of an economic group, such as ASEAN in this case, tends to align the macroeconomic trends of its members under an agreed economic paradigm (see Kocenda, 2001; Pretorius, 2002).

In general, this study addresses the question of whether the ASEAN5 countries have achieved some level of integration in their aggregate economic growth over the period from 1990 to 2006. An auxiliary question concerns whether the 1997 Asian crisis alters the linkages that existed prior to the crisis. These questions will be explored using cointegration tests and vector error correction models (VECM). The linkages in GDP growth rates examined in this study are in terms of real and nominal US dollars (USD) and quarterly observations spanning the period from quarter 1:1990 to quarter 1:2006 are employed. Also, sub-period analysis catering for the period before and after the 1997 crisis is included.

It is found that cointegration among the ASEAN5 GDP growth rates varies depending on the period of analysis as well as whether real or nominal values are used in analysis. There is no long-run relationship in the pre-crisis period. However, there is evidence of a relatively stable long-term relationship in the full period as well as in the post-crisis period. Given the increase in the number of cointegrating vectors identified in the post-crisis period, this study suggests that ASEAN economic integration has become more prominent since the crisis. In the words of Ariff (2006, p.236), ‘the crisis has caused East Asia in general and ASEAN, in particular, to run into each other’s arms…the sense of insecurity has brought them together as never before’.

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43 Kocenda (2001) studies the countries in European Community (EU).
The literature survey, methodology and data used for this chapter are provided in Chapters 2, 3 and 4 of this thesis. The remaining parts of this chapter are organised as follows: Section 6.5 presents the empirical results and provides a discussion of the findings, while Section 5.6 offers some conclusion for this chapter.

6.2 Results and discussion

This section first provides a statistical summary of the GDP data used for this chapter. This is followed by the results for unit root tests, cointegration tests and their respective VECMs analysis.

6.2.1 Statistical summary

Descriptive statistics for ASEAN5 GDP growth are presented in Table 6-1. Average GDP growth is higher prior to the crisis but decreases after the crisis both in real GDP and nominal GDP. Average negative growth is more evident in real GDP than nominal GDP. This is consistent with the negative impact of the 1997 Asian crisis, although it should be noted that the impact of the crisis differs across the ASEAN5 countries.

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Table 6 - 1 Descriptive statistics of GDP growth (continued)

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Note: the full period includes all observations from Q1:1990 to Q1 2006. The pre-crisis period covers the period from Q1:1990 to Q2:1997 and the post-crisis period includes the period from Q3:1998 to Q1:2006. Max, Min, Std Dev, and Obs represent maximum, minimum, standard deviation, and the number of observations respectively.

Variation across the ASEAN5 countries (real and nominal GDP) is also evident from Figure 6-1 and Figure 6-2. There is considerable variation in nominal USD as shown in Figure 6-2. The most striking feature from both graphs is the impact of the 1997 crisis on the level of GDP in these economies. The severity of the crisis, that started as a debt crisis and became a full-fledged development crisis, is described by Wade (1989) as ‘a tragedy nonetheless, almost as cruel as war’.

**Figure 6 - 1 Log ASEAN5 GDP in real USD**
Notes: The log values of GDP series are standardised to q1:1990

The biggest fall in GDP occurs for Indonesia, while the least affected country is Singapore. Singapore’s stability may be due to its stable currency which only declined by about 20% after the crisis and was supported by its strong fundamentals, mirrored by US$21,500 GDP per capita in 1997. Between July and October 1997 the Thai baht fell by nearly 40%, the Malaysian ringgit by 40%, the Philippines peso by about 27% and the Indonesian rupiah by about 40% (Bacha, 2004).

Correlation Analysis

Correlation coefficients for the ASEAN5 country growth rates are reported in Table 6-2. There is some variation in GDP growth correlations among the ASEAN5 in both nominal and real GDP terms. Most of the correlation coefficients for real GDP growth are greater than those for nominal values. There are, however, two important points to note. First, most of the real USD growth correlation coefficients are greater than the nominal USD coefficients. Second, the GDP growth correlations between Malaysia and other countries decrease, in general, after the crisis. On the other hand, other ASEAN5 countries show substantial increments in their correlation with each other after the crisis. In addition, the Philippines shows some variation in its correlations with other countries. In the pre-crisis period, most of the correlation coefficients are negative. In the post-crisis period, however,

---

44 Singapore also maintains high FDI amidst the general decline in FDI in the neighbouring economies because of the attraction of China for international capitalists (Ariff and Khalid, 2005) and the links that exist between China and Singapore.
they are all positive. This suggests that the Philippines GDP growth is not tightly linked with the remaining ASEAN5 members other than with Malaysia, in the pre-crisis period. Poor economic growth may explain this pattern, particularly given the rampant corruption that occurred in both government and business (Leung, 2007). Nonetheless, this scenario has substantially changed since the crisis. For example, the correlation coefficients with Thailand, Singapore and Indonesia range from about 40% to 60% in the post-crisis period. However, contemporaneous movements of output might underestimate the degree of economic integration because of lags in the international transmission of shocks (Phylaktis and Ravazzolo, 2002).

Table 6-2 Correlations of GDP growth

Panel A. Real GDP

<table>
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<tr>
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<th>Pre-crisis period</th>
<th>Post-crisis period</th>
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Note: the full period includes all observations from Q1:1990 to Q1:2006. The pre-crisis period covers the period from Q1:1990 to Q2:1997 and the post-crisis period includes the period from Q3:1998 to Q1:2006.
### Table 6 – 2 Correlations of GDP growth (continued)

#### Panel B. Nominal GDP

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Note: the full period includes all observations from Q1:1990 to Q1:2006. The pre-crisis period covers the period from Q1:1990 to Q2:1997 and the post-crisis period includes the period from Q3:1998 to Q1:2006.

#### Autocorrelation

Table 6-3 reports the autocorrelation coefficients for the levels of the ASEAN5 GDP and their first differences, for both the real and nominal and USD series. The autocorrelation coefficients for the natural log of GDP decline slowly while the autocorrelations for the GDP growth rate die off rapidly. This is consistent with the series being \( I(1) \) processes. This result is expected given the influence of business cycles on economic time series, which results in inertia (sluggishness). Thus successive observations of GDP are likely to be interdependent (Gujarati, 2003).
Table 6 - 3 Autocorrelation of log GDP at levels and 1st differences

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<th>Panel B. Nominal GDP</th>
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Note: GDP and ∆GDP represent logarithms of GDP at levels and 1st differences respectively. Prob denotes probability and AR indicates autoregressive order.
6.2.2 Unit root tests

It is important to test stationarity of GDP time series before conducting Johansen cointegration tests. In this chapter three unit root tests are employed, the ADF test, the P-P test and the KPSS test. The results are reported in Table 6-4 for real GDP and Table 6-5 for nominal GDP (at the 5% level of significance). In general, the full period results provide evidence to support that the series are integrated of order one i.e. $I(1)$ processes.

There is some variation though, in the pre-crisis and post-crisis results in both tables. When other series are integrated of order one, the GDP series for Malaysia (pre-crisis and post-crisis), Indonesia (post-crisis) and the Philippines (pre-crisis) are integrated of order zero. Further, it is noted that the unit root test results for the GDP series of these countries are sensitive to the length of sub-period used. The post-crisis results are probably due to the impact of the crisis on the GDP of individual countries. Given the relatively small sample size, variation in these results is not unexpected, and so the order of integration for all series in the pre-crisis and post-crisis period is assumed to be one. This is supported by the full period results.45

Given that seasonal adjustment is included in the cointegration and vector error correction models (VECM), unit root test (ADF test) were also repeated with seasonal adjustment. The results do not change qualitatively from the previous unit root test results and so are not reported here in order to conserve space.

---

45 Lim & McAleer (2004) also find that the GDP series for Singapore is sensitive to the sample period used in their study. Thus they assume the series to be integrated of order one if a longer period is used.
Table 6 - 4 Unit root tests for GDP in real USD

<table>
<thead>
<tr>
<th></th>
<th>ADF</th>
<th>PP</th>
<th>KPSS</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Level</td>
<td>1's diff</td>
<td>Level</td>
</tr>
<tr>
<td></td>
<td>lags</td>
<td>Probability</td>
<td>lags</td>
</tr>
<tr>
<td><strong>Full period</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Malaysia</td>
<td>0</td>
<td>0.5455</td>
<td>0</td>
</tr>
<tr>
<td>Singapore</td>
<td>0</td>
<td>0.7115</td>
<td>0</td>
</tr>
<tr>
<td>Thailand</td>
<td>0</td>
<td>0.6568</td>
<td>0</td>
</tr>
<tr>
<td>Indonesia</td>
<td>0</td>
<td>0.3589</td>
<td>0</td>
</tr>
<tr>
<td>Philippines</td>
<td>0</td>
<td>0.4423</td>
<td>0</td>
</tr>
<tr>
<td><strong>Pre-crisis period</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Malaysia</td>
<td>5</td>
<td>0.0035</td>
<td>7</td>
</tr>
<tr>
<td>Singapore</td>
<td>0</td>
<td>0.3307</td>
<td>0</td>
</tr>
<tr>
<td>Thailand</td>
<td>0</td>
<td>0.9840</td>
<td>0</td>
</tr>
<tr>
<td>Indonesia</td>
<td>4</td>
<td>0.6960</td>
<td>3</td>
</tr>
<tr>
<td>Philippines</td>
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<td>0.9144</td>
<td>0</td>
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<tr>
<td><strong>Post-crisis period</strong></td>
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<td></td>
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<td>Malaysia</td>
<td>4</td>
<td>0.1224</td>
<td>6</td>
</tr>
<tr>
<td>Singapore</td>
<td>0</td>
<td>0.7348</td>
<td>0</td>
</tr>
<tr>
<td>Thailand</td>
<td>0</td>
<td>0.5942</td>
<td>0</td>
</tr>
<tr>
<td>Indonesia</td>
<td>1</td>
<td>0.0496</td>
<td>0</td>
</tr>
<tr>
<td>Philippines</td>
<td>0</td>
<td>0.7009</td>
<td>5</td>
</tr>
</tbody>
</table>

Note: The post-crisis period for Malaysia is from q1:1999 to q1:2006 because the series otherwise contains a unit root. This might be attributed to the introduction of capital control in September 1998 (Click & Plummer, 2003). In the post-crisis period, the series seems to have a deterministic trend. Yet, this series is included in multivariate cointegration test given the full period results and also because of a small number of observations. Thus, an assumption is made that the series contains unit root in levels if longer period is included in the study, which is beyond the scope of this thesis. 1's diff refers to first differences of the series. * indicates the rejection of the null hypothesis at the 5% level.
Table 6 - 5 Unit root tests for GDP in nominal USD

<table>
<thead>
<tr>
<th></th>
<th>ADF</th>
<th>PP</th>
<th>KPSS</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Level</td>
<td>1\textsuperscript{st} diff</td>
<td>Level</td>
</tr>
<tr>
<td></td>
<td>lags</td>
<td>Probability</td>
<td>lags</td>
</tr>
<tr>
<td><strong>Full period</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Malaysia</td>
<td>0</td>
<td>0.2622</td>
<td>0</td>
</tr>
<tr>
<td>Singapore</td>
<td>0</td>
<td>0.6348</td>
<td>0</td>
</tr>
<tr>
<td>Thailand</td>
<td>0</td>
<td>0.5918</td>
<td>0</td>
</tr>
<tr>
<td>Indonesia</td>
<td>0</td>
<td>0.3236</td>
<td>0</td>
</tr>
<tr>
<td>Philippines</td>
<td>0</td>
<td>0.3005</td>
<td>0</td>
</tr>
<tr>
<td><strong>Pre-crisis period</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
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<td>Malaysia</td>
<td>5</td>
<td>0.0050</td>
<td>6</td>
</tr>
<tr>
<td>Singapore</td>
<td>0</td>
<td>0.5023</td>
<td>0</td>
</tr>
<tr>
<td>Thailand</td>
<td>0</td>
<td>0.9966</td>
<td>0</td>
</tr>
<tr>
<td>Indonesia</td>
<td>4</td>
<td>0.6831</td>
<td>2</td>
</tr>
<tr>
<td>Philippines</td>
<td>5</td>
<td>0.9209</td>
<td>0</td>
</tr>
<tr>
<td><strong>Post-crisis period</strong></td>
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<td></td>
<td></td>
</tr>
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<td>Malaysia</td>
<td>4</td>
<td>0.0370</td>
<td>6</td>
</tr>
<tr>
<td>Singapore</td>
<td>0</td>
<td>0.8620</td>
<td>0</td>
</tr>
<tr>
<td>Thailand</td>
<td>0</td>
<td>0.6050</td>
<td>0</td>
</tr>
<tr>
<td>Indonesia</td>
<td>1</td>
<td>0.0407</td>
<td>0</td>
</tr>
<tr>
<td>Philippines</td>
<td>0</td>
<td>0.8478</td>
<td>5</td>
</tr>
</tbody>
</table>

Note: For the Philippines the pre-crisis period is from q1:1990 to q2: 1997 without q2, q3 and q4 due to some irregular trends observed from the graph of log GDP series. However, the results for ADF changed but not for PP and KPSS. The series still stationary at levels. 1\textsuperscript{st} diff refers to first differences of the series. * indicates the rejection of the null hypothesis at the 5% level.
6.2.3 Cointegration test

Initially, cointegration tests are performed on the series without adjustment for either seasonal effects or crash period effects for the full period. The full period tests are then conducted incorporating both seasonal and crash period adjustment.\(^{46}\) Given unit root test sensitivity to the sample period reported in Table 6-4 and Table 6-5, six quarterly crash dummy variables are used in the analysis. Also, it has been argued that macroeconomic variables such as GDP need a longer time to return to equilibrium in comparison with financial variables (Click and Plummer, 2005).

The results from cointegration tests using different models are presented in Table 6-6, which provides the results for the cointegration tests without any adjustment for seasonal or 1997 crash effects. Table 6-7 presents cointegration test results for models with the inclusion of seasonal and crash period adjustment. As mentioned in the methodology section, trace statistics are relied upon in testing for the number of cointegrating relationships in this study.

Results in Table 6-6 are consistent for both real and nominal GDP for the full and pre-crisis periods. Yet, for the post-crisis period, trace statistics show five cointegrating vectors for real GDP-based analysis which suggests no cointegration in the series for this model, while the trace statistic for nominal GDP indicates the existence of three cointegrating vectors. It is possible that this model is inadequately specified given the possibility of seasonal effects and the impact of the 1997 crash.

The results in Table 6-7 consider the full period analysis with provision for a more complete model (adjustment for seasonal and crash period).\(^{47}\) The results for the full period show that there is one cointegrating vector for real GDP and two cointegrating vectors for nominal GDP. In the pre-crisis period, however, no cointegrating vector is identified for either real or nominal USD, implying that five common stochastic trends exist among the ASEAN5 GDP over this period. A substantial increase in GDP linkage among the ASEAN5 is found in the post-crisis period with three cointegrating vectors (two common stochastic trends) existing for both real and nominal GDP.

---

\(^{46}\) It is widely accepted in literature that macroeconomic series contain seasonal effects.

\(^{47}\) The lag length used in the VAR is as follows: one lag for the full period and pre-crisis period, and three lags for the post-crisis period. The number of lags is similar for real and nominal USD.
The findings suggest that the ASEAN5 economies have become more integrated in the period following the crisis, since there is no statistically significant linkage detected among the ASEAN5 growth rates before the crisis period. The results also suggest that the growth rates of GDP in the ASEAN5 countries display partial convergence in the full period, with this effect concentrated in the post-crisis period. The overall results imply that the GDP of the ASEAN5 countries is cointegrated at present. Yet, while the variables move towards equilibrium in the long run, they do not share a single stochastic trend.

The linkages among the GDP growth of ASEAN5 seem to have strengthened in the later period of the study, consistent with greater economic alignment since the crisis. This point is emphasised by Ariff (2006), who supports the view that the crisis has acted as a catalyst that triggered major changes in the ASEAN economic integration process. Inasmuch, there appears to be no significant difference between the results reported for either real or nominal ASEAN5 GDP.

48 Referring to Cheung and Lai (1993), who state that the Johansen tests are likely to reject the null hypothesis of no cointegration in small sample; a longer sample period for the pre-crisis and post-crisis periods is desirable but it is beyond the scope of this thesis and it shall be left to future research.
Table 6 - 6 Cointegration tests for real and nominal GDP with no adjustment for seasonal or crash effects

<table>
<thead>
<tr>
<th></th>
<th>Real GDP</th>
<th>Nominal GDP</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>$H_0$</td>
<td>$H_A$</td>
</tr>
<tr>
<td></td>
<td>Eigenvalues</td>
<td>$\lambda_{\text{max}}$</td>
</tr>
<tr>
<td>r = 0 r &gt; 0</td>
<td>0.5054</td>
<td>44.3562*</td>
</tr>
<tr>
<td>r ≤ 1 r &gt; 1</td>
<td>0.3966</td>
<td>31.8239*</td>
</tr>
<tr>
<td>r ≤ 2 r &gt; 2</td>
<td>0.1542</td>
<td>10.5477</td>
</tr>
<tr>
<td>r ≤ 3 r &gt; 3</td>
<td>0.0903</td>
<td>5.9591</td>
</tr>
<tr>
<td>r ≤ 4 r = 4</td>
<td>0.0320</td>
<td>2.0487</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Pre-crisis period</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>r = 0 r &gt; 0</td>
<td>0.7474</td>
<td>38.5229*</td>
</tr>
<tr>
<td>r ≤ 1 r &gt; 1</td>
<td>0.4877</td>
<td>18.7286</td>
</tr>
<tr>
<td>r ≤ 2 r &gt; 2</td>
<td>0.3242</td>
<td>10.9730</td>
</tr>
<tr>
<td>r ≤ 3 r &gt; 3</td>
<td>0.2556</td>
<td>8.2661</td>
</tr>
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<td>0.1456</td>
<td>4.4053</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Post-crisis period</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>r = 0 r &gt; 0</td>
<td>0.7795</td>
<td>46.8641*</td>
</tr>
<tr>
<td>r ≤ 1 r &gt; 1</td>
<td>0.6449</td>
<td>32.0971*</td>
</tr>
<tr>
<td>r ≤ 2 r &gt; 2</td>
<td>0.4744</td>
<td>19.9372</td>
</tr>
<tr>
<td>r ≤ 3 r &gt; 3</td>
<td>0.2717</td>
<td>9.8275</td>
</tr>
<tr>
<td>r ≤ 4 r = 4</td>
<td>0.2061</td>
<td>7.1528</td>
</tr>
</tbody>
</table>

Note: This table shows the results for the GDP cointegration without adjustment for seasonal or crash period effects. The critical values are taken from MacKinnon-Haug-Michelis (1999), r representing the number of cointegration vectors. The number of lag used is 1. $H_0$ and $H_A$ refer to the null and alternative hypotheses respectively. r is the number of cointegrating vector. * denotes rejection of the hypothesis at the 5% level.
Table 6 - 7: Cointegration tests for real and nominal GDP with seasonal and crash period adjustment

(c) Full period with seasonal and crash period dummy variables (q2:1997-q4:1998)

<table>
<thead>
<tr>
<th></th>
<th>Real USD</th>
<th>Nominal USD</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>H₀</td>
<td>H₁</td>
</tr>
<tr>
<td></td>
<td>Eigenvalues</td>
<td>λₘₐₓ</td>
</tr>
<tr>
<td>r = 0</td>
<td>0.4161</td>
<td>33.8929*</td>
</tr>
<tr>
<td>r ≤ 1</td>
<td>0.3468</td>
<td>26.8294</td>
</tr>
<tr>
<td>r ≤ 2</td>
<td>0.1983</td>
<td>13.9229</td>
</tr>
<tr>
<td>r ≤ 3</td>
<td>0.0729</td>
<td>4.7658</td>
</tr>
<tr>
<td>r ≤ 4</td>
<td>0.0038</td>
<td>0.2375</td>
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</tbody>
</table>

(b) Pre-crisis period (q1:1990 – q2:1997) with seasonal dummy variables

<table>
<thead>
<tr>
<th></th>
<th>Real USD</th>
<th>Nominal USD</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>H₀</td>
<td>H₁</td>
</tr>
<tr>
<td></td>
<td>Eigenvalues</td>
<td>λₘₐₓ</td>
</tr>
<tr>
<td>r = 0</td>
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</tr>
<tr>
<td>r ≤ 1</td>
<td>0.3705</td>
<td>12.9586</td>
</tr>
<tr>
<td>r ≤ 2</td>
<td>0.3481</td>
<td>11.9803</td>
</tr>
<tr>
<td>r ≤ 3</td>
<td>0.1692</td>
<td>5.1894</td>
</tr>
<tr>
<td>r ≤ 4</td>
<td>0.1066</td>
<td>3.1572</td>
</tr>
</tbody>
</table>

(c) Post-crisis period (q1:1999 – q1:2006q1) with seasonal dummy variables

<table>
<thead>
<tr>
<th></th>
<th>Real USD</th>
<th>Nominal USD</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>H₀</td>
<td>H₁</td>
</tr>
<tr>
<td></td>
<td>Eigenvalues</td>
<td>λₘₐₓ</td>
</tr>
<tr>
<td>r = 0</td>
<td>0.9973</td>
<td>171.9727*</td>
</tr>
<tr>
<td>r ≤ 1</td>
<td>0.9364</td>
<td>79.8790*</td>
</tr>
<tr>
<td>r ≤ 2</td>
<td>0.6148</td>
<td>27.6690*</td>
</tr>
<tr>
<td>r ≤ 3</td>
<td>0.2940</td>
<td>10.0948</td>
</tr>
<tr>
<td>r ≤ 4</td>
<td>0.1495</td>
<td>4.6952</td>
</tr>
</tbody>
</table>

Note: The critical values are taken from MacKinnon-Haug-Michelis (1999). r representing the number of cointegration vectors. H₀ and H₁ refer to null and alternative hypothesis respectively. r is the number of cointegrating vector * denotes rejection of the hypothesis at the 5% level.
6.2.4 Vector error correction models (VECMs)

Cointegration test results reported in the previous section indicate that some important changes have occurred during the study period and, in particular, after the 1997 crisis. In order to examine individual country relationships more closely, separate VECM results are now analysed. Results for real GDP and nominal GDP are presented in Tables 6-8, 6-9 and 6-10. Discussion focuses on speed of adjustment and temporal causality parameters. To assist in understanding the temporal causality results reported in the post-crisis period, $\chi^2$ test statistics for the three lag terms replace $t$-statistic based results. In general, F-statistics for real and nominal GDP models are statistically significant.

*Speed of adjustment*

The speed of adjustment results show that in the full period, Thailand is most sensitive to shock to the long-run equilibrium relationship. There are two cointegrating vectors for nominal GDP with the first focusing on Thailand and Singapore, while the second highlights the relationship between Thailand and the Philippines. Malaysia appears to be exogenous in terms of both real and nominal GDP.

There is no statistically significant speed of adjustment effect in the pre-crisis period. In the post-crisis period, three cointegrating vectors exist in the system. These results suggest that an endogenous system exists between the ASEAN5 with links existing between each of the countries.

**Table 6 - 8 VECM: Speed of adjustment**

**Panel A. Real GDP**

<table>
<thead>
<tr>
<th>Full period</th>
<th>Malaysia</th>
<th>Singapore</th>
<th>Thailand</th>
<th>Indonesia</th>
<th>Philippines</th>
</tr>
</thead>
<tbody>
<tr>
<td>CIV 1</td>
<td>0.0010</td>
<td>0.0095</td>
<td>0.0174*</td>
<td>-0.0354</td>
<td>0.0212</td>
</tr>
<tr>
<td></td>
<td>(0.1399)</td>
<td>(1.1755)</td>
<td>(1.7129)</td>
<td>(-1.6279)</td>
<td>(1.3771)</td>
</tr>
<tr>
<td>Pre-crisis period</td>
<td>Malaysia</td>
<td>Singapore</td>
<td>Thailand</td>
<td>Indonesia</td>
<td>Philippines</td>
</tr>
<tr>
<td>Post-crisis period</td>
<td>Malaysia</td>
<td>Singapore</td>
<td>Thailand</td>
<td>Indonesia</td>
<td>Philippines</td>
</tr>
<tr>
<td>CIV 1</td>
<td>-0.6890</td>
<td>0.7063</td>
<td>2.3980*</td>
<td>10.0725*</td>
<td>2.3212*</td>
</tr>
<tr>
<td></td>
<td>(-1.3687)</td>
<td>(0.4258)</td>
<td>(1.2505)</td>
<td>(3.0787)</td>
<td>(2.3817)</td>
</tr>
<tr>
<td>CIV 2</td>
<td>-0.4755*</td>
<td>-1.5762*</td>
<td>-2.5749*</td>
<td>-8.2700*</td>
<td>-1.7058*</td>
</tr>
<tr>
<td></td>
<td>(-1.7573)</td>
<td>(-1.7680)</td>
<td>(-2.4981)</td>
<td>(-4.7027)</td>
<td>(-3.2567)</td>
</tr>
<tr>
<td>CIV 3</td>
<td>0.3749*</td>
<td>0.9612*</td>
<td>1.4390*</td>
<td>4.5150*</td>
<td>0.8922*</td>
</tr>
<tr>
<td></td>
<td>(2.6895)</td>
<td>(2.0934)</td>
<td>(2.7106)</td>
<td>(4.9849)</td>
<td>(3.3068)</td>
</tr>
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-no estimation for pre-crisis period-
Table 6 - 8 VECM: Speed of adjustment (continued)

Panel B. Nominal GDP

<table>
<thead>
<tr>
<th>Full period</th>
<th>Malaysia</th>
<th>Singapore</th>
<th>Thailand</th>
<th>Indonesia</th>
<th>Philippines</th>
</tr>
</thead>
<tbody>
<tr>
<td>CIV 1</td>
<td>-0.0876</td>
<td>-0.1236</td>
<td>0.2592*</td>
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<td>0.1314</td>
</tr>
<tr>
<td></td>
<td>[-1.1830]</td>
<td>[-1.5078]</td>
<td>[ 2.7285]</td>
<td>[ 1.2888]</td>
<td>[ 0.8217]</td>
</tr>
<tr>
<td>CIV 2</td>
<td>0.0372</td>
<td>0.0282</td>
<td>-0.1219*</td>
<td>0.0903</td>
<td>-0.1452*</td>
</tr>
<tr>
<td></td>
<td>[ 0.9503]</td>
<td>[ 0.6498]</td>
<td>[-2.4256]</td>
<td>[ 0.8033]</td>
<td>[-1.7154]</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Pre-crisis period</th>
<th>Malaysia</th>
<th>Singapore</th>
<th>Thailand</th>
<th>Indonesia</th>
<th>Philippines</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>-no estimation for pre-crisis period-</td>
<td></td>
<td></td>
<td></td>
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</table>

<table>
<thead>
<tr>
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<th>Singapore</th>
<th>Thailand</th>
<th>Indonesia</th>
<th>Philippines</th>
</tr>
</thead>
<tbody>
<tr>
<td>CIV 1</td>
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<td>0.8995*</td>
<td>1.1898*</td>
<td>5.1015*</td>
<td>0.8103*</td>
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<tr>
<td></td>
<td>( 4.2124)</td>
<td>( 2.9634)</td>
<td>( 3.3497)</td>
<td>( 4.4101)</td>
<td>( 2.6013)</td>
</tr>
<tr>
<td>CIV 2</td>
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<td>-1.5494*</td>
<td>-2.1750*</td>
<td>-7.0683*</td>
<td>-1.2519*</td>
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<td>(-4.4262)</td>
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<td>CIV 3</td>
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<td>( 3.9000)</td>
<td>( 5.3707)</td>
<td>( 4.3856)</td>
<td>( 3.5145)</td>
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Note: CIV denotes the cointegrating vector. Value in parentheses indicates $t$-statistics. * indicates significance at the 5% level; + indicates significance at the 10% level.

**Temporal causality**

The short-run causality interactions among ASEAN5 GDP growth are examined and the results presented in Tables 6-9 and 6-10. For the full period, there appear to be limited unidirectional short-run causal links among the ASEAN5 in both real and nominal GDP analyses. In the pre-crisis period, however, more temporal causality relationships prevail and the relationships are evident in both real and nominal GDP.

It is noted that Singapore GDP is affected by GDP of others within the ASEAN5, although Singapore’s GDP growth does not appear to lead other ASEAN5 GDP movements. Further, the Philippines’ GDP growth appears to be independent of the other ASEAN5 members in temporal causality analysis.

Bidirectional causality links are prominent in the post-crisis period. Here, the short-term linkages occur for almost all cases in real and nominal GDP. The economies of ASEAN5 do appear to have become more closely linked in the post-crisis era.
Table 6 - 9 Temporal causality from VECMs for real GDP

(a) Full period

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<tr>
<th>Explanatory Markets (t-1)</th>
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<th>Indonesia</th>
<th>Philippines</th>
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<td>1.0097*</td>
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<td>(2.3072)</td>
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<td>-0.1557</td>
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<td>0.0377</td>
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Seasonal dummy

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<th>Indonesia</th>
<th>Philippines</th>
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<td>0.0238</td>
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<td>(1.9796)</td>
<td>(-0.2362)</td>
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Crash dummy

| DQ4:1997                          | -0.0355  | -0.0062   | 0.0172   | -0.0193   | -0.0312     |
| (-1.2319)                         | (-0.1991)| (0.4413)  | (-0.2303)| (-0.5261)|            |
| DQ3:1997                          | -0.2997* | -0.1028*  | -0.3952* | -0.2720*  | -0.2243*    |
| (-10.086)                         | (-3.2170)| (-9.8074)| (-3.1549)| (-3.6685)|            |
| DQ1:1998                          | -0.2749* | -0.0737   | -0.3055* | 0.1621    | 0.0687      |
| (-4.1768)                         | (-1.0408)| (-3.4232)| (0.8492) | (0.5073)  |
| DQ2:1998                          | -0.0479  | 0.0714    | 0.1678*  | -0.4147*  | 0.1534      |
| (-0.7642)                         | (1.0598) | (1.9754)  | (-2.2818)| (1.1902)  |
| DQ3:1998                          | -0.0942  | -0.0767   | -0.0365  | -0.6524*  | 0.0398      |
| (-1.3271)                         | (-1.0045)| (-0.3795)| (-3.1680)| (0.2727)  |
| DQ4:1998                          | 0.0769   | 0.0269    | 0.2020*  | 0.2171    | 0.1636      |
| (1.4796)                          | (0.4813) | (2.8646)  | (1.4391) | (1.5290)  |

R-squared                          0.8959    0.5242    0.8536    0.7438    0.5643     
F-statistic                        26.9717*  3.4514*  18.2674*  9.0949*  4.0577*     

Note: value in parentheses indicates t-statistics. * indicates significance at the 5% level. ** indicates significance at the 10% level.
Table 6 - 9 Temporal causality from VECMs for real GDP (continued)

(b) Pre-crisis period

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<th>Indonesia</th>
<th>Philippines</th>
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(c) Post-crisis period

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Seasonal dummy

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Note: ( ) indicates t-statistics. * indicates significance at the 5% level. * indicates significance at the 10% level
Table 6 - 10 Temporal causality from VECMs in nominal GDP

(a) Full period

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Seasonal dummy

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Crash dummy

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<tr>
<td></td>
<td>(1.5536)</td>
<td>(0.3634)</td>
<td>(2.3130)</td>
<td>(0.9749)</td>
<td>(1.6687)</td>
<td></td>
</tr>
</tbody>
</table>

R-squared  | 0.9007   | 0.5292   | 0.8775   | 0.7730   | 0.5729    |
F-statistic| 26.0882* | 3.2312*  | 20.6030* | 9.7900*  | 3.8562*   |

Note: Value in parentheses indicates t-statistics. * indicates significance at the 5% level. + indicates significance at the 10% level.
Table 6 - 10 Temporal causality from VECMs (or VAR) (continued)

| Explanatory Markets (t-1) | (b) Pre-crisis period | | | | | (c) Post-crisis period | | | | |
|---------------------------|-----------------------|------------------|------------------|------------------|------------------|------------------|------------------|------------------|------------------|
| Malaysia                  | 0.2095                | -0.3689*         | -0.1694          | -0.0928          | 0.7256           | 12.1107*         | 54.1642*         | 8.6383*          | 8.2991*          |
|                           | (1.0918)              | (-1.7527)        | (-0.9196)        | (-0.6525)        | (1.1533)         |                  |                  |                  |                  |
| Singapore                 | -0.0116               | 0.6064*          | 0.1919           | 0.1149           | 0.0351           | 25.1875*         | 33.8601          | 15.9657*         | 9.6051*          |
|                           | (-0.0631)             | (3.0129)         | (1.0898)         | (0.8446)         | (0.0583)         |                  |                  |                  |                  |
| Thailand                  | 0.2185*               | 0.3199*          | 0.9609*          | 0.0443           | -0.1317          | 24.8877*         | 18.2106*         | 14.6135*         | 18.3553*         |
|                           | (1.92300)             | (2.5662)         | (8.8081)         | (0.5258)         | (-0.3535)        |                  |                  |                  |                  |
| Indonesia                 | 0.4527*               | 0.4367*          | -0.1160          | 0.8896*          | -0.2854          | 4.2339           | 13.4750*         | 23.7102*         | 14.3132*         |
|                           | (3.0249)              | (2.6599)         | (-0.8076)        | (8.0171)         | (-0.5816)        |                  |                  |                  |                  |
| Philippines               | 0.2660*               | 0.1407*          | 0.1041           | 0.0895           | 0.2329           | 4.5062           | 6.5349*          | 5.8351           | 8.7975*          |
|                           | (3.5250)              | (1.6995)         | (1.4375)         | (1.6000)         | (0.9411)         |                  |                  |                  |                  |
| Seasonal dummy            |                       |                  |                  |                  |                  |                  |                  |                  |                  |
| S1                        | -0.0868*              | -0.0070          | -0.0132          | 0.0088           | -0.0641          | -0.0412*         | 0.0794*          | 0.0871*          | 0.0665           |
|                           | (-6.8765)             | (-0.5055)        | (-1.0863)        | (0.9409)         | (-1.5501)        | [-3.5178]        | [2.2897]         | [2.1450]         | [0.5032]         |
| S2                        | -0.0204               | -0.0318          | -0.0196          | 0.0084           | 0.0025           | 0.0098           | 0.1517*          | 0.1327*          | 0.1330           |
|                           | (-1.0591)             | (-1.5047)        | (-1.0629)        | (0.5858)         | (0.0393)         | [0.5233]         | [2.7381]         | [2.0470]         | [0.6299]         |
| S3                        | 0.0330*               | -0.0110          | -0.0048          | 0.0372*          | -0.0300          | -0.0072          | -0.0307          | -0.1508*         | -0.1257          |
|                           | (2.1524)              | (-0.6575)        | (-0.3275)        | (3.2772)         | (-0.5977)        | [-0.6565]        | [-0.9471]        | [-3.9825]        | [-1.0190]        |
| R-squared                 | 0.9942                | 0.9952           | 0.9935           | 0.9973           | 0.7677           | 0.9937           | 0.9467           | 0.9660           | 0.9482           |
| F-statistic               | 427.6926*             | 517.5017*        | 380.7221*        | 914.1442*        | 8.2597*          | 52.4207*         | 5.9260*          | 9.4590*          | 6.0976*          |

Note: Value in parentheses indicates t-statistics. * indicates significance at the 5% level. ** indicates significance at the 10% level.
6.2.5 Implication of the results

Several points emerge from the cointegration tests and VECM estimation. There is little substantial difference in the results between the real and nominal GDP-based analyses. Thus the following discussion is relevant for both real and nominal GDP. The results suggest that there is not enough evidence to support cointegration relationships among the GDP growth of the ASEAN5 in the pre-crisis period but partial cointegration relationships exist in the full period and post-crisis period. Further, most of the short-term causality is unidirectional. This suggests that there is no one country within the ASEAN5 that led the GDP growth rates of other members from 1990 up to the 1997 crisis. The lack of cointegration may be attributed to the unique country factors that determine the GDP growth for each of the members.49

The results also produce some evidence of stronger economic ties among the ASEAN5 after the crisis period, with three cointegrating relations and increased bi-directional causality among country GDP growth rates. Likewise, adjustment towards equilibrium is evident across the ASEAN5 in a longer-term sense. There is little evidence of a leadership role played by any one of the ASEAN5 countries.

6.3 Conclusion

This study finds that the GDP growth of the ASEAN5 is cointegrated over the full period as well as the post-crisis period. However, there is no cointegrating relationship documented in the pre-crisis period. Similar results are obtained using both real and nominal GDP for each of the ASEAN5. This supports the argument that economic links among the ASEAN5 increased in the post-crisis period.

The existence of three cointegrating relationships in the post-crisis period is consistent with partial convergence of the series and this suggests that ASEAN has been effective in its endeavours to reduce the misalignment of growth in wealth among its members. Yet the GDP of ASEAN5 countries is still quite disparate. For example, in 2005 the GDP of ASEAN5 nations ranged from US$98.4 billion for the Philippines to US$287 billion for Indonesia. In terms of annual GDP growth, this ranges from 4.5 percent for

49 As noted by Cuadrado-Raura (2001), the analysis of common patterns does not allow clear generalisation.
Thailand to 6.6 percent for Singapore.⁵⁰ The finding of stronger GDP growth linkages in recent years among the ASEAN5 suggests that ASEAN is making progress towards realising the creation of its own economic community.

Chapter 7

ASEAN5 TRADE

7.1 Introduction

International trade is an important factor for a country’s development and growth, enhanced by the globalisation that forces nations to compete. Trade, indeed, is a means of reaping the gains from specialisation and exchange where such specialisation is driven by sound government institutions that encourage the development of entrepreneurial activities (Elliot, 2007). The relationship between trade and growth is exemplified by endogenous growth models that postulate benefits of trade from at least two resources. First, international trade may act as a diffusion of foreign technologies. Second, international trade may produce incentives for local research and development (Kali et al., 2007).

Traditionally, trade theory looks to explain the pattern of trade which revolves around technology, endowments and taste to determine the pattern of trade between nations. However, in the wake of service trade in information technology (IT), Marjit (2007) proposes time zone as another factor that could further explain international trade patterns. There are three major classic trade theories underlying the domain of trade studies: the Richardian theory of comparative advantage (see Golub and Hsieh, 2000), the Heckscher-Ohlin-Samuelson (HOS) model of relative factor abundance (Martin, 1976) and Krugman’s model of increasing returns to scale (IRS) (Krugman, 1980). In light of these theories, various models of trade emerge in the literature to capture the dynamics of domestic, regional and global trade.

ASEAN faces a tough challenge to maintain its competitive position in international trade. This is due to the recent emergence of China as an economic power and to the shock and upheaval caused by the 1997 crisis. As such, a renewed enthusiasm emerges among ASEAN nations to pursue and strengthen the goal of regional cooperation (Elliot and Ikemoto, 2004). Indeed, trade flow is one of the important forces in economic integration. Ultimately, the ASEAN region is moving towards realising its Vision 2020 to create ‘a stable, prosperous and highly competitive ASEAN economic region in which there is a free flow of goods, services and investment, and freer flow of capital’ (Dennis and Yusof, 2003 pp.29). As a regional cooperation, greater economic integration among members is important for ASEAN in order to increase its negotiation and bargaining power.
in the global arena (Low, 2003) as well as to compete with other regional blocs (Elliot and Ikemoto, 2004).

The contribution of this study to the existing literature is as follows. First, four different measures of trade are presented in the early part of the study to highlight the pattern of trade at national and ASEAN5 levels. The aim is to gauge the characteristics of trade among the ASEAN5 economies and also between ASEAN5 and the rest of the world. Second, the estimation of error correction models for different trade variables is provided. Estimation is carried out for the period 1990 to 2006, complete with two sub-periods that include the pre- and post-1997 crisis periods. The results offer some insight into the trade balance, trade patterns and linkages that exist among the ASEAN5 nations. The formation of ASEAN Free Trade Area (AFTA) is relevant to this study but, given that it was made operational in January 1993, no specific adjustment is made in the analysis that follows.51

The patterns of trade in ASEAN5 show that intra-ASEAN trade has not been not badly affected by the 1997 crisis. In particular, the effect of the crisis has had greater impact on intra-ASEAN imports than that on exports. Members with strong economic fundamentals such as Singapore and Malaysia maintain intra-ASEAN trade levels despite the crisis. While ASEAN5 global imports tended to drop on average with the crisis, exports remained little altered. The findings from cointegration tests suggest different relationships for different trade measures. Trade balance for each of the ASEAN5 countries differs across countries and periods. For total trade growth, evidence of partial convergence is found for the full, pre- and post-crisis periods. Import growth results, however, suggest that no significant long-run link exists between the ASEAN5. Export growth results indicate partial convergence for the full period and pre-crisis period but there is no cointegration relationship evident in the post-crisis period. Thus, it appears that each trade measure has its own unique characteristics and differing long-run relationships. In the short run though, it is found that most of the causality is unidirectional, with domestic factors playing the main role in determining trade growth for each of the ASEAN5 members.

The literature survey, methodology and data used for this chapter are provided in Chapters 2, 3 and 4 of this thesis. The remainder of this chapter is organised as follows. Section 7.2 presents brief characteristics of ASEAN5 trade while Section 7.3 presents the empirical results and discussion from analyses. Finally, Section 7.4 summarises the findings of the study.

51 The effects of AFTA are specifically studied by Tang (2005) and Sharma & Chua (2000).
7.2 ASEAN5 trade characteristics

It is important to recognise some characteristics of ASEAN trade before testing for cointegration. Four import and export measures are used in this section to describe ASEAN5 trade characteristics at the country level, the ASEAN5 level and for ASEAN5 relative to the rest of the world. The first measure deals with intra-ASEAN5 trade levels expressed as the log of real US dollar trade. The second measure indicates the proportion of intra-ASEAN trade for each member in comparison with their respective global trade. The third measure shows the proportion of intra-ASEAN5 trade for each member relative to total intra-ASEAN5 trade. The final measure represents the proportion of ASEAN5 trade relative to global trade. Each measure provides some insight into various aspects of the trade patterns prevailing among the ASEAN5 economies over the study period.

7.2.1 Intra-ASEAN5 trade

The levels of intra-ASEAN5 trade for each of the ASEAN5 members over the study period are captured by this measure (Figure 7-1). The import and export measures are represented by:

\[
\text{Import: } \log (M_{ii}) = \text{Total country } i \text{ imports from the other four members of ASEAN5 in natural log of real US dollar term.}
\]

\[
\text{Export: } \log (X_{ii}) = \text{Total country } i \text{ exports to the other four members of ASEAN5 in natural log of real US dollar term.}
\]

where \( i \) indicates the first measure and \( i \) is one of the ASEAN5 countries, Malaysia, Singapore, Thailand, Indonesia and the Philippines.

Figure 7-1 shows that Malaysia and Indonesia export more than they import from other members of ASEAN5. Singapore generally maintains trade balance with the other ASEAN5 nations. This is probably due to Singapore’s role as the main intermediary among the ASEAN5 rather than as a consumer of imports. For example, Abeysinghe (1998) states that Singapore’s imports are driven primarily by exports, thus generating strong correlation and cointegration between the two series. This is also evident from the correlation table (Table 7-1) below. Thailand has tended to import more from the other

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52 In this study the term ‘intra’ refers to the countries within ASEAN5.
ASEAN5 members while the Philippines has the lowest value of intra-ASEAN trade, although there is a change in the Philippines trade pattern evident at the end of the 1990s.

The correlations between intra-ASEAN5 real imports and exports are presented in Table 7-1. The values indicate that intra-ASEAN5 trade for Malaysia and Singapore is highly correlated and stable across the different periods. More variations are found for the remaining three countries, suggesting that the 1997 crisis has had a severe impact on real trade for Thailand, Indonesia and the Philippines.

Table 7 - 1 Correlation between intra-ASEAN5 real imports and exports

<table>
<thead>
<tr>
<th></th>
<th>Malaysia</th>
<th>Singapore</th>
<th>Thailand</th>
<th>Indonesia</th>
<th>Philippines</th>
</tr>
</thead>
<tbody>
<tr>
<td>Full period</td>
<td>96.77%</td>
<td>95.13%</td>
<td>64.10%</td>
<td>82.27%</td>
<td>93.48%</td>
</tr>
<tr>
<td>Pre-crisis period</td>
<td>95.69%</td>
<td>93.56%</td>
<td>88.48%</td>
<td>65.71%</td>
<td>90.03%</td>
</tr>
<tr>
<td>Post-crisis period</td>
<td>95.04%</td>
<td>95.73%</td>
<td>92.34%</td>
<td>93.15%</td>
<td>51.54%</td>
</tr>
</tbody>
</table>

In general, intra-ASEAN5 trade correlation and real trade imports and exports are stable for Malaysia and Singapore over the study period. Nevertheless, some variations prevail for Thailand and Indonesia as depicted in Figure 7-1 and Table 7-1. The impact of the 1997 crisis on intra-ASEAN5 trade varies across ASEAN5 members, probably explained by economic fundamentals and high intra-ASEAN5 trade levels prior to the crisis for Singapore and Malaysia, compared to Thailand, Indonesia and, in particular, the Philippines.
Note: The legend for the graphs indicates that imports represent log ($M_{it}$) and exports represent log ($X_{it}$).

Figure 7 - 1 Intra-ASEAN5 trade in log real US dollars
7.2.2 Intra-ASEAN5 trade relative to each ASEAN5 member’s global trade

Figure 7-2 shows the proportion (in percentages) of intra-ASEAN trade for each ASEAN5 country relative to that country’s total trade. The proportion of intra-ASEAN5 trade (imports and exports) is represented by:

Proportion of imports:

\[ M_{2i} = \frac{\text{country } i \text{ imports from the other four members of ASEAN5}}{\text{Total global imports for country } i} \times 100 \]

Proportion of exports:

\[ X_{2i} = \frac{\text{country } i \text{ exports to the other four members of ASEAN5}}{\text{Total global exports for country } i} \times 100 \]

where 2 indicates the second trade measure used in this section and \( i \) is one of the ASEAN5 countries, Malaysia, Singapore, Thailand, Indonesia and the Philippines.

Figure 7-2 shows that the level of intra-ASEAN5 trade varies for each of the ASEAN5 countries. However, the prevailing patterns suggest that the ASEAN5 trade more with countries outside the group. This supports Tang (2005) who argues that developing countries depend more on developed countries for their exports. They also import more from developed countries and this allows them to adopt high technology through imports. Even though Singapore is a developed country, it also exhibits similar patterns to those of the developing ASEAN5 countries in this context. For example, all of the ASEAN5 countries have Japan and the US among their main trading partners, consistent with Kali et al. (2007) who document high trade concentration for developing economies with major economic powers.

It is interesting to note that there are a distinct import and export patterns for Thailand in Figure 7-2. In particular, the levels of these two series differ substantially for Thailand.

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53 It is interesting to note that there is a spike in the graph for Indonesia (Figure 7-2) in January and February 1995 and towards the end of the study period. Indonesian imports from the ASEAN4 increased significantly in January and February 1995 despite decreases in its total imports. Thus the share of intra-ASEAN5 imports increased dramatically. However, it is hard to explain the reason for a spike at the end of the study period but it appears that since early 2005, capital/investment related imports had increased substantially on a year-on-year (YoY) basis (http://jakarta.usembassy.gov/econ/trade-invest_nov05.html). Even so, Figure 7-1 shows no indication of huge changes in Indonesia’s real intra-ASEAN5 imports and the increment seems to be gradual at the end of the study period.
compared with the other countries except for Malaysia (pre-crisis period). The proportion of Thailand’s intra-ASEAN5 imports is always more than 30 percent of its total global imports while its export amount is only about 16 percent of its total global exports. In 2002 through to 2006, Malaysia is the fourth-biggest import partner for Thailand, joined by Singapore in fifth place in 2003 and 2004.\(^{54}\)

| Table 7 - 2 Share of each member’s intra-ASEAN5 trade relative to their total trade |
|-------------------------------------|------------------|-----------------|-----------------|-----------------|------------------|
| **Panel A: Imports**                | Malaysia         | Singapore       | Thailand        | Indonesia       | Philippines      |
| Full period                         | 21.18%           | 15.57%          | 35.53%          | 15.93%          | 13.53%           |
| Pre-crisis period                   | 19.04%           | 14.93%          | 39.81%          | 10.01%          | 10.58%           |
| Post-crisis period                  | 23.03%           | 15.54%          | 32.42%          | 22.27%          | 16.16%           |

| **Panel B: Exports**                | Malaysia         | Singapore       | Thailand        | Indonesia       | Philippines      |
| Full period                         | 25.85%           | 15.65%          | 16.61%          | 15.06%          | 12.50%           |
| Pre-crisis period                   | 27.75%           | 16.70%          | 16.68%          | 12.82%          | 9.28%            |
| Post-crisis period                  | 24.15%           | 14.67%          | 16.70%          | 16.89%          | 15.81%           |

Table 7-2 shows each of the ASEAN5 member’s share of intra-ASEAN5 imports (Panel A) and exports (Panel B) relative to their respective total trade. The results show that Thailand has the highest share of intra-ASEAN5 imports while Malaysia has the highest share of exports relative to its total exports.

\(^{54}\) International Trade Statistics website is available at http://www.intracen.org
Note: The legend for the graphs indicates that ‘imports’ represents log \(M_{2i}\) and ‘exports’ represent log \(X_{2i}\).

**Figure 7.2** Share of intra-ASEAN5 trade for each member relative to that member's global trade
7.2.3 Percentage of each member’s intra-ASEAN5 trade relative to total intra-ASEAN5 trade

The proportion of each member’s intra-ASEAN5 relative to total intra-ASEAN5 trade is of interest here. It is important to observe whether there are significant movements in the share of intra-ASEAN5 trade for each member, because trade is a means to achieve the economic integration desired by ASEAN as a whole. This aspect is captured by the following:

**Proportion of intra-ASEAN5 imports:**

\[ M_{3i} = \frac{\text{Total country } i \text{ imports from the other four members of ASEAN5}}{\text{Total ASEAN5 imports}} \times 100 \]

**Proportion of intra-ASEAN5 exports:**

\[ X_{3i} = \frac{\text{Total country } i \text{ exports to the other four members of ASEAN5}}{\text{Total ASEAN5 exports}} \times 100 \]

where 3 indicates the third trade measure used in this section and \( i \) is one of the ASEAN5 countries, Malaysia, Singapore, Thailand, Indonesia and the Philippines. Table 7-3 shows each of the ASEAN5 member’s trade proportion from total ASEAN5 trade for different periods while Figure 7-3 shows the trend of these proportions for each of the ASEAN5 members. These table and figure show that Singapore has the biggest intra-ASEAN5 import and export share (more than 35%), while the Philippines has the smallest intra-ASEAN5 trade proportions (approximately 5% to 10%). Singapore also imports more than it exports for some years after the 1997 crisis before this pattern merges towards equality a few years before the end of the study period. This is probably due to imports from other members becoming cheaper because of devaluation of their currencies relative to Singapore, following the 1997 crisis.

### Table 7 - 3 Each member’s average trade share of total intra-ASEAN5 trade

<table>
<thead>
<tr>
<th></th>
<th>Malaysia</th>
<th>Singapore</th>
<th>Thailand</th>
<th>Indonesia</th>
<th>Philippines</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Panel A: Imports</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Full period</td>
<td>22.14%</td>
<td>37.82%</td>
<td>19.59%</td>
<td>11.27%</td>
<td>9.18%</td>
</tr>
<tr>
<td>Pre-crisis period</td>
<td>21.26%</td>
<td>37.77%</td>
<td>20.04%</td>
<td>12.97%</td>
<td>7.96%</td>
</tr>
<tr>
<td>Post-crisis period</td>
<td>23.05%</td>
<td>37.60%</td>
<td>19.77%</td>
<td>9.58%</td>
<td>10.01%</td>
</tr>
<tr>
<td><strong>Panel B: Exports</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Full period</td>
<td>23.45%</td>
<td>36.33%</td>
<td>17.12%</td>
<td>15.79%</td>
<td>7.30%</td>
</tr>
<tr>
<td>Pre-crisis period</td>
<td>23.02%</td>
<td>37.68%</td>
<td>16.39%</td>
<td>17.10%</td>
<td>5.81%</td>
</tr>
<tr>
<td>Post-crisis period</td>
<td>24.03%</td>
<td>35.14%</td>
<td>17.84%</td>
<td>14.45%</td>
<td>8.54%</td>
</tr>
</tbody>
</table>
Note: The legend indicates that ‘imports’ represent $\log(M_{i,t})$ and ‘exports’ represent $\log(X_{i,t})$.

Figure 7 - 3 Share of each member’s intra-ASEAN5 trade relative to ASEAN5 total trade
Further, the proportion of Malaysian and Thailand intra-ASEAN5 imports and exports appears relatively stable over the periods while Indonesian intra-ASEAN5 imports show greatest decreases (about 3%) after the crisis, probably because of the weakness of the Indonesian rupiah due to the crisis. The weakness of the rupiah, however, did not help to increase Indonesia’s intra-ASEAN5 exports in the post-crisis period, as its share of exports drops from 17.10% to 14.45% after the crisis. In summary, Singapore followed by Malaysia exhibit the greatest share of intra-ASEAN5 trade, consistent with their economic strength compared to that of Thailand, Indonesia and the Philippines.

7.2.4 Percentage of ASEAN5 trade relative to world trade

It is important to review the position of ASEAN5 trade relative to global trade. This is a crucial issue as ASEAN5 economies depend heavily on international export markets. While a country’s exports as a percentage of GDP are often used as an indicator of that economy’s international competitiveness (Dennis and Yusof, 2003), country trade relative to global trade also provides some insight. This measure is defined as:

**Proportion of ASEAN5 imports from world imports:**

\[ M_4 = \frac{\text{Total of ASEAN5 imports}}{\text{Total world imports}} \times 100 \]

**Proportion of ASEAN5 imports from world exports:**

\[ X_4 = \frac{\text{Total of ASEAN5 exports}}{\text{Total world exports}} \times 100 \]

where 4 indicates the fourth trade measure used in this section. The graph and scatter plot for the fourth measure is presented in Figure 7-4 and Figure 7-5. There appears to be a structural break in ASEAN global trade around the 1997 crisis. The proportion of ASEAN5 imports and exports increases from 1990, although import share is slightly higher than export share. However, with the 1997 crisis the ASEAN5 import share dropped substantially. This suggests that most of the economies in the ASEAN5 were severely affected by the crisis such that their imports deteriorated.
The following table (Table 7-4) emphasises this effect. ASEAN5 pre-crisis global import share drops from 5.88% to 5.00% post-crisis, while the corresponding export share increases from 5.47% to 5.96%.

<table>
<thead>
<tr>
<th></th>
<th>Import</th>
<th>Export</th>
</tr>
</thead>
<tbody>
<tr>
<td>Full period</td>
<td>5.40%</td>
<td>5.73%</td>
</tr>
<tr>
<td>Pre-crisis period</td>
<td>5.88%</td>
<td>5.47%</td>
</tr>
<tr>
<td>Post-crisis period</td>
<td>5.00%</td>
<td>5.96%</td>
</tr>
</tbody>
</table>

The devaluation of ASEAN5 currencies has contributed to an increased cost of imports as well as an increase in the competitiveness of exports to the rest of the world (Elliot and Ikemoto, 2004). Yet the export proportion of global trade does not reflect the hypothesised export pricing effect as might be expected (Figure 7-4), particularly given that the import/export differential has remained since the 1997 crisis.
Summary

Figures 1 to 6 provide some insight into the characteristics of ASEAN5 trade. The level of intra-ASEAN trade differs across ASEAN5 countries but a gradual increase in trade flows is observed for most members, perhaps facilitated by trade liberalisation processes such as the creation of AFTA in 1993.\footnote{See Tang (2005) for study on the impact of AFTA for ASEAN.} Furthermore, the 1997 crisis appears to have slowed down imports to the ASEAN5 countries. However, exports global share is little changed over the study period. The next section deals with an empirical investigation of the cointegrating relationship that exists among ASEAN5 member trade.

7.3 Results and discussion

Given the variation in ASEAN5 trade evident in the previous section, it is important now to analyse the links that exist for different trade measures among the ASEAN5 group. This section examines ASEAN5 trade including ASEAN5 country imports, exports and ASEAN5 country total trade (imports plus exports). These international trade measures are important in this study because they contribute to the understanding of the ASEAN5 trade relationships in both the long term and the short term. Statistical characteristics for the relevant trade growth measures are discussed first, before testing long-run relationships and their respective error correction relationships.

7.3.1 Statistical characteristics of the series

Descriptive Statistics

Table 7-5 provides summary statistics for total trade growth (Panel A), total import growth (Panel B) and total export growth (Panel C). There is some variation in the results for each measure, particularly regarding the pre- and post-crisis periods.

Average total trade growth (Table 7-5, Panel A) decreases for Malaysia, Indonesia and the Philippines but there is an increase observed for Singapore and Thailand from the pre-crisis to the post-crisis period. The standard deviation values for all countries except Singapore are higher pre-crisis but tend to level off after the crisis, which is probably due to decreased trade activity. Notably, the Indonesian standard deviation of total trade growth dropped from 13.99\% to 7.73\% after the crisis. Further results are found in the import and export growth results reported in Table 7-5, Panels B and C.
Table 7-5 Descriptive statistics

Panel A. ASEAN5 total trade growth

<table>
<thead>
<tr>
<th></th>
<th>Full period</th>
<th>Pre-crisis period</th>
<th>Post-crisis period</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Mean</td>
<td>Median</td>
<td>Max</td>
</tr>
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Note: Max, Min, Std Dev, and Obs represent maximum, minimum, standard deviation, and the number of observations respectively.

Table 7-5 (Panel B) shows the descriptive statistics for import growth. Taken together for the full period, pre-crisis and post-crisis periods, the results suggest that some contraction of import growth follows the crisis except for Thailand. Thailand is an important exception because the full period and pre-crisis import growth are similar at 0.14% and 0.15% while post-crisis growth increases to 0.19%. Overall, these growth values indicate that import growth for Thailand is not adversely affected by the 1997 crisis and this growth has increased, while other economies in ASEAN5 show a decrease in their import growth.

The largest fall in import growth is recorded for the Philippines (0.24% pre-crisis to 0.12% post-crisis). Even though a slight decrease occurs for Indonesian import growth post-crisis (taking the full period value of 0.17% into account), it supports the argument that the crisis led to deterioration in Indonesian import growth.
Table 7-5 Descriptive statistics (continued)

Panel B. Descriptive Statistics for ASEAN5 import growth

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Panel C. Descriptive statistics for ASEAN5 export growth

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Note: Max, Min, Std Dev, andObs represent maximum, minimum, standard deviation, and the number of observations respectively.
Export growth for ASEAN5 economies other than Singapore decreases in general after the crisis (Table 7-5, Panel C). In the case of Malaysia, the pegged exchange rate may have made its exports more expensive relative to imports. Yet the Philippines export growth exhibits the greatest drop among the ASEAN5, from pre-crisis (0.32%) to post-crisis (0.19%). Both import growth and export growth decreases support the decrease in total trade growth reported for the Philippines (Table 7-5, Panel A). For the Philippines, electrical and electronic equipment is the main export sector and in 2002 the share of this sector to world exports decreased from 2.00% to 1.36% in 2006. Increased competition from China may have also been a factor.

**Correlation**

Pair-wise Pearson correlations in Table 7-6 focus on total trade growth (Panel A), import growth (Panel B), export growth (Panel C), and each ASEAN5 member’s import and export correlation (Panel D) for the full period, pre-crisis and post-crisis periods.

In Table 7-6 (Panel A), the correlation between total trade growth of the ASEAN5 countries is quite high except for the correlation between Indonesia and the Philippines (34.88 percent). In general, the results show that the correlation in total trade for the ASEAN5 increases from the pre-crisis to the post-crisis period. Correlation matrices for import growth and export growth (Table 7-6, Panels B and C respectively) provide further comparison of the behaviour of ASEAN5 import and export growth.

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56 Malaysia unpegged the ringgit from US dollar and replaced it with a managed float against a basket of currencies on 21 July 2005.

Table 7 - 6 Correlation matrices

Panel A. Correlation of ASEAN5 total trade growth

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Panel B. Correlation of ASEAN5 import growth

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Panel C. Correlation of ASEAN5 export growth

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Panel D. Correlation between import growth and export growth for each of the ASEAN5 members

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The correlation for import growth (Table 7-6, Panel B) in the pre-crisis and post-crisis periods points to an interesting observation – the correlation between Indonesia and the other ASEAN5 members decreases after the crisis. The pre-crisis period correlation level for Indonesia, relative to the other ASEAN5 countries, ranges from 21.67 to 43.81 but drops to 10.10 to 17.32 post-crisis. Export growth correlation coefficients (Table 7-6, Panel C) increase for all countries from the pre-crisis to the post-crisis period. Further, most of the correlation coefficients are large in value in the post-crisis period, with the highest correlation recorded between Malaysian and Singaporean export growth (84.00) and the lowest between Singapore and the Philippines (60.69).

To some extent, this finding suggests a prolonged contraction in Indonesian imports after the 1997 crisis and it appears to take a long time to return to its pre-crisis level, when compared to other ASEAN5 members. Nonetheless, global exports for the ASEAN5 seem to flourish following the crisis. This is also consistent with Figure 7-4 which shows that the ASEAN5 global export share increases after the crisis.

The correlation coefficients between import and export growth for each of the ASEAN5 countries are given in Table 7-6, Panel D. The full period results show that import and export growth for Malaysia, Singapore and Thailand is highly correlated (above 50 percent), while for Indonesia and the Philippines imports are weakly correlated with exports. Similar patterns are observed during the pre-crisis period. Yet, stronger import and export growth correlation is observed in the post-crisis for all ASEAN5 countries, except for Thailand whose correlation decreases slightly from its pre-crisis level. It is noted that the correlation coefficients for the Philippines increase markedly from 15.07 to 52.30.

**Autocorrelation**

Table 7-7 reports sample autocorrelations for the log of total trade series (at levels) and their first differences (Panel A), log of imports series and their first differences (Panel B), and log of exports series and their first differences (Panel C). Overall, the results show that the autocorrelations for each series die off slowly, suggesting that the series are possibly non-stationary. Autocorrelations for first differences dies off quite rapidly. These results suggest that the log trade values may follow an \( I(1) \) processes, with the growth (i.e. first differences) series being stationary.
### Table 7 - 7 Autocorrelations

#### Panel A. Autocorrelations of ASEAN5 total trade series

<table>
<thead>
<tr>
<th>Level</th>
<th>AR1</th>
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<th>AR3</th>
<th>AR4</th>
<th>AR5</th>
<th>AR6</th>
<th>Prob</th>
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<tbody>
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<td>0.9410</td>
<td>0.9230</td>
<td>0.8990</td>
<td>0.8770</td>
<td>0.8520</td>
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Pre-crisis period

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<th>AR4</th>
<th>AR5</th>
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Post-crisis period

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<th>AR4</th>
<th>AR5</th>
<th>AR6</th>
<th>Prob</th>
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Note: AR indicates autoregression at different lag of the series. Prob denotes the probability of the series. Level and 1st diff represent the autocorrelation of the series at level and first differences respectively.

#### Panel B. Autocorrelation of ASEAN5 imports

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<th>AR5</th>
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### Table 7-7 Autocorrelation (continued)

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<th>AR3</th>
<th>AR4</th>
<th>AR5</th>
<th>AR6</th>
<th>Prob</th>
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Note: AR indicates autoregression at different lag of the series. Prob denotes the probability of the series. Level and 1st diff represent the autocorrelation of the series at level and first differences respectively.

### Panel C. Autocorrelation of ASEAN5 exports

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<th>AR5</th>
<th>AR6</th>
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Table 7-7 Autocorrelation (continued)

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Note: AR indicates autoregression at different lag of the series. Prob denotes the probability of the series. Level and 1<sup>st</sup> diff represent the autocorrelation of the series at level and first differences respectively.

7.3.2 Unit root tests

Augmented Dickey-Fuller tests (ADF), Phillip-Perron tests (PP) and KPSS tests are conducted and results are presented in Table 7-8. The results for total trade are presented in Panel A, imports in Panel B and exports in Panel C.

There is some variation in the results for all periods and it appears that the series are cointegrated at different orders. Some series are stationary at levels while others are stationary at first differences. Failure to adjust for seasonal effects and crash effects (only the full period sample needs both adjustments) could explain these results. Hence, another set of ADF unit root tests are estimated with seasonal adjustment and crash period adjustment. The results are presented in Table 7-9 Panel A (total trade), Panel B (imports) and Panel C (exports). It appears that the unit root tests for all periods now support the null hypothesis of a unit root in total trade, imports and exports at levels, and reject this hypothesis for the first differences. It is noted, however, that the Singaporean total trade series for the post-crisis period is not statistically significant. Given the relatively small sample size, some variation in these results is expected and so the order of integration for all series is assumed to be one after correction for seasonal effects.

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58 It is widely accepted in the literature that macroeconomic series contain seasonal effects.
59 Lim & McAleer (2004) follow this approach in their study.
Table 7 - 8 Unit root tests

Panel A. Unit root tests for ASEAN5 total trade

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Note: No seasonal and crash period adjustment is made to the series.
Table 7-8 Unit root tests (continued)

Panel B. Unit root tests for ASEAN5 total imports

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Note: No seasonal and crash period adjustment is made in unit root tests.
### Table 7-8 Unit root tests (continued)

Panel C. Unit root tests for ASEAN5 exports

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Note: No seasonal and crash period adjustment is made to the series in unit root tests.
Table 7 - 9 Unit root test: ADF with seasonal and crisis period adjustment

<table>
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<tr>
<th></th>
<th>Panel A. Total trade</th>
<th></th>
<th>Panel B. Imports</th>
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<th>Panel C. Exports</th>
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<td>-1.8946</td>
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<tr>
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Note: * denotes 5% significance level (critical value = -3.41); + denotes 10% significance level (critical value = -3.13).
7.3.3 Cointegration test

Johansen cointegration tests are performed on the series with adjustment for both seasonal and crash period effects for the full period, while pre-crisis and post-crisis periods need only seasonal adjustment. The results from cointegration tests are presented in Table 7-10 to Table 7-13. Table 7-10 represents the cointegration test for each ASEAN5 country’s imports and exports. The purpose of these tests is to examine the existence of long-term linkages between total imports and total exports for each of the ASEAN5 members for the full period, pre-crisis period and post-crisis period. Table 10 provides the cointegration results for ASEAN5 total trade, Table 7-11 is for ASEAN5 imports and Table 7-12 is for ASEAN5 exports. Both trace statistics and maximum eigenvalues are presented in the results but the trace statistics are relied upon in testing for the number of cointegrating vectors in this study.

The results of the cointegration test for each ASEAN5 country’s imports and exports are given in Table 7-10. Knowledge of whether imports and exports are cointegrated is important in discussion of trade balance (Arize, 2002). The results indicate that trade flows are cointegrated for Indonesia in the full period, for Malaysia and the Philippines in the pre-crisis period, and for Thailand in the post-crisis period. It is worth noting that Singaporean trade flows are not significantly cointegrated in any of the periods.

The existence of a cointegrating relationship between imports and exports for the respective ASEAN5 countries implies that trade imbalances are short-run phenomena and are sustainable in the long run, and that macroeconomic policies have been effective in bringing imports and exports into equilibrium (Irandoust and Ericsson, 2004). However, the failure of imports and exports to exhibit a long-run relationship for some ASEAN5 countries perhaps suggests that the economic policies implemented in those periods are in violation of intertemporal international budget constraints (Baharumshah et al., 2003), ignoring capital flows. Further, import and export divergence could be due to technological shocks or the existence of productivity gaps (Irandoust and Ericsson, 2004).
Table 7 - Cointegration test between imports and exports for each ASEAN5 member

<table>
<thead>
<tr>
<th></th>
<th>$H_0$</th>
<th>$H_A$</th>
<th>Eigenvalues</th>
<th>$\lambda_{\text{max}}$</th>
<th>$\lambda_{\text{trace}}$</th>
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Note: The test assumes linear trends in the series but the cointegrating equations have only intercepts. The critical values are taken from MacKinnon-Haug-Michelines (1999), $r$ representing the number of cointegrating vectors. $H_0$ and $H_A$ refer to null and alternative hypothesis respectively. $^*$ denotes rejection of the hypothesis at the 5% level.

Results for ASEAN5 total trade (Table 7-11) indicate that two cointegrating vectors exist in both the full period and post-crisis period, while there is only one cointegrating vector for the pre-crisis period. The results suggest that for total trade, ASEAN5 shows some signs of convergence, with tighter links existing after the crisis. The results for ASEAN5 imports (Table 7-12) are substantially different from the results for total trade. For this measure, there is no statistically significant cointegrating relationship in either the full period or the sub-periods. This finding suggests that import growth for the ASEAN5 nations shows little evidence of convergence in the long run and this movement is not affected by the 1997 crisis.
Table 7 - 11 Johansen cointegration test for ASEAN5 total trade

<table>
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<th>$\lambda_{trace}$</th>
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</tr>
<tr>
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</tr>
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<td>96.6586*</td>
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</tr>
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<td>$r = 4$</td>
<td>0.0003</td>
<td>0.0544</td>
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</tr>
</tbody>
</table>

Note: The test assumes linear trends in the series but the cointegrating equations have only intercepts. The critical values are taken from MacKinnon-Haug-Michelis (1999). $k$ indicates the number of lag used in estimation; $r$ representing the number of cointegrating vectors. $H_0$ and $H_A$ refer to the null and alternative hypothesis respectively. * denotes rejection of the hypothesis at the 5% level.

Table 7 - 12 Johansen cointegration test for ASEAN5 imports

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<th>$H_0$</th>
<th>$H_A$</th>
<th>Eigenvalues</th>
<th>$\lambda_{max}$</th>
<th>$\lambda_{trace}$</th>
</tr>
</thead>
<tbody>
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<td></td>
<td></td>
<td></td>
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<td>8.6965</td>
<td>8.6788</td>
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</tr>
<tr>
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<td>$r = 4$</td>
<td>0.0002</td>
<td>0.0176</td>
<td>0.0176</td>
<td></td>
</tr>
<tr>
<td><strong>Post-crisis period ($k = 1$)</strong></td>
<td></td>
<td></td>
<td></td>
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<td></td>
</tr>
<tr>
<td>$r = 0$</td>
<td>$r &gt; 0$</td>
<td>0.2714</td>
<td>27.5449</td>
<td>59.5580</td>
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</tr>
<tr>
<td>$r \leq 1$</td>
<td>$r &gt; 1$</td>
<td>0.1579</td>
<td>14.9561</td>
<td>32.0130</td>
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<tr>
<td>$r \leq 2$</td>
<td>$r &gt; 2$</td>
<td>0.1210</td>
<td>11.2185</td>
<td>17.0570</td>
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<td>0.0643</td>
<td>5.7825</td>
<td>5.8384</td>
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<td>0.0006</td>
<td>0.0559</td>
<td>0.0559</td>
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</tbody>
</table>

Note: The test assumes linear trends in the series but the cointegrating equations have only intercepts. The critical values are taken from MacKinnon-Haug-Michelis (1999). $k$ indicates the number of lag used in estimation; $r$ representing the number of cointegrating vectors. $H_0$ and $H_A$ refer to the null and alternative hypothesis respectively. * denotes rejection of the hypothesis at the 5% level.
### Table 7 - 13 Johansen cointegration test for ASEAN5 exports

<table>
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<tr>
<th></th>
<th>$H_0$</th>
<th>$H_A$</th>
<th>Eigenvalues</th>
<th>$\lambda_{\text{max}}$</th>
<th>$\lambda_{\text{trace}}$</th>
</tr>
</thead>
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<td><strong>Full Period ($k = 1$)</strong></td>
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<tr>
<td>$r = 0$</td>
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<td>0.3180</td>
<td>73.8556$^*$</td>
<td>149.0048$^*$</td>
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</tr>
<tr>
<td>$r \leq 1$</td>
<td>$r &gt; 1$</td>
<td>0.2366</td>
<td>52.0926$^*$</td>
<td>75.1492$^*$</td>
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</tr>
<tr>
<td>$r \leq 2$</td>
<td>$r &gt; 2$</td>
<td>0.1024</td>
<td>20.8465</td>
<td>23.0566</td>
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<tr>
<td>$r \leq 3$</td>
<td>$r &gt; 3$</td>
<td>0.0112</td>
<td>2.1714</td>
<td>2.2101</td>
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</tr>
<tr>
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<td>$r = 4$</td>
<td>0.0002</td>
<td>0.0387</td>
<td>0.0387</td>
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</tr>
<tr>
<td><strong>Pre-crisis period ($k = 1$)</strong></td>
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<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>$r = 0$</td>
<td>$r &gt; 0$</td>
<td>0.4185</td>
<td>47.7147$^*$</td>
<td>116.2940$^*$</td>
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<tr>
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<td>$r &gt; 1$</td>
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<td>68.5793$^*$</td>
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<td>20.9254</td>
<td>30.2962$^*$</td>
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<td>9.3707</td>
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<td>$r = 4$</td>
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<td>0.1375</td>
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<td><strong>Post-crisis period ($k = 1$)</strong></td>
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</tr>
<tr>
<td>$r = 0$</td>
<td>$r &gt; 0$</td>
<td>0.2696</td>
<td>27.3371</td>
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<td>$r &gt; 1$</td>
<td>0.1976</td>
<td>19.1568</td>
<td>34.0391</td>
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<tr>
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<td>$r &gt; 2$</td>
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<td>$r &gt; 3$</td>
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<td>5.9983</td>
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<tr>
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<td>$r = 4$</td>
<td>0.0007</td>
<td>0.0591</td>
<td>0.0591</td>
<td></td>
</tr>
</tbody>
</table>

Note: The test assumes linear trends in the series but the cointegrating equations have only intercepts. The critical values are taken from MacKinnon-Haug-Michelis (1999). $k$ indicates the number of lag used in estimation; $r$ representing the number of cointegrating vectors. $H_0$ and $H_A$ refer to the null and alternative hypothesis respectively. $^*$ denotes rejection of the hypothesis at the 5% level.

Cointegration results for exports (Table 7-13) include two cointegrating vectors for the full period and three cointegrating vectors for the pre-crisis period, yet no cointegrating vector is identified for the post-crisis period. Thus, while ASEAN5 import growth is partially integrated before the crisis, there is no evidence of this in the post-crisis period. It appears that the cointegration of total trade growth is probably driven more by the cointegration in export growth than from import growth. However, the exact driving force for the total trade growth results remains a puzzle because there is no statistically significant cointegration relationship identified in the post-crisis period for export growth or import growth. It may be that the crisis period had a critical impact on the total period analysis, even with dummy variable adjustment for this period.

The findings also point to the importance of examining different measures of trade because while total trade incorporates imports plus exports, the results obtained from this measure do not conform to the results obtained for imports and exports when analysed separately. This is probably due to differences in the underlying forces behind import and export growth. For example, a more liberalised trade regime may raise import growth by more than exports simply because there is greater demand and greater access to imports (Santos-Paulino and Thirlwall, 2004). Finally, it is evident that the 1997 crisis has had a greater impact on long-run ASEAN5 export growth integration than on either total trade or import growth.
7.3.4 Vector error correction models (VECMs)

In order to examine the interaction among the ASEAN5 members for different trade measures, separate VECM results are now analysed. At national level, the error correction results between imports and exports are presented in Table 7-14 (A to E) while at ASEAN5 levels the results for different trade measures are given in Table 7-15 to Table 7-19. Discussion focuses on the error correction term where appropriate and temporal causality parameters. To assist in understanding the temporal causality results where there is more than one lag, Chi-square ($\chi^2$) test statistics are also included.

Trade at national level

Results for relationship between imports and exports for each ASEAN5 members

This section deals with the relationship between imports and exports for each ASEAN5 member. The results for Malaysia (Table 14, A) show that for the full period, movements in imports significantly explain its exports and the relationship is unidirectional. In the pre-crisis period, there is one cointegrating vector with a significant error correction coefficient for exports of 0.3339, i.e. the Malaysian exports variable eliminates 33.39 percent of the disequilibrium error in the relationship. As such, it takes about three months for the equilibrium error to be corrected.\footnote{60} However, in the pre-crisis period there is no significant short-run causality found between imports and exports as shown from temporal causality results. Further, there is also no significant short-run causality in the post-crisis period identified for Malaysian imports and exports.

\footnote{60 Speed of adjustment is the time taken for disequilibrium error to be eliminated and it is approximated as the reciprocal of error correction coefficient.}
### Table 7 - 14 VECMs and VAR for each of ASEAN5 imports and exports

#### Panel A. Malaysia

<table>
<thead>
<tr>
<th>Error correction term</th>
<th>Imports</th>
<th>Exports</th>
<th>Imports</th>
<th>Exports</th>
</tr>
</thead>
<tbody>
<tr>
<td>No CIV</td>
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<td>-</td>
<td>1 CIV</td>
<td>0.1254</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>0.3339*</td>
</tr>
<tr>
<td></td>
<td></td>
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</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>(-2.9752)</td>
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</table>

#### Temporal causality

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<th>Variable explained</th>
<th>Explanatory variable</th>
<th>Variable explained</th>
<th>Explanatory variable</th>
<th>Variable explained</th>
</tr>
</thead>
<tbody>
<tr>
<td>Imports (t-1)</td>
<td>0.5276*</td>
<td>Imports (t-1)</td>
<td>-0.2192</td>
<td>Imports (t-1)</td>
<td>0.5777*</td>
</tr>
<tr>
<td></td>
<td>(6.1226)</td>
<td></td>
<td>(-1.6277)</td>
<td></td>
<td>(3.6528)</td>
</tr>
<tr>
<td>Imports (t-2)</td>
<td>0.3795*</td>
<td>Imports (t-2)</td>
<td>-0.2140</td>
<td>Imports (t-2)</td>
<td>0.2965+</td>
</tr>
<tr>
<td></td>
<td>(4.4149)</td>
<td></td>
<td>(-1.5540)</td>
<td></td>
<td>(-0.6256)</td>
</tr>
<tr>
<td>Exports (t-1)</td>
<td>0.1268</td>
<td>Exports (t-1)</td>
<td>-0.0402</td>
<td>Exports (t-1)</td>
<td>-0.1204</td>
</tr>
<tr>
<td></td>
<td>(1.9066)</td>
<td></td>
<td>(-0.3091)</td>
<td></td>
<td>(-0.7106)</td>
</tr>
<tr>
<td>Exports (t-2)</td>
<td>0.2841*</td>
<td>Exports (t-2)</td>
<td>-0.1609</td>
<td>Exports (t-2)</td>
<td>0.2323</td>
</tr>
<tr>
<td></td>
<td>(-0.4548)</td>
<td></td>
<td>(-1.2081)</td>
<td></td>
<td>(1.3847)</td>
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</table>

<table>
<thead>
<tr>
<th>Chi-square</th>
<th>Imports (t)</th>
<th>Exports (t)</th>
<th>Imports (t)</th>
<th>Exports (t)</th>
<th>Imports (t)</th>
<th>Exports (t)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Imports (t-1)</td>
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<td>Imports (t-1)</td>
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<td>Imports (t-1)</td>
<td></td>
</tr>
<tr>
<td>Exports (t-1)</td>
<td>3.1096</td>
<td></td>
<td>Exports (t-1)</td>
<td></td>
<td>Exports (t-1)</td>
<td></td>
</tr>
</tbody>
</table>

| R-squared | 0.9822 | 0.9800 |
| F-statistic | 266.3582* | 236.4537* |

Note: CIV refer to cointegrating vector. * indicates 5% level of significance and + indicates 10% level of significance.
Table 7-14 VECM and VAR for each of ASEAN5 imports and exports (continued)

Panel B. Singapore

<table>
<thead>
<tr>
<th>Full period</th>
<th>Pre-crisis period</th>
<th>Post-crisis period</th>
</tr>
</thead>
<tbody>
<tr>
<td>Error correction term</td>
<td>Error correction term</td>
<td>Error correction term</td>
</tr>
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<td>Exports (t)</td>
<td>Imports (t)</td>
</tr>
<tr>
<td>No CIV</td>
<td>-</td>
<td>No CIV</td>
</tr>
</tbody>
</table>

<table>
<thead>
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<th>Temporal causality</th>
<th>Temporal causality</th>
<th>Temporal causality</th>
</tr>
</thead>
<tbody>
<tr>
<td>Explanatory variable</td>
<td>Variable explained</td>
<td>Explanatory variable</td>
</tr>
<tr>
<td>Imports (t-1)</td>
<td>0.5010*</td>
<td>0.1109</td>
</tr>
<tr>
<td>(5.1117)</td>
<td>(1.0342)</td>
<td>(3.4280)</td>
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<tr>
<td>Imports (t-2)</td>
<td>0.3088*</td>
<td>-0.0823</td>
</tr>
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<td>(3.1347)</td>
<td>(-0.7635)</td>
<td>(2.1608)</td>
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<td>Exports (t-1)</td>
<td>0.0793</td>
<td>0.5065*</td>
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<td>(0.8989)</td>
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<td>(0.5146)</td>
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<td>Exports (t-2)</td>
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<td>(0.9529)</td>
<td>(4.7530)</td>
<td>(1.3274)</td>
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<table>
<thead>
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<th>Chi-square</th>
<th>Chi-square</th>
<th>Chi-square</th>
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</tr>
<tr>
<td>Exports (t-1)</td>
<td>5.6059*</td>
<td></td>
</tr>
</tbody>
</table>

| R-squared | 0.9801 | 0.9819 | R-squared | 0.9730 | 0.9614 | R-squared | 0.9529 | 0.9735 |
| F-statistic | 237.1902* | 261.0324* | F-statistic | 173.1351* | 119.4234* | F-statistic | 95.7668* | 173.5559* |

Note: CIV refer to cointegrating vector. * indicates 5% level of significance and + indicates 10% level of significance.
Table 7-14 VECM and VAR for each of ASEAN5 imports and exports (continued)

Panel C. Thailand

<table>
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<th>Error correction term</th>
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<td>Imports (t-2)</td>
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<td>(1.1609)</td>
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<td>(0.4946)</td>
<td>(7.8508)</td>
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<td>0.3382*</td>
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<td>(0.5999)</td>
<td>(4.3602)</td>
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<td>Imports (t-1)</td>
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<td>0.0212</td>
</tr>
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<td>(5.3727)</td>
<td>(0.1629)</td>
</tr>
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<td>Imports (t-2)</td>
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<td>0.0313</td>
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</tr>
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<td>(-2.7385)</td>
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</tr>
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<td>(-1.1816)</td>
<td>(-2.5649)</td>
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<tr>
<td>Exports (t-2)</td>
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<td>-0.2442+</td>
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<td>(-1.9976)</td>
<td>(-1.8739)</td>
</tr>
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</table>

<table>
<thead>
<tr>
<th>Chi-square</th>
<th>Chi-square</th>
<th>Chi-square</th>
</tr>
</thead>
<tbody>
<tr>
<td>Imports (t) Imports (t) Exports (t)</td>
<td>Imports (t) Exports (t) Imports (t) Exports (t)</td>
<td>Imports (t) Imports (t) Exports (t) Exports (t)</td>
</tr>
<tr>
<td>Imports (t-1) 2.8890</td>
<td>Imports (t-1) 0.3214</td>
<td>Imports (t-1) 5.6532*</td>
</tr>
<tr>
<td>Exports (t-1) 7.1617*</td>
<td>Exports (t-1) 10.2050*</td>
<td>Exports (t-1) 4.1421</td>
</tr>
<tr>
<td>R-squared 0.9831</td>
<td>R-squared 0.9739</td>
<td>R-squared 0.6831</td>
</tr>
<tr>
<td>F-statistic 280.3033*</td>
<td>F-statistic 179.2581*</td>
<td>F-statistic 9.4327*</td>
</tr>
</tbody>
</table>

Note: CIV refers to cointegrating vector. * indicates 5% level of significance and + indicates 10% level of significance.
Table 7-14 VECM and VAR for each of ASEAN5 imports and exports (continued)

Panel D. Indonesia

<table>
<thead>
<tr>
<th></th>
<th>Full period</th>
<th>Pre-crisis period</th>
<th>Post-crisis period</th>
</tr>
</thead>
<tbody>
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<td></td>
<td>Error correction term</td>
<td>Error correction term</td>
<td>Error correction term</td>
</tr>
<tr>
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<td>Exports (t)</td>
<td>Imports (t)</td>
</tr>
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</tr>
<tr>
<td>No CIV</td>
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<td></td>
<td>No CIV</td>
</tr>
</tbody>
</table>

|                      | Error correction term | Error correction term | Error correction term |
|                      | Imports (t) | Exports (t) | Imports (t) | Exports (t) | Imports (t) | Exports (t) |
|                       | -0.0572     | 0.2659*     | -          | -          | -          | -          |
|                       | (-1.1024)   | (3.2494)    |             |             |             |             |

|                      | Variable explained | Variable explained | Variable explained |
|                      | Imports (t-1) | Exports (t-1) | Imports (t-2) | Exports (t-2) | Imports (t-3) | Exports (t-3) | Imports (t-4) | Exports (t-4) |
| Imports (t-1)        | -0.5136*     | 0.0316      | -0.2890*    | 0.0701      | -0.0876     | 0.1788      | -0.0376      | -0.5609*     |
|                      | (-5.8132)   | (0.2271)    | (-3.1874)   | (0.4904)    | (-1.0623)   | (1.3762)    | (-0.6124)    | (-5.7876)    |
| Imports (t-2)        | -0.2890*     | 0.0701      | 0.4652*     | 0.3534      | 0.0278      | 0.2129*     | 0.0392       | 0.1854       |
|                      | (-3.1874)   | (0.4904)    | (4.3036)    | (1.5374)    | (0.5026)    | (1.8104)    | (0.7129)     | (1.5836)     |
| Imports (t-3)        | -0.0876     | 0.1788      | 0.4652*     | 0.3534      | 0.0278      | 0.2129*     | 0.0392       | 0.1854       |
|                      | (-1.0623)   | (1.3762)    | (4.3036)    | (1.5374)    | (0.5026)    | (1.8104)    | (0.7129)     | (1.5836)     |
| Exports (t-1)        | -0.0376     | -0.5609*    | 0.0278      | 0.2129*     | 0.0392      | 0.1854      | 0.0392       | 0.1854       |
|                      | (-0.6124)   | (-5.7876)   | (0.5026)    | (1.8104)    | (0.7129)    | (1.5836)    | (0.7129)     | (1.5836)     |
| Exports (t-2)        | 0.0172      | -0.3537*    | 0.0278      | 0.2129*     | 0.0392      | 0.1854      | 0.0392       | 0.1854       |
|                      | (0.2814)    | (-3.6700)   | (0.5026)    | (1.8104)    | (0.7129)    | (1.5836)    | (0.7129)     | (1.5836)     |
| Exports (t-3)        | 0.0120*     | -0.0932     | 0.0278      | 0.2129*     | 0.0392      | 0.1854      | 0.0392       | 0.1854       |
|                      | (0.2385)    | (-1.1791)   | (0.5026)    | (1.8104)    | (0.7129)    | (1.5836)    | (0.7129)     | (1.5836)     |

<table>
<thead>
<tr>
<th>Chi-square</th>
<th>Imports (t)</th>
<th>Exports (t)</th>
<th>Imports (t)</th>
<th>Exports (t)</th>
<th>Imports (t)</th>
<th>Exports (t)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Imports (t-1)</td>
<td>12.7565*</td>
<td>2.9183</td>
<td>15.9568*</td>
<td>1.0173</td>
<td>2.1951</td>
<td>7.3960*</td>
</tr>
<tr>
<td>Exports (t-1)</td>
<td>0.6330</td>
<td>0.5618</td>
<td>0.9640</td>
<td>0.8761</td>
<td>0.9749</td>
<td>0.9787</td>
</tr>
<tr>
<td>F-statistic</td>
<td>7.3790*</td>
<td>5.4839*</td>
<td>128.4819*</td>
<td>33.9471*</td>
<td>157.3673*</td>
<td>186.8930*</td>
</tr>
</tbody>
</table>

Note: CIV refers to cointegrating vector. * indicates 5% level of significance and + indicates 10% level of significance.
Table 7-14 VECM and VAR for each of ASEAN5 imports and exports (continued)

Panel E. The Philippines

<table>
<thead>
<tr>
<th>Error correction term</th>
<th>Error correction term</th>
<th>Error correction term</th>
</tr>
</thead>
<tbody>
<tr>
<td>Imports ($t$)</td>
<td>Exports ($t$)</td>
<td>Imports ($t$)</td>
</tr>
<tr>
<td>No CIV</td>
<td>-</td>
<td>1 CIV</td>
</tr>
</tbody>
</table>

Temporal causality

<table>
<thead>
<tr>
<th>Variable explained</th>
<th>Variable explained</th>
<th>Variable explained</th>
</tr>
</thead>
<tbody>
<tr>
<td>Imports ($t-1$)</td>
<td>Exports ($t-1$)</td>
<td>Imports ($t-1$)</td>
</tr>
<tr>
<td>No CIV</td>
<td>-</td>
<td>1 CIV</td>
</tr>
</tbody>
</table>

Temporal causality

<table>
<thead>
<tr>
<th>Variable explained</th>
<th>Variable explained</th>
</tr>
</thead>
<tbody>
<tr>
<td>Imports ($t-1$)</td>
<td>Exports ($t-1$)</td>
</tr>
<tr>
<td>No CIV</td>
<td>-</td>
</tr>
</tbody>
</table>

Chi-square

<table>
<thead>
<tr>
<th>Variable explained</th>
<th>Variable explained</th>
</tr>
</thead>
<tbody>
<tr>
<td>Imports ($t-1$)</td>
<td>Exports ($t-1$)</td>
</tr>
<tr>
<td>No CIV</td>
<td>-</td>
</tr>
</tbody>
</table>

Note: CIV refers to cointegrating vector. * indicates 5% level of significance and + indicates 10% level of significance.
There is no evidence of cointegration between imports and exports for Singapore (Table 7-14, Panel B). The temporal causality results for Singapore show that in the full period, Singapore’s exports explain its imports. However, in the pre-crisis and post-crisis periods, there is no significant short-run causality found between imports and exports. The absence of a short-run relationship (other than for the full period) and the absence of a long-run relationship for Singaporean imports and exports imply that the two series are not tightly linked together. It is possible that the short-run causality found for full period (exports caused imports) is due to the 1997 crisis.

There is also no evidence of cointegration between imports and exports for Thailand in the full period and pre-crisis period but cointegration is identified in the post-crisis period (Table 7-14, Panel C). The error correction term for imports coefficient is significant, thus suggesting that Thailand’s imports bear the brunt of adjustment towards equilibrium in the post-crisis period. Temporal causality results indicate significant causality from exports to imports for the full period and pre-crisis period although this is not the evident in the post-crisis period – indeed, causality runs from imports to exports for the post-crisis period.

There is evidence of cointegration between imports and exports for Indonesia in the full period although no such evidence exists in the pre-crisis and post-crisis periods. For the full period the Indonesian error correction coefficient suggests that exports bear the adjustments to the long-run equilibrium (Table 7-14, Panel D). Based on the Chi-square statistics, it appears that Indonesian imports drive exports in the full and pre-crisis periods but in the post-crisis period, the causality runs from exports to imports.

There is no evidence of cointegration for the Philippines except in the pre-crisis period. In the pre-crisis period, the error correction term coefficient is significant for imports (-0.4793). This indicates that 47.93 percent of the disequilibrium error is eliminated by imports. The temporal causality results suggest that exports consistently affect imports across each of the study periods.

There is little evidence of cointegration between imports and exports for the ASEAN5. Unidirectional relationships are dominant in temporal causality findings, implying little co-movement between imports and exports for the ASEAN5 countries.
Trade at ASEAN5 levels

Error correction terms (ECTs) for ASEAN5 total trade.

There are two cointegrating vectors identified in the full period for ASEAN5 total trade (Table 7-15), the first of which focuses on Singapore while the second highlights the relationship between Thailand, Indonesia and the Philippines. Malaysia appears to be exogenous. In this case, Singapore bears 14.95 percent of the adjustment towards equilibrium for the first vector, while Thailand, Indonesia and the Philippines eliminate disequilibrium error at 6.67 percent, 22.72 percent and 9.47 percent respectively for the second vector. In the pre-crisis period Singapore, Indonesia and the Philippines are endogenous to the system, identified by significant error correction coefficients. These countries respond to the deviation from the equilibrium with ECTs of 1.22 (Singapore), 4.45 (Indonesia) and 3.19 (the Philippines). During this period, Malaysia and Thailand are exogenous.

Table 7 - 15 VECM: Error correction term for total trade

<table>
<thead>
<tr>
<th>Full period</th>
<th>Malaysia</th>
<th>Singapore</th>
<th>Thailand</th>
<th>Indonesia</th>
<th>Philippines</th>
</tr>
</thead>
<tbody>
<tr>
<td>CIV 1</td>
<td>-0.0976</td>
<td>-0.1495*</td>
<td>0.0428</td>
<td>-0.0434</td>
<td>0.0051</td>
</tr>
<tr>
<td></td>
<td>(-1.5902)</td>
<td>(-3.1121)</td>
<td>(1.0025)</td>
<td>(-0.6353)</td>
<td>(0.0887)</td>
</tr>
<tr>
<td>CIV 2</td>
<td>-0.0648</td>
<td>-0.0637</td>
<td>-0.0667*</td>
<td>0.2272*</td>
<td>-0.0947*</td>
</tr>
<tr>
<td></td>
<td>(-1.2356)</td>
<td>(-1.5506)</td>
<td>(-1.8293)</td>
<td>(3.8876)</td>
<td>(-1.9361)</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Pre-crisis period</th>
<th>Malaysia</th>
<th>Singapore</th>
<th>Thailand</th>
<th>Indonesia</th>
<th>Philippines</th>
</tr>
</thead>
<tbody>
<tr>
<td>CIV 1</td>
<td>-0.0025</td>
<td>0.0122*</td>
<td>-0.0024</td>
<td>-0.0445*</td>
<td>0.0319*</td>
</tr>
<tr>
<td></td>
<td>(-0.2566)</td>
<td>(1.9502)</td>
<td>(-0.3786)</td>
<td>(-3.5838)</td>
<td>(3.4709)</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Post-crisis period</th>
<th>Malaysia</th>
<th>Singapore</th>
<th>Thailand</th>
<th>Indonesia</th>
<th>Philippines</th>
</tr>
</thead>
<tbody>
<tr>
<td>CIV 1</td>
<td>-0.3647*</td>
<td>-0.1566</td>
<td>-0.0955</td>
<td>0.0244</td>
<td>0.3229**</td>
</tr>
<tr>
<td></td>
<td>(-2.0587)</td>
<td>(-0.7161)</td>
<td>(-0.5475)</td>
<td>(0.1351)</td>
<td>(1.7633)</td>
</tr>
<tr>
<td>CIV 2</td>
<td>0.0875*</td>
<td>0.0581</td>
<td>0.0389</td>
<td>0.0890*</td>
<td>-0.0776*</td>
</tr>
<tr>
<td></td>
<td>(2.3837)</td>
<td>(1.2815)</td>
<td>(1.0754)</td>
<td>(2.3738)</td>
<td>(-2.0438)</td>
</tr>
</tbody>
</table>

Note: * indicates 5% level of significance and + indicates 10% level of significance. CIV refers to the number of cointegrating vector.

The post-crisis period exhibits two cointegrating vectors where the first vector identifies Malaysia and the Philippines as endogenous while for the second vector, Malaysia, Indonesia and the Philippines are shown to be endogenous. The magnitudes of the error correction coefficients in the first vector are greater than in the second vector for
Malaysia and the Philippines. For example, Malaysia and the Philippines contribute 36.47 percent and 32.29 percent respectively to correcting the disequilibrium in the first vector. The percentage of disequilibrium error adjustment decreases to 8.75 percent for Malaysia and 7.76 percent for the Philippines in the second vector.

*ECTs for ASEAN5 exports*

Table 7-16 presents the complete results for ASEAN5 exports. The cointegration test identifies two cointegrating vectors in the full period, three vectors in the pre-crisis period but no evidence of cointegration in the post-crisis period. As such, the error correction term estimation for the full period suggests that Malaysia, Singapore and Thailand are endogenous in the first vector while the second vector highlights the endogeneity of Thailand, Indonesia and the Philippines. For the pre-crisis period, Malaysia and Thailand eliminate most of the disequilibrium error in the first vectors; in the second vector it is left to Malaysia and the Philippines while Singapore and Thailand eliminate the disequilibrium in the third vector.

**Table 7 - 16 VECM: Error correction term for ASEAN5 exports**

<table>
<thead>
<tr>
<th></th>
<th>Full period</th>
<th>Pre-crisis period</th>
<th>Post-crisis period</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Malaysia</td>
<td>Singapore</td>
<td>Thailand</td>
</tr>
<tr>
<td>1 CIV</td>
<td>-0.4336*</td>
<td>-0.2418*</td>
<td>0.1849*</td>
</tr>
<tr>
<td></td>
<td>(-4.6882)</td>
<td>(-3.1221)</td>
<td>(2.7740)</td>
</tr>
<tr>
<td>2 CIV</td>
<td>0.0471</td>
<td>0.0367</td>
<td>-0.0484*</td>
</tr>
<tr>
<td></td>
<td>(1.1926)</td>
<td>(1.1094)</td>
<td>(-1.6999)</td>
</tr>
<tr>
<td>3 CIV</td>
<td>-0.0719</td>
<td>0.2083*</td>
<td>-0.1923*</td>
</tr>
<tr>
<td></td>
<td>(-0.5675)</td>
<td>(1.9987)</td>
<td>(-2.0861)</td>
</tr>
<tr>
<td>No CIV</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
</tbody>
</table>

Note: * indicates 5% level of significance and + indicates 10% level of significance. CIV refers to the number of cointegrating vector.
**Temporal causality for ASEAN5 trade measures**

Short-run causality in ASEAN5 trade is examined and the results are presented in Table 7-17 (ASEAN5 total trade), Table 7-18 (ASEAN5 imports) and Table 7-19 (ASEAN5 exports).

There is considerable variation in temporal causality for ASEAN5 total trade (Table 7-17) but it is noted that Singapore’s total trade growth is not affected by the other ASEAN5 countries’ total trade growth, neither for the full period nor the sub-periods. Also, each country’s lagged total trade growth explains current growth except for Singapore in the full period and pre-crisis period. However, in the post-crisis period, this is evident only for Malaysia and Thailand. Most of the causality relationships are unidirectional with a few exceptions including Malaysia and Indonesia (full period, based on Chi-square statistics), Malaysia and Indonesia, and the Philippines and Indonesia (pre-crisis period). Further, the levels of causality relationships in the post-crisis period decreases from the pre-crisis period.
Table 7 - Temporal causality for total trade

<table>
<thead>
<tr>
<th>Explanatory Variables (t-1)</th>
<th>Market Explained (t)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Malaysia</td>
</tr>
<tr>
<td>Malaysia (t-1)</td>
<td>-0.3212*</td>
</tr>
<tr>
<td></td>
<td>(-2.8947)</td>
</tr>
<tr>
<td>Malaysia (t-2)</td>
<td>-0.1259</td>
</tr>
<tr>
<td></td>
<td>(-1.1706)</td>
</tr>
<tr>
<td>Singapore (t-1)</td>
<td>0.0963</td>
</tr>
<tr>
<td></td>
<td>(0.6792)</td>
</tr>
<tr>
<td>Singapore (t-2)</td>
<td>0.1090</td>
</tr>
<tr>
<td></td>
<td>(0.7828)</td>
</tr>
<tr>
<td>Thailand (t-1)</td>
<td>-0.0883</td>
</tr>
<tr>
<td></td>
<td>(-0.5783)</td>
</tr>
<tr>
<td>Thailand (t-2)</td>
<td>-0.0913</td>
</tr>
<tr>
<td></td>
<td>(-0.6395)</td>
</tr>
<tr>
<td>Indonesia (t-1)</td>
<td>-0.0486</td>
</tr>
<tr>
<td></td>
<td>(-0.5036)</td>
</tr>
<tr>
<td>Indonesia (t-2)</td>
<td>0.0159*</td>
</tr>
<tr>
<td></td>
<td>(0.1999)</td>
</tr>
<tr>
<td>Philippines (t-1)</td>
<td>0.1084</td>
</tr>
<tr>
<td></td>
<td>(1.1867)</td>
</tr>
<tr>
<td>Philippines (t-2)</td>
<td>0.1814*</td>
</tr>
<tr>
<td></td>
<td>(1.9874)</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Chi-Square</th>
</tr>
</thead>
<tbody>
<tr>
<td>Malaysia (t-1)</td>
</tr>
<tr>
<td>Singapore (t-1)</td>
</tr>
<tr>
<td>Thailand (t-1)</td>
</tr>
<tr>
<td>Indonesia (t-1)</td>
</tr>
<tr>
<td>Philippines (t-1)</td>
</tr>
</tbody>
</table>

| Seasonal effect | yes | Yes | yes | yes | yes |
| Crash period effects | yes | Yes | yes | yes | yes |

| R-squared | 0.6362 | 0.7072 | 0.7371 | 0.6553 | 0.6217 |

Note: * indicates 5% level of significance and + indicates 10% level of significance.
### Table 7-17 Temporal causality for total trade (continued)

#### Pre-crisis period

<table>
<thead>
<tr>
<th>Explanatory Variables (t-1)</th>
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</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Malaysia</td>
</tr>
<tr>
<td>Malaysia (t-1)</td>
<td>-0.3233*</td>
</tr>
<tr>
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<td>(-2.4506)</td>
</tr>
<tr>
<td>Singapore (t-1)</td>
<td>0.2727</td>
</tr>
<tr>
<td></td>
<td>(1.2529)</td>
</tr>
<tr>
<td>Thailand (t-1)</td>
<td>-0.1752</td>
</tr>
<tr>
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<td>(-0.8013)</td>
</tr>
<tr>
<td>Indonesia (t-1)</td>
<td>-0.1590+</td>
</tr>
<tr>
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<td>(-1.8054)</td>
</tr>
<tr>
<td>Philippines (t-1)</td>
<td>-0.0042</td>
</tr>
<tr>
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<td>(-0.0393)</td>
</tr>
<tr>
<td>Seasonal effects</td>
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</tr>
<tr>
<td>R-squared</td>
<td>0.6269</td>
</tr>
<tr>
<td>F-statistic</td>
<td>6.9191*</td>
</tr>
</tbody>
</table>

#### Post-crisis period

<table>
<thead>
<tr>
<th>Explanatory Variables (t-1)</th>
<th>Market Explained (t)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Malaysia</td>
</tr>
<tr>
<td>Malaysia (t-1)</td>
<td>-0.5021*</td>
</tr>
<tr>
<td></td>
<td>(-2.7476)</td>
</tr>
<tr>
<td>Singapore (t-1)</td>
<td>0.1250</td>
</tr>
<tr>
<td></td>
<td>(0.8410)</td>
</tr>
<tr>
<td>Thailand (t-1)</td>
<td>0.1385</td>
</tr>
<tr>
<td></td>
<td>(0.8686)</td>
</tr>
<tr>
<td>Indonesia (t-1)</td>
<td>0.0112</td>
</tr>
<tr>
<td></td>
<td>(0.0596)</td>
</tr>
<tr>
<td>Philippines (t-1)</td>
<td>-0.2626+</td>
</tr>
<tr>
<td></td>
<td>(-1.7935)</td>
</tr>
<tr>
<td>Seasonal effects</td>
<td>yes</td>
</tr>
<tr>
<td>R-squared</td>
<td>0.7961</td>
</tr>
</tbody>
</table>

Note: * indicates 5% level of significance and + indicates 10% level of significance.

The results in Table 7-18 (ASEAN5 imports) show that in the full period, Thailand is influenced by Indonesia, Indonesia is influenced by the Philippines and the Philippines is influenced by Singapore. In general, the results for the pre-crisis and post-crisis periods are consistent with the importance of domestic factors where a particular country’s past imports \((t-1)\) explain its current imports \((t)\). For example, in the pre-crisis period each ASEAN5 country’s past imports significantly explain its current imports, with the exception of Thailand which is also influenced by Indonesia (at the 10 percent level of}
significance). A similar trend is observed for the post-crisis period. However, bidirectional causality exists for Thailand and Indonesia, suggesting stronger relations between import growth for these two countries after the crisis. In addition, the Philippines imports are significantly influenced by those of Singapore and Indonesia. As such, there are more causality linkages observed in the post-crisis period compared to either the full period or the pre-crisis period.

Table 7 - 18 Temporal causality for ASEAN5 imports

<table>
<thead>
<tr>
<th>Variable Explained (t)</th>
<th>Malaysia (t-1)</th>
<th>Singapore (t-1)</th>
<th>Thailand (t-1)</th>
<th>Indonesia (t-1)</th>
<th>Philippines (t-1)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>0.5230*</td>
<td>0.0360</td>
<td>0.0700</td>
<td>-0.0368</td>
<td>0.0237</td>
</tr>
<tr>
<td></td>
<td>(6.0982)</td>
<td>(0.5438)</td>
<td>(0.9680)</td>
<td>(-0.4541)</td>
<td>(0.2735)</td>
</tr>
<tr>
<td></td>
<td>0.3055*</td>
<td>-0.0119</td>
<td>-0.0843</td>
<td>0.0277</td>
<td>0.0608</td>
</tr>
<tr>
<td></td>
<td>(3.6138)</td>
<td>(-1.8240)</td>
<td>(-1.8200)</td>
<td>(0.3472)</td>
<td>(0.7120)</td>
</tr>
<tr>
<td></td>
<td>0.0022</td>
<td>0.5053*</td>
<td>0.0537</td>
<td>0.0880</td>
<td>0.3151*</td>
</tr>
<tr>
<td></td>
<td>(0.0183)</td>
<td>(5.3727)</td>
<td>(0.5224)</td>
<td>(0.7651)</td>
<td>(2.5609)</td>
</tr>
<tr>
<td></td>
<td>0.0494</td>
<td>0.2938*</td>
<td>0.0538</td>
<td>-0.1643</td>
<td>-0.2845*</td>
</tr>
<tr>
<td></td>
<td>(0.3988)</td>
<td>(3.0748)</td>
<td>(0.5155)</td>
<td>(-1.4058)</td>
<td>(-2.2764)</td>
</tr>
<tr>
<td></td>
<td>0.0158</td>
<td>0.0696</td>
<td>0.3744*</td>
<td>0.0098</td>
<td>-0.0451</td>
</tr>
<tr>
<td></td>
<td>(0.1479)</td>
<td>(0.8413)</td>
<td>(4.1414)</td>
<td>(0.0964)</td>
<td>(-0.4164)</td>
</tr>
<tr>
<td></td>
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<td>0.3585*</td>
<td>0.1746*</td>
<td>-0.0438</td>
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<td>(0.8433)</td>
<td>(4.0715)</td>
<td>(1.7715)</td>
<td>(-0.4159)</td>
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<tr>
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<td>-0.0089</td>
<td>-0.0445</td>
<td>0.1369*</td>
<td>0.4915*</td>
<td>0.0077</td>
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<td>(-0.6385)</td>
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<td>-0.0650</td>
<td>0.0357</td>
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<td>0.3043*</td>
<td>0.1194</td>
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<td>(0.6264)</td>
<td>(3.4210)</td>
<td>(1.2558)</td>
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<td>0.1148</td>
<td>-0.0042</td>
<td>-0.0786</td>
<td>0.0038</td>
<td>0.4182*</td>
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<td>(-0.0728)</td>
<td>(-1.2485)</td>
<td>(0.0543)</td>
<td>(5.5526)</td>
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<td>0.0150</td>
<td>0.0541</td>
<td>0.1110</td>
<td>0.4151*</td>
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<td></td>
<td>(-0.2003)</td>
<td>(0.2592)</td>
<td>(0.8540)</td>
<td>(1.5652)</td>
<td>(5.4722)</td>
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</table>

<table>
<thead>
<tr>
<th>Chi-square absolute values</th>
</tr>
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<tbody>
<tr>
<td>Malaysia (t-1)</td>
</tr>
<tr>
<td>Singapore (t-1)</td>
</tr>
<tr>
<td>Thailand (t-1)</td>
</tr>
<tr>
<td>Indonesia (t-1)</td>
</tr>
<tr>
<td>Philippines (t-1)</td>
</tr>
</tbody>
</table>

| Seasonal effect           | yes            | yes            | yes            | yes             | yes             |
| Crash effect              | yes            | yes            | yes            | yes             | yes             |

| R-squared                 | 0.9830         | 0.9804         | 0.9839         | 0.9859          | 0.9823          |
| F-statistic               | 226.1761*      | 195.9335*      | 239.2748*      | 274.3734*       | 218.1423*       |

Note: * indicates 5% level of significance and + indicates 10% level of significance.
Table 7-18 Temporal causality for ASEAN5 imports (continued)

<table>
<thead>
<tr>
<th>Pre-crisis period</th>
<th>Variable Explained (t)</th>
<th>Malaysia</th>
<th>Singapore</th>
<th>Thailand</th>
<th>Indonesia</th>
<th>Philippines</th>
</tr>
</thead>
<tbody>
<tr>
<td>Malaysia (t-1)</td>
<td>0.7664*</td>
<td>0.0638</td>
<td>0.0743</td>
<td>0.0782</td>
<td>-0.0289</td>
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</tr>
<tr>
<td></td>
<td>(8.5256)</td>
<td>(1.0698)</td>
<td>(1.2371)</td>
<td>(1.0121)</td>
<td>(-0.2937)</td>
<td></td>
</tr>
<tr>
<td>Singapore (t-1)</td>
<td>0.0456</td>
<td>0.4641*</td>
<td>-0.0528</td>
<td>0.1668</td>
<td>0.2257</td>
<td></td>
</tr>
<tr>
<td></td>
<td>(0.2367)</td>
<td>(3.6290)</td>
<td>(-4.0999)</td>
<td>(1.0057)</td>
<td>(1.0684)</td>
<td></td>
</tr>
<tr>
<td>Thailand (t-1)</td>
<td>0.1773</td>
<td>0.1912*</td>
<td>0.6842*</td>
<td>0.0765</td>
<td>0.2275</td>
<td></td>
</tr>
<tr>
<td></td>
<td>(1.0591)</td>
<td>(1.7224)</td>
<td>(6.1167)</td>
<td>(0.5316)</td>
<td>(1.2406)</td>
<td></td>
</tr>
<tr>
<td>Indonesia (t-1)</td>
<td>-0.0005</td>
<td>0.1363</td>
<td>0.1617*</td>
<td>0.5846*</td>
<td>0.1489</td>
<td></td>
</tr>
<tr>
<td></td>
<td>(-0.0034)</td>
<td>(1.5133)</td>
<td>(1.7821)</td>
<td>(5.0055)</td>
<td>(1.0007)</td>
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</tr>
<tr>
<td>Philippines (t-1)</td>
<td>0.0802</td>
<td>0.0651</td>
<td>0.0698</td>
<td>0.0590</td>
<td>0.5037*</td>
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<tr>
<td></td>
<td>(0.7806)</td>
<td>(0.9548)</td>
<td>(1.0170)</td>
<td>(0.6675)</td>
<td>(4.4745)</td>
<td></td>
</tr>
</tbody>
</table>

Seasonal effects: yes yes yes No No

R-squared: 0.9702 0.9712 0.9734 0.9586 0.9463
F-statistic: 146.6016* 151.8539* 164.4650* 104.2269* 79.3220*

Post-crisis period

<table>
<thead>
<tr>
<th>Variable Explained (t)</th>
<th>Malaysia</th>
<th>Singapore</th>
<th>Thailand</th>
<th>Indonesia</th>
<th>Philippines</th>
</tr>
</thead>
<tbody>
<tr>
<td>Malaysia (t-1)</td>
<td>0.5215*</td>
<td>0.1115</td>
<td>0.1547</td>
<td>0.2208</td>
<td>0.0275</td>
</tr>
<tr>
<td></td>
<td>(2.9816)</td>
<td>(0.5827)</td>
<td>(0.6817)</td>
<td>(1.0235)</td>
<td>(0.1573)</td>
</tr>
<tr>
<td>Singapore (t-1)</td>
<td>0.1054</td>
<td>0.7372*</td>
<td>0.1701</td>
<td>-0.1546</td>
<td>0.2391*</td>
</tr>
<tr>
<td></td>
<td>(0.9070)</td>
<td>(5.7981)</td>
<td>(1.1281)</td>
<td>(-1.0783)</td>
<td>(2.0592)</td>
</tr>
<tr>
<td>Thailand (t-1)</td>
<td>0.0462</td>
<td>0.0073</td>
<td>0.3239*</td>
<td>0.3383*</td>
<td>-0.0715</td>
</tr>
<tr>
<td></td>
<td>(0.3623)</td>
<td>(0.0520)</td>
<td>(1.9576)</td>
<td>(2.1509)</td>
<td>(-0.5609)</td>
</tr>
<tr>
<td>Indonesia (t-1)</td>
<td>0.1639</td>
<td>0.0137</td>
<td>0.4069*</td>
<td>0.5507*</td>
<td>0.2326*</td>
</tr>
<tr>
<td></td>
<td>(1.3967)</td>
<td>(0.1067)</td>
<td>(2.6732)</td>
<td>(3.8064)</td>
<td>(1.9844)</td>
</tr>
<tr>
<td>Philippines (t-1)</td>
<td>0.0699</td>
<td>0.1497</td>
<td>0.0016</td>
<td>0.1364</td>
<td>0.4030*</td>
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<tr>
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<td>(0.6102)</td>
<td>(1.1948)</td>
<td>(0.0109)</td>
<td>(0.9660)</td>
<td>(3.5232)</td>
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</tbody>
</table>

Seasonal effects: yes yes yes yes yes

R-squared: 0.9544 0.9475 0.9577 0.9662 0.9402
F-statistic: 91.6452* 79.0232* 98.9991* 125.0116* 68.7791*

Note: *5% significance level (1.960); + 10% significance level (1.645)

Table 7-19 presents the causality results for ASEAN5 exports. In the full period, bidirectional causality exists only between Indonesia and the Philippines. In general, causality for ASEAN5 exports increases from the pre-crisis to the post-crisis period. In these periods, all the links are unidirectional. For example, Thailand’s exports in the short run are explained only by its previous period exports across all the sample periods. Thus, Thailand exports, in particular, appear to be influenced by domestic factors rather than ASEAN5 export levels.
### Table 7 - 19 Temporal causality for ASEAN5 exports

#### Full period

<table>
<thead>
<tr>
<th>Variable Explained (t)</th>
<th>Malaysia (t-1)</th>
<th>Singapore (t-1)</th>
<th>Thailand (t-1)</th>
<th>Indonesia (t-1)</th>
<th>Philippines (t-1)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Malaysia (t-1)</td>
<td>-0.1046</td>
<td>0.1585*</td>
<td>-0.0842</td>
<td>0.1555</td>
<td>0.0403</td>
</tr>
<tr>
<td>(1.1005)</td>
<td>(1.9913)</td>
<td>(-1.2298)</td>
<td>(1.1068)</td>
<td>(0.3981)</td>
<td></td>
</tr>
<tr>
<td>Singapore (t-1)</td>
<td>-0.0267</td>
<td>-0.4444*</td>
<td>0.0008</td>
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<td>-0.1219</td>
</tr>
<tr>
<td>(-0.2409)</td>
<td>(-4.7931)</td>
<td>(0.0098)</td>
<td>(-1.5780)</td>
<td>(-1.0334)</td>
<td></td>
</tr>
<tr>
<td>Thailand (t-1)</td>
<td>-0.1919*</td>
<td>-0.1612*</td>
<td>-0.3214*</td>
<td>-0.0106</td>
<td>0.3284*</td>
</tr>
<tr>
<td>(-1.7090)</td>
<td>(-1.7139)</td>
<td>(-3.9703)</td>
<td>(-0.0636)</td>
<td>(2.7456)</td>
<td></td>
</tr>
<tr>
<td>Indonesia (t-1)</td>
<td>-0.0535</td>
<td>-0.0335</td>
<td>-0.0058</td>
<td>-0.1026</td>
<td>-0.2118*</td>
</tr>
<tr>
<td>(-0.9186)</td>
<td>(-0.6867)</td>
<td>(-0.1372)</td>
<td>(-1.1925)</td>
<td>(-3.4158)</td>
<td></td>
</tr>
<tr>
<td>Philippines (t-1)</td>
<td>-0.0720</td>
<td>-0.0149</td>
<td>-0.0398</td>
<td>-0.2060*</td>
<td>-0.4043*</td>
</tr>
<tr>
<td>(-1.0877)</td>
<td>(-0.2687)</td>
<td>(-0.8343)</td>
<td>(-2.1068)</td>
<td>(-5.7376)</td>
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</tbody>
</table>

- Seasonal effect: yes
- Crash effect: yes
- R-squared: 0.5799 0.6332 0.7158 0.5654 0.6030
- F-statistic: 5.9808* 7.4791* 10.9154* 5.6370* 6.5814*  

#### Pre-crisis period

<table>
<thead>
<tr>
<th>Variable Explained (t)</th>
<th>Malaysia (t-1)</th>
<th>Singapore (t-1)</th>
<th>Thailand (t-1)</th>
<th>Indonesia (t-1)</th>
<th>Philippines (t-1)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Malaysia (t-1)</td>
<td>-0.0303</td>
<td>0.1188</td>
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<td>(-0.2302)</td>
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<td>(-0.7946)</td>
<td>(0.5569)</td>
<td>(0.3021)</td>
<td></td>
</tr>
<tr>
<td>Singapore (t-1)</td>
<td>-0.1726</td>
<td>-0.3568*</td>
<td>-0.0611</td>
<td>-0.3254</td>
<td>0.1562</td>
</tr>
<tr>
<td>(-0.9377)</td>
<td>(-2.3586)</td>
<td>(-0.4568)</td>
<td>(-0.9834)</td>
<td>(0.7393)</td>
<td></td>
</tr>
<tr>
<td>Thailand (t-1)</td>
<td>-0.2038</td>
<td>-0.2950*</td>
<td>-0.3848*</td>
<td>-0.2382</td>
<td>0.0530</td>
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<tr>
<td>(-1.1714)</td>
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<td>(-3.0423)</td>
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<td>(0.2652)</td>
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</tr>
<tr>
<td>Indonesia (t-1)</td>
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<td>-0.0682</td>
<td>-0.0086</td>
<td>-0.0219</td>
<td>-0.2103*</td>
</tr>
<tr>
<td>(-0.7403)</td>
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<td>(-0.1614)</td>
<td>(-0.1665)</td>
<td>(-2.5021)</td>
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<tr>
<td>Philippines (t-1)</td>
<td>-0.2209*</td>
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<td>-0.0846</td>
<td>-0.4118*</td>
</tr>
<tr>
<td>(-2.3403)</td>
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<td>(-0.5959)</td>
<td>(-0.4983)</td>
<td>(-3.7987)</td>
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</table>

- Seasonal effects: yes
- R-squared: 0.6060 0.6344 0.7305 0.6001 0.5111
- F-statistic: 5.5051* 6.2108* 9.7026* 5.3715* 3.7418*  

#### Post-crisis period

<table>
<thead>
<tr>
<th>Variable Explained (t)</th>
<th>Malaysia (t-1)</th>
<th>Singapore (t-1)</th>
<th>Thailand (t-1)</th>
<th>Indonesia (t-1)</th>
<th>Philippines (t-1)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Malaysia (t-1)</td>
<td>0.3975*</td>
<td>-0.2388</td>
<td>-0.1203</td>
<td>-0.0724</td>
<td>0.2193</td>
</tr>
<tr>
<td>(2.8039)</td>
<td>(-1.4792)</td>
<td>(-0.9668)</td>
<td>(-0.5537)</td>
<td>(1.2719)</td>
<td></td>
</tr>
<tr>
<td>Singapore (t-1)</td>
<td>0.0776</td>
<td>0.8764*</td>
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<tr>
<td>(0.7074)</td>
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<td>(1.9376)</td>
<td>(0.1471)</td>
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<tr>
<td>Thailand (t-1)</td>
<td>0.2221+</td>
<td>0.2328</td>
<td>0.9277*</td>
<td>0.3720*</td>
<td>0.2851+</td>
</tr>
<tr>
<td>(1.7337)</td>
<td>(1.5955)</td>
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<td>(3.1484)</td>
<td>(1.8292)</td>
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</tr>
<tr>
<td>Indonesia (t-1)</td>
<td>-0.0579</td>
<td>0.0220</td>
<td>-0.0411</td>
<td>0.3067+</td>
<td>-0.2980</td>
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<tr>
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<td>(0.1116)</td>
<td>(-0.2708)</td>
<td>(1.9234)</td>
<td>(-1.4165)</td>
<td></td>
</tr>
<tr>
<td>Philippines (t-1)</td>
<td>0.2342*</td>
<td>0.0752</td>
<td>0.0898</td>
<td>0.0921</td>
<td>0.7823*</td>
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<tr>
<td>(3.0815)</td>
<td>(0.8693)</td>
<td>(1.3471)</td>
<td>(1.3140)</td>
<td>(8.4618)</td>
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</tr>
</tbody>
</table>

- Seasonal effects: yes
- R-squared: 0.9744 0.9725 0.9856 0.9778 0.9783
- F-statistic: 166.2335* 154.5463* 300.2572* 192.4674* 197.2307*  

Note: * indicates 5% level of significance and + indicates 10% level of significance.
As a summary, error correction terms and temporal causality tests suggest that trade within ASEAN5 is not strongly determined by the trade with other members. This is evident from the lack of causality (unidirectional and bidirectional term) found for the three trade measures. Short-run trade growth in each ASEAN5 country is generally independent of other ASEAN5 members. This is consistent with Figure 7-2 which shows that the share of trade outside ASEAN5 is more important than intra-ASEAN5 trade.

7.4 Conclusion

International trade has played a fundamental part in accelerating economic growth for ASEAN5. Imports and exports have been the engine of growth (Awakose, 2007) for ASEAN5 economies. This is consistent with the trade-oriented industrialisation policy adopted by ASEAN countries that also encourages ASEAN trade to increase substantially with non-member countries (Tang, 2005). ASEAN international trade has also been intensified through support of unilateral and multilateral reduction in trade barriers (Sharma and Chua, 2000).

In an early section of this chapter, it is shown that the value of intra-ASEAN5 imports is less than the value of intra-ASEAN exports. Also, the proportion of intra-ASEAN trade is generally less than the proportion of trade with non-ASEAN countries. Furthermore, the 1997 crisis had a greater impact on the level of exports than on imports. In fact, based on Figure 7-4 and consistent with Elliot and Ikemoto (2004), ASEAN5 may have increased their exports to the rest of the world as the crisis increased product competitiveness with the devaluation in most ASEAN5 currencies as a result of the crisis.

Johansen cointegration tests suggest that there are differences in the long-term relationship that exists for ASEAN5 trade. There is little evidence of cointegration between imports and exports for the ASEAN5 countries. Singapore, for example, provides no evidence of long-run relationship between imports and exports, while other countries exhibit cointegration either for the full period or for sub-periods. As such, it is fair to suggest that the ASEAN5 country imports and exports are not tightly linked. There is little evidence of a tendency towards some equilibrium level, although the crisis may have altered the balance between imports and exports for each of the ASEAN5 economies. This argument is supported by error correction term estimates that suggest it is either imports or exports that adjust towards equilibrium, not both.
The findings from cointegration tests for total trade show that the number of cointegrating vectors increases after the crisis. Thus, in general, the ASEAN5 total trade exhibits increased convergence after the crisis, probably driven by export movements as there is no significant cointegrating vector documented in the analysis for imports in either the full period or sub-periods.

The results for the ASEAN5 exports show a strong indication of a long-run relationship with three cointegrating vectors in the pre-crisis period. However, there is no statistically significant cointegrating relationship in the post-crisis period, suggesting that export movements after the crisis are probably driven by different competitive levels possessed by each of the ASEAN members. Moreover, short-term causality analysis highlights unidirectional trade effects consistent with domestic factors being important determinants of short-run country trade. These results are rather puzzling given that the ASEAN5 total trade results provide evidence of increased integration in the post-crisis period, yet no evidence of integration is found for either imports or exports for this period.

The ASEAN5 imports do not appear to share a long-run relationship in their movements when analysis is documented in any of the periods under study. Perhaps it is because ASEAN countries have similar characteristics such that comparative advantage results in them looking elsewhere for imports (Jugurnath, Stewart and Brooks, 2007) and that country factors are probably important determinants for each ASEAN5 member’s level of imports.
Chapter 8

ASEAN5 ASSET PRICING FOR SIZE-BTME AND INDUSTRY PORTFOLIOS

8.1 Introduction

For more than five decades, efforts have continued in the quest to explain asset returns. Finance models such as the capital asset pricing model (CAPM) (Sharpe, 1964 and Lintner, 1965), Merton’s (1973) intertemporal capital asset pricing model (ICAPM) and the Fama and French (1993) multifactor model contribute to our understanding of returns. It is also documented in the literature that average stock returns are related to past performance, giving rise to a momentum investment strategy (i.e. buying past winning stocks – Winners – and selling past losing stocks – Losers). Studies such as those by Jegadeesh and Titman (1993), Rouwenhorst (1998) and Hurn and Pavlov (2003) give further insight into momentum effects for developed markets.

Asset pricing models have been applied to the equity markets in Singapore, Malaysia, Thailand, Indonesia and the Philippines but these studies vary in terms of data source and time frame. A contribution of this thesis is its focus on ASEAN which is represented by its five founding nations, and it is the gap in literature concerning asset pricing for the ASEAN countries that motivates the writing of this chapter, particularly with regard to the impact of momentum.

Analysis is this chapter is based on both the one-factor model (CAPM) and the four-factor model which is an extension of Fama and French’s (1993) three-factor model. The extension involves the inclusion of Jegadish and Titman’s (1993) momentum effect, as used in Carhart (1997). In addition, this study follows Chen and Fang (2007) who recently employ the four-factor model in their study of Pacific Basin stock markets including Malaysia, Thailand, Indonesia and Singapore, using monthly data from the Pacific-Basin Capital Market (PACAP) database. The current study uses quarterly observations data obtained from Datastream. This provides an important validation of the Chen and Fang analysis with different data set and different return interval. Further,

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61 Jegadeesh and Titman (1993) use one-year momentum but this study employs short-term momentum i.e. six-month return period. Carhart (1997) examines mutual funds in the US market while ASEAN5 markets are the focus of this chapter.
62 Other countries considered in this study are Japan, Hong Kong and South Korea.
regression that includes industry excess returns as the dependent variables is undertaken in addition to size and book-to-market equity (BTME) based portfolios.

The questions that this study seek to answer include: (1) Can the four-factor model based on size, value and momentum capture the variations of average stock returns for each of the ASEAN5 equity markets better than the traditional CAPM? (2) Is there a size, value premium and momentum effect in the equity markets across ASEAN5? (3) Do the size, value and momentum factors also explain excess industry returns for the ASEAN5?

It is found that the four-factor model performs better than the CAPM in explaining excess returns for the ASEAN5 equity markets where the size and value premia are observed. It also appears that size effects are more prominent than value effects in ASEAN5 markets over the study period. Further, there is limited support for momentum effects in the ASEAN5 equity markets. The effects of size, value and momentum on industry returns varies across industries. Further, size and value effects have more weight than momentum effects.

The literature survey, methodology and data used for this chapter are provided in Chapters 2, 3 and 4 of this thesis. The remainder of this chapter is organised as follows. Section 8.2 presents the summary statistics for the variables used in the model regressions. Section 8.3 presents the results and discussion of the findings, while Section 8.4 offers some conclusion for the study.

8.2 Summary statistics for variables
In this section, summary statistics and correlation matrices for dependent and explanatory variables used in the regressions are presented.

8.2.1 Malaysia
The results for Malaysia (Table 8-1) show that the average SMB return is 1.35% per quarter. The HML factor has an average premium of 2.99% per quarter, suggesting that the variance in excess returns due to size and book-to-market equity factors in the Malaysian stock market are economically important. The average momentum effect (MOM) and excess market return ($Rm-Rf$) are negative (-0.07% and -1.17% respectively), though Drew and Veeraraghavan (2002; 2003) find positive mean excess returns for $Rm-Rf$ in their study. This is most likely period-specific. The MOM result does not support the existence of a
momentum effect for the Malaysian market, consistent with Chen and Fang (2007) and Hameed and Kusnadi (2002).

The six portfolios formed for Malaysia show average excess returns ranging from 0.35% to -3.85% per quarter. The highest average return belongs to the S/H portfolio, consistent with Fama and French (1993), Chui and Wei (1998) and Drew and Veeraraghavan (2002; 2003).

A negative relation exists between average return and size while a positive relation prevails between book-to-market equity and average return. The average industry excess returns produce a wide range of values with the highest average returns for the Financial sector (1.27% per quarter). Sectors with positive average excess returns are Consumer Services, Telecom and Oil & Gas, with the remaining sectors having negative average excess returns.\(^63\)

### Table 8-1 Summary statistics for dependent and explanatory returns of the portfolios for Malaysia

<table>
<thead>
<tr>
<th></th>
<th>SMB</th>
<th>HML</th>
<th>MOM</th>
<th>Rm -Rf</th>
</tr>
</thead>
<tbody>
<tr>
<td>Average</td>
<td>0.0135</td>
<td>0.0299</td>
<td>-0.0007</td>
<td>-0.0117</td>
</tr>
<tr>
<td>Std deviation</td>
<td>0.0894</td>
<td>0.0611</td>
<td>0.0780</td>
<td>0.0757</td>
</tr>
<tr>
<td>Minimum</td>
<td>-0.3794</td>
<td>-0.1289</td>
<td>-0.2593</td>
<td>-0.1817</td>
</tr>
<tr>
<td>Maximum</td>
<td>0.2871</td>
<td>0.2151</td>
<td>0.2785</td>
<td>0.2325</td>
</tr>
<tr>
<td>r1</td>
<td>0.0468</td>
<td>-0.0078</td>
<td>-0.0096</td>
<td>-0.2159</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th></th>
<th>Size-BTME</th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Average</td>
<td>-0.0120</td>
<td>-0.0151</td>
<td>-0.0292</td>
<td>-0.0090</td>
</tr>
<tr>
<td>Std deviation</td>
<td>0.2230</td>
<td>0.1991</td>
<td>0.1781</td>
<td>0.2555</td>
</tr>
<tr>
<td>Minimum</td>
<td>-0.7149</td>
<td>-0.6886</td>
<td>-0.6454</td>
<td>-0.9053</td>
</tr>
<tr>
<td>Maximum</td>
<td>0.6152</td>
<td>0.5956</td>
<td>0.4698</td>
<td>0.7067</td>
</tr>
<tr>
<td>r1</td>
<td>-0.1488</td>
<td>-0.1212</td>
<td>0.0157</td>
<td>-0.1378</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th></th>
<th>Industry</th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Average</td>
<td>0.0009</td>
<td>-0.0093</td>
<td>-0.0031</td>
<td>0.0101</td>
</tr>
<tr>
<td>Std deviation</td>
<td>0.1409</td>
<td>0.1941</td>
<td>0.1774</td>
<td>0.1596</td>
</tr>
<tr>
<td>Minimum</td>
<td>-0.4111</td>
<td>-0.5191</td>
<td>-0.6995</td>
<td>-0.4966</td>
</tr>
<tr>
<td>Maximum</td>
<td>0.3946</td>
<td>0.6272</td>
<td>0.435</td>
<td>0.5093</td>
</tr>
<tr>
<td>r1</td>
<td>-0.2026</td>
<td>0.0082</td>
<td>-0.1853</td>
<td>-0.0828</td>
</tr>
</tbody>
</table>

<p>| | | | | |</p>
<table>
<thead>
<tr>
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</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Oil &amp; Gas</td>
<td>Basic Mats</td>
<td>Industrials</td>
<td>Cons Goods</td>
</tr>
<tr>
<td>Average</td>
<td>0.0009</td>
<td>-0.0093</td>
<td>-0.0031</td>
<td>-0.0017</td>
</tr>
<tr>
<td>Std deviation</td>
<td>0.1409</td>
<td>0.1941</td>
<td>0.1774</td>
<td>0.197</td>
</tr>
<tr>
<td>Minimum</td>
<td>-0.4111</td>
<td>-0.5191</td>
<td>-0.6995</td>
<td>-0.6462</td>
</tr>
<tr>
<td>Maximum</td>
<td>0.3946</td>
<td>0.6272</td>
<td>0.435</td>
<td>0.4383</td>
</tr>
<tr>
<td>r1</td>
<td>-0.2026</td>
<td>0.0082</td>
<td>-0.1853</td>
<td>-0.1541</td>
</tr>
</tbody>
</table>

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<table>
<thead>
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<th></th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Telecom</td>
<td>Utilities</td>
<td>Financial</td>
<td>Technology</td>
</tr>
<tr>
<td>Average</td>
<td>0.0099</td>
<td>-0.0016</td>
<td>0.0127</td>
<td>-0.0219</td>
</tr>
<tr>
<td>Std deviation</td>
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<td>0.1678</td>
<td>0.2059</td>
<td>0.2796</td>
</tr>
<tr>
<td>Minimum</td>
<td>-0.5725</td>
<td>-0.4515</td>
<td>-0.5953</td>
<td>-0.6339</td>
</tr>
<tr>
<td>Maximum</td>
<td>0.6147</td>
<td>0.5206</td>
<td>0.5842</td>
<td>0.5011</td>
</tr>
<tr>
<td>r1</td>
<td>-0.2992</td>
<td>-0.2394</td>
<td>-0.0451</td>
<td>0.4894</td>
</tr>
</tbody>
</table>

<p>| | | | | |</p>
<table>
<thead>
<tr>
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<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Health care</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Average</td>
<td>n/a</td>
<td>n/a</td>
<td>n/a</td>
<td>n/a</td>
</tr>
<tr>
<td>Std deviation</td>
<td>n/a</td>
<td>n/a</td>
<td>n/a</td>
<td>n/a</td>
</tr>
<tr>
<td>Minimum</td>
<td>n/a</td>
<td>n/a</td>
<td>n/a</td>
<td>n/a</td>
</tr>
<tr>
<td>Maximum</td>
<td>n/a</td>
<td>n/a</td>
<td>n/a</td>
<td>n/a</td>
</tr>
<tr>
<td>r1</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Note: In this table, the dependent returns indicate excess returns on size-BTME portfolios (B/H, B/M, B/L, S/M, and S/L). Size of firms is represented by B (big) and S (small) while book-to-market equity is represented by H (high), M (medium), and L (low). This includes excess returns on industry group portfolios; r1 is the first order autocorrelation coefficient; n/a indicates unavailable data. The explanatory returns are the average premium for the common factors represented by Rm -Rf (returns to the market portfolio minus risk-free rate), SMB (small minus big), HML (high minus low), and MOM (winners minus losers).

\(^63\) Healthcare sector is not available for Malaysia.
8.2.2 Singapore

The results for Singapore (Table 8-2) show that the average SMB return is -0.50% per quarter. The HML factor has an average premium of 3.30% per quarter. The mean excess return for HML is higher than SMB, consistent with Shum and Tang (2005). The average momentum excess return (MOM) is -0.20% and 0.9% for excess market return (Rm-Rf). In general, the MOM returns does not support the existence of a momentum effect for Singapore, consistent with Hameed and Kusnadi (2002) and Chen and Fang (2007).

The six portfolios formed for Singapore show average excess returns ranging from -0.93% to 1.34% per quarter. The S/H portfolio has the highest average returns, consistent with Fama and French (1993) and Shum and Tang (2005). This indicates a negative relation between return and size effect but a positive relation between return and book-to-market equity effects. Most of the average industry excess returns for Singapore are positive with the highest average returns for the Healthcare sector (2.16%) and the lowest for the Technology sector (-1.41%).

Table 8 - 2 Summary statistics for dependent and explanatory returns of the portfolios for Singapore

<table>
<thead>
<tr>
<th>Explanatory returns</th>
<th>Average</th>
<th>Std deviation</th>
<th>Minimum</th>
<th>Maximum</th>
<th>r1</th>
</tr>
</thead>
<tbody>
<tr>
<td>SMB</td>
<td>-0.0050</td>
<td>0.0848</td>
<td>-0.1390</td>
<td>0.4367</td>
<td>-0.0405</td>
</tr>
<tr>
<td>HML</td>
<td>0.0330</td>
<td>0.0634</td>
<td>-0.1229</td>
<td>0.2390</td>
<td>0.0631</td>
</tr>
<tr>
<td>MOM</td>
<td>-0.0020</td>
<td>0.0945</td>
<td>-0.3151</td>
<td>0.2249</td>
<td>0.0015</td>
</tr>
<tr>
<td>Rm –Rf</td>
<td>0.0090</td>
<td>0.1449</td>
<td>-0.3726</td>
<td>0.4387</td>
<td>0.0059</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Dependent returns</th>
<th>Average</th>
<th>Std deviation</th>
<th>Minimum</th>
<th>Maximum</th>
<th>r1</th>
</tr>
</thead>
<tbody>
<tr>
<td>Size-BTME</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>B/H</td>
<td>0.0134</td>
<td>0.1784</td>
<td>-0.4512</td>
<td>0.6806</td>
<td>-0.1070</td>
</tr>
<tr>
<td>B/M</td>
<td>-0.0066</td>
<td>0.1786</td>
<td>-0.5552</td>
<td>0.5925</td>
<td>-0.1138</td>
</tr>
<tr>
<td>B/L</td>
<td>-0.0187</td>
<td>0.1675</td>
<td>-0.4643</td>
<td>0.4594</td>
<td>-0.0427</td>
</tr>
<tr>
<td>S/H</td>
<td>0.0079</td>
<td>0.2296</td>
<td>-0.4472</td>
<td>1.0877</td>
<td>-0.1040</td>
</tr>
<tr>
<td>S/M</td>
<td>-0.0149</td>
<td>0.2177</td>
<td>-0.4853</td>
<td>0.9596</td>
<td>-0.1433</td>
</tr>
<tr>
<td>S/L</td>
<td>-0.0293</td>
<td>0.2237</td>
<td>-0.5572</td>
<td>0.9229</td>
<td>-0.1128</td>
</tr>
<tr>
<td>Industry</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Oil &amp; Gas</td>
<td>0.0172</td>
<td>0.2015</td>
<td>-0.3663</td>
<td>0.6732</td>
<td>0.144</td>
</tr>
<tr>
<td>Basic Materials</td>
<td>0.0146</td>
<td>0.2361</td>
<td>-0.6468</td>
<td>0.9652</td>
<td>-0.0012</td>
</tr>
<tr>
<td>Industrials</td>
<td>0.0096</td>
<td>0.1362</td>
<td>-0.3982</td>
<td>0.3349</td>
<td>-0.0792</td>
</tr>
<tr>
<td>Consumer Goods</td>
<td>0.0198</td>
<td>0.2297</td>
<td>-0.552</td>
<td>0.8365</td>
<td>-0.1128</td>
</tr>
<tr>
<td>Consumer Services</td>
<td>0.0135</td>
<td>0.1344</td>
<td>-0.3994</td>
<td>0.5104</td>
<td>-0.0383</td>
</tr>
<tr>
<td>Telecom</td>
<td>-0.0041</td>
<td>0.1188</td>
<td>-0.3486</td>
<td>0.1903</td>
<td>0.018</td>
</tr>
<tr>
<td>Utilities</td>
<td>n/a</td>
<td>n/a</td>
<td>n/a</td>
<td>n/a</td>
<td>n/a</td>
</tr>
<tr>
<td>Financial</td>
<td>0.0169</td>
<td>0.1663</td>
<td>-0.363</td>
<td>0.6331</td>
<td>-0.0044</td>
</tr>
<tr>
<td>Technology</td>
<td>-0.0141</td>
<td>0.2950</td>
<td>-0.8562</td>
<td>0.5331</td>
<td>0.0767</td>
</tr>
<tr>
<td>Health care</td>
<td>0.0216</td>
<td>0.1264</td>
<td>-0.3108</td>
<td>0.3591</td>
<td>0.0298</td>
</tr>
</tbody>
</table>

Note: In this table, the dependent returns indicate excess returns on size-BTME portfolios (B/H, B/M, B/L, S/M, and S/L). Size of firms is represented by B (big) and S (small) while book-to-market equity is represented by H (high), M (medium), and L (low). This includes excess returns on industry group portfolios; r1 is the first order autocorrelation coefficient; n/a indicates unavailable data. The explanatory returns are the average premium for the common factors represented by Rm -Rf (returns to the market portfolio minus risk-free rate), SMB (small minus big), HML (high minus low), and MOM (winners minus losers).
8.2.3 Thailand

Table 8-3 shows that average excess SMB return for Thailand is 2.72% per quarter while the HML factor has average premium of 6.30% per quarter. The mean excess return for HML is higher than SMB, similar to Chen and Fang (2007). Also, trading strategies based on the value effect are more risky than the size effect given that the quarterly standard deviation of HML is almost double that for SMB. The average momentum excess return (MOM) is positive at 0.18% but there is a negative value (-1.88%) for average excess market return (Rm-Rf). The size-BTME portfolios for Thailand produce average excess returns from 6.40% to 1.83% per quarter. The industry excess mean returns show that the Oil & Gas sector has the highest value (4.47%) while the Consumer Services sector has the lowest value (-2.80%).

Table 8 - 3 Summary statistics for dependent and explanatory returns of the portfolios for Thailand

<table>
<thead>
<tr>
<th>Explanatory returns</th>
<th>Average</th>
<th>Std deviation</th>
<th>Minimum</th>
<th>Maximum</th>
<th>r1</th>
</tr>
</thead>
<tbody>
<tr>
<td>SMB</td>
<td>0.0272</td>
<td>0.0676</td>
<td>-0.1438</td>
<td>0.2447</td>
<td>0.0995</td>
</tr>
<tr>
<td>HML</td>
<td>0.0630</td>
<td>0.1169</td>
<td>-0.2165</td>
<td>0.4746</td>
<td>0.0696</td>
</tr>
<tr>
<td>MOM</td>
<td>0.0018</td>
<td>0.1096</td>
<td>-0.4569</td>
<td>0.1958</td>
<td>-0.0364</td>
</tr>
<tr>
<td>Rm -Rf</td>
<td>-0.0188</td>
<td>0.2048</td>
<td>-0.5910</td>
<td>0.5367</td>
<td>-0.1492</td>
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</table>

<table>
<thead>
<tr>
<th>Dependent returns</th>
<th>Average</th>
<th>Std deviation</th>
<th>Minimum</th>
<th>Maximum</th>
<th>r1</th>
</tr>
</thead>
<tbody>
<tr>
<td>Size-BTME</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>B/H</td>
<td>0.0053</td>
<td>0.2409</td>
<td>-0.7698</td>
<td>0.7768</td>
<td>-0.1354</td>
</tr>
<tr>
<td>B/M</td>
<td>-0.0235</td>
<td>0.1856</td>
<td>-0.4898</td>
<td>0.4609</td>
<td>-0.0746</td>
</tr>
<tr>
<td>B/L</td>
<td>-0.0538</td>
<td>0.1860</td>
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<td>0.0081</td>
</tr>
<tr>
<td>S/H</td>
<td>0.0183</td>
<td>0.1877</td>
<td>-0.4941</td>
<td>0.5937</td>
<td>-0.0419</td>
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<tr>
<td>S/M</td>
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<td>-0.0968</td>
</tr>
<tr>
<td>S/L</td>
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<td>-0.8203</td>
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<td>-0.0159</td>
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</table>

<table>
<thead>
<tr>
<th>Industry</th>
<th>Average</th>
<th>Std deviation</th>
<th>Minimum</th>
<th>Maximum</th>
<th>r1</th>
</tr>
</thead>
<tbody>
<tr>
<td>Oil &amp; Gas</td>
<td>0.0447</td>
<td>0.1823</td>
<td>-0.3564</td>
<td>0.7118</td>
<td>0.019</td>
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<td>Basic Materials</td>
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<td>0.6343</td>
<td>0.1205</td>
</tr>
<tr>
<td>Consumer Goods</td>
<td>0.0095</td>
<td>0.2443</td>
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<td>-0.143</td>
</tr>
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<td>-0.1267</td>
</tr>
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<td>-0.0014</td>
</tr>
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<td>Financial</td>
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<td>0.2689</td>
<td>-0.8635</td>
<td>0.7994</td>
<td>-0.1787</td>
</tr>
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<td>0.3189</td>
<td>-0.7472</td>
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<td>-0.1083</td>
</tr>
<tr>
<td>Health care</td>
<td>0.0024</td>
<td>0.1484</td>
<td>-0.3376</td>
<td>0.547</td>
<td>-0.0744</td>
</tr>
</tbody>
</table>

Note: In this table, the dependent returns indicate excess returns on size-BTME portfolios (B/H, B/M, B/L, S/M, and S/L). Size of firms is represented by B (big) and S (small) while book-to-market equity is represented by H (high), M (medium), and L (low). This includes excess returns on industry group portfolios; r1 is the first order autocorrelation coefficient. The explanatory returns are the average premium for the common factors represented by Rm -Rf (returns to the market portfolio minus risk-free rate), SMB (small minus big), HML (high minus low), and MOM (winners minus losers).

64 This pattern prevails in three out of four different horizons in their study.
65 Hameed and Kusnadi (2002) and Chen and Fang (2007) also find that the mean MOM returns for Thailand are not significant in their studies.
66 However, Chui and Wei (1998) find the highest mean excess return for S/L portfolio but the difference with S/H is small (2.79% versus 2.67%).
8.2.4 Indonesia

The results for Indonesia are given in Table 8-4. The average excess SMB return for Indonesia is 2.60% per quarter while for the HML factor it is 5.59% per quarter. The mean excess return for HML is higher than SMB. Chen and Fang (2007) find similar results in their three-quarter and four-quarter rebalancing horizons while SMB returns are bigger than HMLs for two-quarter and one-quarter rebalancing horizons. The average momentum excess return (MOM) is negative at -0.54%. The average excess market return (Rm-Rf) is also negative (-2.66%). The size-BTME portfolios for Indonesia produce consistent negative average excess returns per quarter, yet the largest average return remains in the S/H portfolio (-1.29%) and the lowest return occurs for the B/L portfolio (-8.13%). The industry excess mean returns show the Utilities sector to have the highest value (19.53%) while the Financial sector has the lowest value (-4.93%).

Table 8 - 4 Summary statistics for dependent and explanatory returns of the portfolios for Indonesia

<table>
<thead>
<tr>
<th>Explanatory returns</th>
<th>Average</th>
<th>Std deviation</th>
<th>Minimum</th>
<th>Maximum</th>
<th>r1</th>
</tr>
</thead>
<tbody>
<tr>
<td>SMB</td>
<td>0.0260</td>
<td>0.0671</td>
<td>-0.0921</td>
<td>0.3103</td>
<td>0.2256</td>
</tr>
<tr>
<td>HML</td>
<td>0.0559</td>
<td>0.0870</td>
<td>-0.1941</td>
<td>0.2909</td>
<td>-0.0333</td>
</tr>
<tr>
<td>MOM</td>
<td>-0.0054</td>
<td>0.1264</td>
<td>-0.4318</td>
<td>0.3952</td>
<td>-0.1138</td>
</tr>
<tr>
<td>Rm - Rf</td>
<td>-0.0266</td>
<td>0.1788</td>
<td>-0.5948</td>
<td>0.4383</td>
<td>-0.0182</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Dependent returns</th>
<th>Average</th>
<th>Std deviation</th>
<th>Minimum</th>
<th>Maximum</th>
<th>r1</th>
</tr>
</thead>
<tbody>
<tr>
<td>Size-BTME</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>B/H</td>
<td>-0.0258</td>
<td>0.2506</td>
<td>-0.7248</td>
<td>0.9770</td>
<td>-0.1340</td>
</tr>
<tr>
<td>B/M</td>
<td>-0.0484</td>
<td>0.1902</td>
<td>-0.5561</td>
<td>0.6226</td>
<td>0.0413</td>
</tr>
<tr>
<td>B/L</td>
<td>-0.0813</td>
<td>0.1683</td>
<td>-0.5959</td>
<td>0.3756</td>
<td>-0.0381</td>
</tr>
<tr>
<td>S/H</td>
<td>-0.0129</td>
<td>0.2176</td>
<td>-0.5349</td>
<td>0.9881</td>
<td>-0.1969</td>
</tr>
<tr>
<td>S/M</td>
<td>-0.0566</td>
<td>0.1784</td>
<td>-0.5137</td>
<td>0.7630</td>
<td>0.0068</td>
</tr>
<tr>
<td>S/L</td>
<td>-0.0755</td>
<td>0.2709</td>
<td>-0.7257</td>
<td>1.3771</td>
<td>-0.2109</td>
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</tbody>
</table>

<table>
<thead>
<tr>
<th>Industry</th>
<th>Average</th>
<th>Std deviation</th>
<th>Minimum</th>
<th>Maximum</th>
<th>r1</th>
</tr>
</thead>
<tbody>
<tr>
<td>Oil &amp; Gas</td>
<td>0.0097</td>
<td>0.1698</td>
<td>-0.4181</td>
<td>0.5738</td>
<td>0.0292</td>
</tr>
<tr>
<td>Basic Materials</td>
<td>-0.0372</td>
<td>0.2034</td>
<td>-0.5195</td>
<td>0.508</td>
<td>0.0023</td>
</tr>
<tr>
<td>Industrials</td>
<td>0.0402</td>
<td>0.1994</td>
<td>-0.3069</td>
<td>0.7113</td>
<td>0.4038</td>
</tr>
<tr>
<td>Consumer Goods</td>
<td>-0.0198</td>
<td>0.2181</td>
<td>-0.5584</td>
<td>0.7002</td>
<td>-0.1469</td>
</tr>
<tr>
<td>Consumer Services</td>
<td>-0.0272</td>
<td>0.241</td>
<td>-0.8481</td>
<td>0.8248</td>
<td>-0.1337</td>
</tr>
<tr>
<td>Telecom</td>
<td>n/a</td>
<td>n/a</td>
<td>n/a</td>
<td>n/a</td>
<td>n/a</td>
</tr>
<tr>
<td>Utilities</td>
<td>0.1953</td>
<td>0.2653</td>
<td>-0.235</td>
<td>0.4972</td>
<td>0.1272</td>
</tr>
<tr>
<td>Financial</td>
<td>-0.0493</td>
<td>0.2462</td>
<td>-0.661</td>
<td>0.5217</td>
<td>0.0766</td>
</tr>
<tr>
<td>Technology</td>
<td>n/a</td>
<td>n/a</td>
<td>n/a</td>
<td>n/a</td>
<td>n/a</td>
</tr>
<tr>
<td>Health care</td>
<td>-0.0024</td>
<td>0.2116</td>
<td>-0.5143</td>
<td>0.552</td>
<td>-0.1289</td>
</tr>
</tbody>
</table>

Note: In this table, the dependent returns indicate excess returns on size-BTME portfolios (B/H, B/M, B/L, S/M, and S/L). Size of firms is represented by B (big) and S (small) while book-to-market equity is represented by H (high), M (medium), and L (low). This includes excess returns on industry group portfolios; r1 is the first order autocorrelation coefficient; n/a indicates unavailable data. The explanatory returns are the average premium for the common factors represented by Rm-Rf (returns to the market portfolio minus risk-free rate), SMB (small minus big), HML (high minus low), and MOM (winners minus losers).
8.2.5 Philippines

The results for the Philippines are shown in Table 8-5. The average SMB return is -1.45% per quarter. The HML factor has an average premium of 6.25% per quarter and the mean excess return for HML is higher than SMB. Average momentum excess return (MOM) is 0.19% while the excess average market return, Rm-Rf, has a negative value of -1.88% per quarter. It is noted that for the Philippines, the size premium may not be as large as the value premium and that the results shows some support for momentum effects in this market. All of the six portfolios formed for the Philippines have negative average excess returns per quarter. It is noted that the lowest average excess return is for the S/L portfolio which is different from other ASEAN5 markets (B/L). Drew and Veeraraghavan (2003) record the highest mean excess (monthly) return in the S/M portfolio followed by the S/H portfolio. The small number of stocks available for the Philippines may contribute to this result. The average industry excess returns for the Philippines are generally negative, except for the Telecom sector.

Table 8 - 5 Summary statistics for dependent and explanatory returns of the portfolios for the Philippines

<table>
<thead>
<tr>
<th>Explanatory returns</th>
<th>Average</th>
<th>Std deviation</th>
<th>Minimum</th>
<th>Maximum</th>
<th>r1</th>
</tr>
</thead>
<tbody>
<tr>
<td>SMB</td>
<td>-0.0145</td>
<td>0.0768</td>
<td>-0.2315</td>
<td>0.1637</td>
<td>-0.0833</td>
</tr>
<tr>
<td>HML</td>
<td>0.0625</td>
<td>0.1205</td>
<td>-0.1319</td>
<td>0.7046</td>
<td>0.0333</td>
</tr>
<tr>
<td>MOM</td>
<td>0.0019</td>
<td>0.1005</td>
<td>-0.2637</td>
<td>0.2320</td>
<td>0.0687</td>
</tr>
<tr>
<td>Rm –Rf</td>
<td>-0.0188</td>
<td>0.1821</td>
<td>-0.5358</td>
<td>0.4680</td>
<td>-0.0052</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Dependent returns</th>
<th>Average</th>
<th>Std deviation</th>
<th>Minimum</th>
<th>Maximum</th>
<th>r1</th>
</tr>
</thead>
<tbody>
<tr>
<td>Size-BTME</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>B/H</td>
<td>-0.0017</td>
<td>0.1866</td>
<td>-0.5528</td>
<td>0.3986</td>
<td>0.0067</td>
</tr>
<tr>
<td>B/M</td>
<td>-0.0147</td>
<td>0.1445</td>
<td>-0.3966</td>
<td>0.2533</td>
<td>-0.1224</td>
</tr>
<tr>
<td>B/L</td>
<td>-0.0484</td>
<td>0.1338</td>
<td>-0.4385</td>
<td>0.2852</td>
<td>0.0965</td>
</tr>
<tr>
<td>S/H</td>
<td>-0.0177</td>
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<td>-0.1110</td>
</tr>
<tr>
<td>S/M</td>
<td>-0.0687</td>
<td>0.1796</td>
<td>-0.5721</td>
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<td>0.0806</td>
</tr>
<tr>
<td>S/L</td>
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<td>0.1559</td>
<td>-0.4799</td>
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<td>0.0560</td>
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<table>
<thead>
<tr>
<th>Industry</th>
<th>Average</th>
<th>Std deviation</th>
<th>Minimum</th>
<th>Maximum</th>
<th>r1</th>
</tr>
</thead>
<tbody>
<tr>
<td>Oil &amp; Gas</td>
<td>-0.0406</td>
<td>0.2374</td>
<td>-0.5934</td>
<td>0.5316</td>
<td>-0.1241</td>
</tr>
<tr>
<td>Basic Materials</td>
<td>-0.0342</td>
<td>0.3363</td>
<td>-1.0191</td>
<td>0.8778</td>
<td>0.0923</td>
</tr>
<tr>
<td>Industrials</td>
<td>-0.0212</td>
<td>0.2483</td>
<td>-0.7553</td>
<td>0.8784</td>
<td>-0.1989</td>
</tr>
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<td>Consumer Goods</td>
<td>-0.0065</td>
<td>0.1747</td>
<td>-0.626</td>
<td>0.5497</td>
<td>0.0665</td>
</tr>
<tr>
<td>Consumer Services</td>
<td>-0.0251</td>
<td>0.2092</td>
<td>-0.5697</td>
<td>0.5774</td>
<td>0.0754</td>
</tr>
<tr>
<td>Telecom</td>
<td>0.0054</td>
<td>0.1874</td>
<td>-0.4152</td>
<td>0.4453</td>
<td>0.0439</td>
</tr>
<tr>
<td>Utilities</td>
<td>-0.0047</td>
<td>0.2420</td>
<td>-0.8179</td>
<td>0.6496</td>
<td>0.0315</td>
</tr>
<tr>
<td>Financial</td>
<td>-0.0058</td>
<td>0.1653</td>
<td>-0.4286</td>
<td>0.4157</td>
<td>0.1121</td>
</tr>
<tr>
<td>Technology</td>
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<td>n/a</td>
<td>n/a</td>
<td>n/a</td>
<td>n/a</td>
</tr>
<tr>
<td>Health care</td>
<td>n/a</td>
<td>n/a</td>
<td>n/a</td>
<td>n/a</td>
<td>n/a</td>
</tr>
</tbody>
</table>

Note: In this table, the dependent returns indicate excess returns on size-BTME portfolios (B/H, B/M, B/L, S/M, and S/L). Size of firms is represented by B (big) and S (small) while book-to-market equity is represented by H (high), M (medium), and L (low). This includes excess returns on industry group portfolios; r1 is the first order autocorrelation coefficient; n/a indicates unavailable data. The explanatory returns are the average premium for the common factors represented by Rm -Rf (returns to the market portfolio minus risk-free rate), SMB (small minus big), HML (high minus low), and MOM (winners minus losers).
8.2.6 Correlation matrix

The correlation coefficients for the explanatory variables presented in Table 8-6 shows that the correlations between explanatory variables are relatively low, although there are two cases where the correlation coefficients are more than 0.50 (in absolute value) found for Thailand. In general, the results suggest that multicollinearity is not a problem for the regression models to work.

Table 8 - 6 Correlation for explanatory variables of the regression models

<table>
<thead>
<tr>
<th>Panel A: Malaysia</th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Rm-Rf</td>
<td>SMB</td>
<td>HML</td>
</tr>
<tr>
<td>SMB</td>
<td>0.3932</td>
<td>0.0488</td>
<td></td>
</tr>
<tr>
<td>HML</td>
<td>0.2616</td>
<td></td>
<td>-0.3316</td>
</tr>
<tr>
<td>MOM</td>
<td>-0.2362</td>
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<td>-0.0595</td>
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</table>

<table>
<thead>
<tr>
<th>Panel B: Singapore</th>
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<th></th>
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</thead>
<tbody>
<tr>
<td></td>
<td>Rm-Rf</td>
<td>SMB</td>
<td>HML</td>
</tr>
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<td>SMB</td>
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<td>MOM</td>
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<td>0.0923</td>
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</table>

<table>
<thead>
<tr>
<th>Panel C: Thailand</th>
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<th></th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Rm-Rf</td>
<td>SMB</td>
<td>HML</td>
</tr>
<tr>
<td>SMB</td>
<td>-0.5268</td>
<td></td>
<td></td>
</tr>
<tr>
<td>HML</td>
<td>-0.0084</td>
<td>0.5053</td>
<td></td>
</tr>
<tr>
<td>MOM</td>
<td>-0.1282</td>
<td>-0.2353</td>
<td>-0.3373</td>
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</table>

<table>
<thead>
<tr>
<th>Panel D: Indonesia</th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Rm-Rf</td>
<td>SMB</td>
<td>HML</td>
</tr>
<tr>
<td>SMB</td>
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<td></td>
<td></td>
</tr>
<tr>
<td>HML</td>
<td>0.1548</td>
<td>0.3467</td>
<td></td>
</tr>
<tr>
<td>MOM</td>
<td>-0.3118</td>
<td>-0.1819</td>
<td>-0.0868</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Panel E: Philippines</th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Rm-Rf</td>
<td>SMB</td>
<td>HML</td>
</tr>
<tr>
<td>SMB</td>
<td>-0.0294</td>
<td></td>
<td></td>
</tr>
<tr>
<td>HML</td>
<td>-0.0936</td>
<td>0.2805</td>
<td></td>
</tr>
<tr>
<td>MOM</td>
<td>0.0491</td>
<td>0.1001</td>
<td>-0.1926</td>
</tr>
</tbody>
</table>

Note: The explanatory return variables are the average premium for the common factors represented by Rm -Rf (returns to the market portfolio minus risk-free rate), SMB (small minus big), HML (high minus low), and MOM (winners minus losers).
8.3 Regression analysis

Regression analysis is used to examine the performance of CAPM and the four-factor model (Carhart, 1997) for ASEAN5 stock markets. Results from tests of the CAPM and four-factor model using the six size-BTME portfolios excess returns are presented in this section.

8.3.1 Malaysia

Table 8-7 reports the CAPM regression parameters for Malaysia. The results show that the intercept (a) is not statistically different from zero for all portfolios except for B/L at the 5% level. The overall market factor, $\beta$, is statistically significant for all portfolios and they are greater than 1, consistent with Drew and Veeraraghavan (2002, 2003), and Chen and Fang (2007). The adjusted $R^2$ is from 0.6994 to 0.8672 with average value of 0.7819.

For industry excess returns, the intercept ($\alpha$) is statistically significantly different from zero for Consumer Services and Financial sectors. The $\beta$-coefficient varies between 0.7143 and 1.2136 while adjusted $R^2$ exhibit higher variation than for the six size-BTME portfolios. The average $R^2$ value is 0.7174.

There are problems with missing data in these analyses and this is particularly evident when comparing the size-BTME portfolio betas with industry portfolio betas. The size-BTME portfolios seem to focus on higher beta stocks as each of the portfolio betas exceed one. This missing data problem is not as severe for the industry portfolios. This effect is evident for most of the analyses that follow.
Table 8 - 7 Regression analysis of the CAPM for Malaysia

\[ CAPM: R_i - R_f = \alpha + \beta (R_m - R_f) + e_i \]

<table>
<thead>
<tr>
<th>Size-BTME portfolios</th>
<th>( \alpha )</th>
<th>( t(\alpha) )</th>
<th>( \beta )</th>
<th>( t(\beta) )</th>
<th>( \text{Adj } R^2 )</th>
<th>( SE )</th>
</tr>
</thead>
<tbody>
<tr>
<td>B/H</td>
<td>-0.0064</td>
<td>-0.5265</td>
<td>1.2336*</td>
<td>16.5304</td>
<td>0.8025</td>
<td>0.0967</td>
</tr>
<tr>
<td>B/M</td>
<td>-0.0098</td>
<td>-1.1108</td>
<td>1.1417*</td>
<td>20.8889</td>
<td>0.8672</td>
<td>0.0708</td>
</tr>
<tr>
<td>B/L</td>
<td>-0.0246*</td>
<td>-2.8337</td>
<td>1.0062*</td>
<td>18.7677</td>
<td>0.8402</td>
<td>0.0694</td>
</tr>
<tr>
<td>S/H</td>
<td>0.0093</td>
<td>0.5927</td>
<td>1.3696*</td>
<td>14.2004</td>
<td>0.7489</td>
<td>0.1249</td>
</tr>
<tr>
<td>S/M</td>
<td>-0.0031</td>
<td>-0.1999</td>
<td>1.2974*</td>
<td>13.6421</td>
<td>0.7332</td>
<td>0.1232</td>
</tr>
<tr>
<td>S/L</td>
<td>-0.0320*</td>
<td>-1.7580</td>
<td>1.4140*</td>
<td>12.5795</td>
<td>0.6994</td>
<td>0.1456</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Industry portfolios</th>
<th>( \alpha )</th>
<th>( t(\alpha) )</th>
<th>( \beta )</th>
<th>( t(\beta) )</th>
<th>( \text{Adj } R^2 )</th>
<th>( SE )</th>
</tr>
</thead>
<tbody>
<tr>
<td>Oil &amp; Gas</td>
<td>0.0041</td>
<td>0.4147</td>
<td>0.7143*</td>
<td>11.5907</td>
<td>0.6628</td>
<td>0.0798</td>
</tr>
<tr>
<td>Basic Mats</td>
<td>-0.0043</td>
<td>-0.4301</td>
<td>1.0840*</td>
<td>17.4468</td>
<td>0.8193</td>
<td>0.0805</td>
</tr>
<tr>
<td>Industrials</td>
<td>0.0014</td>
<td>0.1421</td>
<td>0.9730*</td>
<td>15.7979</td>
<td>0.7875</td>
<td>0.0798</td>
</tr>
<tr>
<td>Consumer Goods</td>
<td>0.0028*</td>
<td>0.1935</td>
<td>0.9812*</td>
<td>10.9922</td>
<td>0.6379</td>
<td>0.1156</td>
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<tr>
<td>Consumer Services</td>
<td>0.0144*</td>
<td>2.4404</td>
<td>0.9354*</td>
<td>25.7020</td>
<td>0.9084</td>
<td>0.0471</td>
</tr>
<tr>
<td>Telecom</td>
<td>0.0145</td>
<td>1.0893</td>
<td>1.0113*</td>
<td>12.2669</td>
<td>0.6884</td>
<td>0.1068</td>
</tr>
<tr>
<td>Utilities</td>
<td>0.0009</td>
<td>0.0919</td>
<td>0.8940*</td>
<td>15.2418</td>
<td>0.7994</td>
<td>0.0730</td>
</tr>
<tr>
<td>Financial</td>
<td>0.0183*</td>
<td>2.5807</td>
<td>1.2136*</td>
<td>27.7437</td>
<td>0.9204</td>
<td>0.0567</td>
</tr>
<tr>
<td>Technology</td>
<td>-0.0462</td>
<td>-1.0810</td>
<td>1.0664*</td>
<td>3.7819</td>
<td>0.2322</td>
<td>0.2315</td>
</tr>
<tr>
<td>Health care</td>
<td>n/a</td>
<td>n/a</td>
<td>n/a</td>
<td>n/a</td>
<td>n/a</td>
<td>n/a</td>
</tr>
</tbody>
</table>

Note: In this table, the dependent returns indicate excess returns on B/H, B/M, B/L, S/M, and S/L − six portfolio combinations formed from size and book-to-market equity. Size of firms is represented by B (big) and S (small) while book-to-market equity is represented by H (high), M (medium), and L (low); \( \alpha \) is the intercept and \( \beta \) is the slope coefficient for \( R_m - R_f \); \( \text{Adj } R^2 \) is the adjusted value of \( R^2 \); SE is the standard error; \( t() \) indicates the t-statistics with * represents 5% level of significance (critical value = 1.980) while + represents 10% level of significance (critical value = 1.658); n/a indicates unavailable data.

Table 8-8 shows the time series regression results for the four-factor model of six size-BTME portfolios. The intercepts for the six portfolios are small but statistically significant. Negative intercepts are also found by Chen and Fang (2007) where some of them are also significant.\(^{67}\) The market betas are all positive and statistically significant consistent with Chen and Fang (2007).

Table 8 - 8 Regression analysis of the four-factor model for Malaysia

\[ R_i - R_f = \alpha + \beta (R_m - R_f) + sSMB_t + hHML_t + mMOM_t + e_t \]

<table>
<thead>
<tr>
<th>Size-BTME portfolios</th>
<th>( \alpha )</th>
<th>( t(\alpha) )</th>
<th>( \beta )</th>
<th>( t(\beta) )</th>
<th>( s )</th>
<th>( t(s) )</th>
<th>( h )</th>
<th>( t(h) )</th>
<th>( m )</th>
<th>( t(m) )</th>
<th>Adj ( R^2 )</th>
<th>SE</th>
</tr>
</thead>
<tbody>
<tr>
<td>B/H</td>
<td>-0.0316*</td>
<td>-2.9777</td>
<td>1.0450*</td>
<td>15.9768</td>
<td>0.3559*</td>
<td>3.0373</td>
<td>0.6315*</td>
<td>4.0138</td>
<td>-0.4402*</td>
<td>-3.3667</td>
<td>0.8887</td>
<td>0.0750</td>
</tr>
<tr>
<td>B/M</td>
<td>-0.0192*</td>
<td>-2.1775</td>
<td>1.0383*</td>
<td>19.1070</td>
<td>0.2550*</td>
<td>2.6193</td>
<td>0.1615</td>
<td>1.2358</td>
<td>-0.2929*</td>
<td>-2.6962</td>
<td>0.9037</td>
<td>0.0623</td>
</tr>
<tr>
<td>B/L</td>
<td>-0.0208*</td>
<td>-2.4741</td>
<td>0.9484*</td>
<td>18.2663</td>
<td>0.2887*</td>
<td>3.1043</td>
<td>-0.2859*</td>
<td>-2.2896</td>
<td>-0.2203*</td>
<td>-2.1226</td>
<td>0.8900</td>
<td>0.0595</td>
</tr>
<tr>
<td>S/H</td>
<td>-0.0243*</td>
<td>-2.3703</td>
<td>1.0475*</td>
<td>16.5936</td>
<td>1.0006*</td>
<td>8.8477</td>
<td>0.6391*</td>
<td>4.2087</td>
<td>-0.3797*</td>
<td>-3.0090</td>
<td>0.9211</td>
<td>0.0724</td>
</tr>
<tr>
<td>S/M</td>
<td>-0.0292*</td>
<td>-2.9292</td>
<td>0.9944*</td>
<td>16.1721</td>
<td>1.0998*</td>
<td>9.9837</td>
<td>0.3634*</td>
<td>2.4570</td>
<td>-0.2620*</td>
<td>-2.1313</td>
<td>0.9182</td>
<td>0.0705</td>
</tr>
<tr>
<td>S/L</td>
<td>-0.0453*</td>
<td>-3.6231</td>
<td>1.1183*</td>
<td>14.5143</td>
<td>1.1714*</td>
<td>8.4866</td>
<td>-0.1395</td>
<td>-0.7530</td>
<td>-0.5157*</td>
<td>-3.3489</td>
<td>0.8964</td>
<td>0.0884</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Industry</th>
<th>( \alpha )</th>
<th>( t(\alpha) )</th>
<th>( \beta )</th>
<th>( t(\beta) )</th>
<th>( s )</th>
<th>( t(s) )</th>
<th>( h )</th>
<th>( t(h) )</th>
<th>( m )</th>
<th>( t(m) )</th>
<th>Adj ( R^2 )</th>
<th>SE</th>
</tr>
</thead>
<tbody>
<tr>
<td>Oil &amp; Gas</td>
<td>0.0047</td>
<td>0.4260</td>
<td>0.7055*</td>
<td>10.3326</td>
<td>-0.1111</td>
<td>-0.9086</td>
<td>-0.0173</td>
<td>-0.1052</td>
<td>-0.3157*</td>
<td>-2.3130</td>
<td>0.6963</td>
<td>0.0783</td>
</tr>
<tr>
<td>Basic Materials</td>
<td>-0.0150</td>
<td>-1.3671</td>
<td>0.9957*</td>
<td>14.7430</td>
<td>0.2544*</td>
<td>2.1023</td>
<td>0.2353</td>
<td>1.4487</td>
<td>-0.0882</td>
<td>-0.6536</td>
<td>0.8434</td>
<td>0.0775</td>
</tr>
<tr>
<td>Industrials</td>
<td>-0.0090</td>
<td>-0.8092</td>
<td>0.9184*</td>
<td>13.4063</td>
<td>0.1698</td>
<td>1.3834</td>
<td>0.2926*</td>
<td>1.7759</td>
<td>0.1049</td>
<td>0.7662</td>
<td>0.8072</td>
<td>0.0786</td>
</tr>
<tr>
<td>Consumer Goods</td>
<td>0.0111</td>
<td>0.7560</td>
<td>0.9277*</td>
<td>10.2755</td>
<td>0.1498</td>
<td>0.9261</td>
<td>-0.4311*</td>
<td>-1.9855</td>
<td>-0.5891*</td>
<td>-3.2646</td>
<td>0.7283</td>
<td>0.1035</td>
</tr>
<tr>
<td>Consumer Services</td>
<td>0.0199*</td>
<td>3.2311</td>
<td>0.9940*</td>
<td>26.2127</td>
<td>-0.2425*</td>
<td>-3.5698</td>
<td>-0.0821</td>
<td>-0.8998</td>
<td>-0.0194</td>
<td>-0.2556</td>
<td>0.9270</td>
<td>0.0435</td>
</tr>
<tr>
<td>Telecom</td>
<td>0.0252*</td>
<td>1.7847</td>
<td>1.1377*</td>
<td>13.0455</td>
<td>-0.3665*</td>
<td>-2.3461</td>
<td>-0.1592</td>
<td>-0.7589</td>
<td>0.2847</td>
<td>1.6333</td>
<td>0.7442</td>
<td>0.1000</td>
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<tr>
<td>Utilities</td>
<td>-0.0002</td>
<td>-0.0209</td>
<td>0.9545*</td>
<td>14.3592</td>
<td>-0.1100</td>
<td>-0.9738</td>
<td>0.0754</td>
<td>0.4279</td>
<td>0.3352*</td>
<td>2.7081</td>
<td>0.8388</td>
<td>0.0680</td>
</tr>
<tr>
<td>Financial</td>
<td>0.0098</td>
<td>1.4420</td>
<td>1.1235*</td>
<td>26.7717</td>
<td>0.2105*</td>
<td>2.8001</td>
<td>0.1551</td>
<td>1.5362</td>
<td>-0.2655*</td>
<td>-3.1649</td>
<td>0.9453</td>
<td>0.0481</td>
</tr>
<tr>
<td>Technology</td>
<td>-0.0115</td>
<td>-0.2269</td>
<td>1.2276*</td>
<td>3.4257</td>
<td>-0.2410</td>
<td>-0.3268</td>
<td>-1.5391</td>
<td>-1.3882</td>
<td>-1.1753*</td>
<td>-1.6789</td>
<td>0.3541</td>
<td>0.2247</td>
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<td>Health care</td>
<td>n/a</td>
<td>n/a</td>
<td>n/a</td>
<td>n/a</td>
<td>n/a</td>
<td>n/a</td>
<td>n/a</td>
<td>n/a</td>
<td>n/a</td>
<td>n/a</td>
<td>n/a</td>
<td>n/a</td>
</tr>
</tbody>
</table>

Note: In this table, the dependent returns indicate excess returns on B/H, B/M, B/L, S/M, and S/L − six portfolio combinations formed from size and book-to-market equity. Size of firms is represented by B (big) and S (small) while book-to-market equity is represented by H (high), M (medium), and L (low); \( \alpha \) is the intercept; \( \beta, s, h, \) and \( m \) are the slopes for \( Rm-Rf, SMB, HML, \) and MOM respectively.; Adj \( R^2 \) is the adjusted value of \( R^2 \); SE is the standard error; \( t() \) indicates the t-statistics with * represents 5% level of significance (critical value = 1.980) while + represents 10% level of significance (critical value = 1.658); n/a indicates unavailable data.
As indicated by Shum and Tang (2005), the results show no clear relation between market beta and size effect because the S/H portfolio has the highest average return yet, the highest beta in this regression belongs to the S/L portfolio.

It is interesting to note the diminishing pattern for the $s$-coefficients on SMB from small portfolios to big portfolios. The average coefficient for big size portfolios is 0.30 while the average coefficient for small size is much larger at 1.09 yet, they are all statistically significant. The slopes on HML, $h$, produce negative coefficients for the B/L and S/L portfolios. This is probably driven by low-BTME. Two of the portfolios do not have significant coefficients (B/M and S/L). The $h$-coefficients increase monotonically from negative to positive when moving from low-BTME to high-BTME. The size effect appears to be more prominent for Malaysia than the value effect, given that the $s$-coefficients range from 0.2550 to 1.1714 to while the $h$-coefficients ranging from -0.2859 to 0.6391. These results are consistent with Fama and French (1993), Drew and Veeraraghavan (2002, 2003), and Chen and Fang (2007). The $m$-coefficients on MOM for the six portfolios are negative with significant t-statistics. This finding gives support to momentum effects on size-BTME portfolios for Malaysia. This is consistent with Chen and Fang (2007) who record negative momentum coefficients for Malaysia in their study. However, this result is not consistent with Hameed and Kusnadi (2002) or McInish et al. (2008), who find no evidence of momentum effects in the Malaysian market. The differences in results are probably due to different time period, data and methodology used in calculating the momentum returns.

Overall, the four-factor model is better at explaining the variation in size-BTME portfolio returns for Malaysian companies than the CAPM, as can be seen from the average adjusted $R^2$ value. The CAPM regression generates average $R^2$ of 0.7819 while the four-factor model has average $R^2$ of 0.9030, which implies that the dependent variables of the four-factor model explains 90.30% of the variation in of average size-BTME portfolio returns compared to 78.19% by the CAPM.

The $\alpha$-coefficients for industry portfolio returns consist of positive and negative values, ranging from -0.0115 to 0.0252. There are only two significant

---

*Chen and Fang (2007) find negative and statistically significant momentum coefficients for 4-quarter rebalancing horizon and negative but not significant coefficients for 1-quarter rebalancing horizon. Further, in averaging the regressions, they find that the average momentum coefficient is negative and 18 of the 27 regressions are statistically significant from zero.*
intercepts, Consumer Services (5% level) and Telecom (10% level). The $\beta$-coefficients are close to one and both the $s$-coefficients and $h$-coefficients exhibit positive and negative values. In general, for Malaysian industry excess returns, the size effect is more prominent than value effect. There are four significant $s$-coefficients and two significant $h$-coefficients. For momentum effects, only the Utilities sector has a positive and significant $m$-coefficient.

The adjusted $R^2$ for the industry-based four-factor models ranges between 0.3541 and 0.9453 with an average $R^2$ of 0.7650, which is higher than 0.7174 as exhibited for the CAPM model. Certainly, the explanatory power of the four-factor model varies across industries. Overall, the results for the CAPM and the four-factor model for Malaysian firms suggest that the latter explains the average excess returns better than the traditional CAPM.

8.3.2 Singapore

In Table 8-9, results for the CAPM regression parameters for Singapore show that the intercepts ($\alpha$) are statistically different from zero for all portfolios except for B/H and S/H portfolios. The overall market factor, $\beta$, is statistically significant for all portfolios and they are greater than 1. For industry excess returns, the intercepts are not statistically significant except for Technology (at the 10% level) and the $\beta$-coefficients show higher variation but they are statistically significantly different from zeros.
Table 8 - 9 Regression analysis of the CAPM for Singapore

\[ CAPM: R_i - R_f = \alpha + \beta [R_m - R_f] + \epsilon, \]

<table>
<thead>
<tr>
<th>Size-BTME portfolios</th>
<th>(\alpha)</th>
<th>(t(\alpha))</th>
<th>(\beta)</th>
<th>(t(\beta))</th>
<th>Adj (R^2)</th>
<th>SE</th>
</tr>
</thead>
<tbody>
<tr>
<td>B/H</td>
<td>0.0029</td>
<td>0.3871</td>
<td>1.1609*</td>
<td>22.3441</td>
<td>0.8895</td>
<td>0.0598</td>
</tr>
<tr>
<td>B/M</td>
<td>-0.0168*</td>
<td>-1.9001</td>
<td>1.1333*</td>
<td>18.4698</td>
<td>0.8462</td>
<td>0.0706</td>
</tr>
<tr>
<td>B/L</td>
<td>-0.0281*</td>
<td>-3.1814</td>
<td>1.0495*</td>
<td>17.1013</td>
<td>0.8251</td>
<td>0.0706</td>
</tr>
<tr>
<td>S/H</td>
<td>-0.0042</td>
<td>-0.2744</td>
<td>1.3411*</td>
<td>12.5301</td>
<td>0.7169</td>
<td>0.1231</td>
</tr>
<tr>
<td>S/M</td>
<td>-0.0263*</td>
<td>-1.7639</td>
<td>1.2621*</td>
<td>12.2018</td>
<td>0.7060</td>
<td>0.1190</td>
</tr>
<tr>
<td>S/L</td>
<td>-0.0406*</td>
<td>-2.4869</td>
<td>1.2587*</td>
<td>11.0963</td>
<td>0.6651</td>
<td>0.1305</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Industry portfolios</th>
<th>(\alpha)</th>
<th>(t(\alpha))</th>
<th>(\beta)</th>
<th>(t(\beta))</th>
<th>Adj (R^2)</th>
<th>SE</th>
</tr>
</thead>
<tbody>
<tr>
<td>Oil &amp; Gas</td>
<td>0.0023</td>
<td>0.1299</td>
<td>1.0395*</td>
<td>8.1153</td>
<td>0.5275</td>
<td>0.1397</td>
</tr>
<tr>
<td>Basic Mats</td>
<td>0.0029</td>
<td>0.1634</td>
<td>1.2995*</td>
<td>10.4132</td>
<td>0.6362</td>
<td>0.1436</td>
</tr>
<tr>
<td>Industrials</td>
<td>0.0021</td>
<td>0.2679</td>
<td>0.8379*</td>
<td>15.4968</td>
<td>0.7948</td>
<td>0.0622</td>
</tr>
<tr>
<td>Consumer Goods</td>
<td>0.0080</td>
<td>0.4910</td>
<td>1.3135*</td>
<td>11.6691</td>
<td>0.6871</td>
<td>0.1295</td>
</tr>
<tr>
<td>Consumer Services</td>
<td>0.0057</td>
<td>1.0089</td>
<td>0.8755*</td>
<td>22.4938</td>
<td>0.8908</td>
<td>0.0448</td>
</tr>
<tr>
<td>Telecom</td>
<td>-0.0049</td>
<td>-0.2974</td>
<td>0.2184*</td>
<td>1.8990</td>
<td>0.0713</td>
<td>0.1157</td>
</tr>
<tr>
<td>Utilities</td>
<td>n/a</td>
<td>n/a</td>
<td>n/a</td>
<td>n/a</td>
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<tr>
<td>Financial</td>
<td>0.0068</td>
<td>1.5611</td>
<td>1.1224*</td>
<td>37.0766</td>
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<td>0.0348</td>
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<tr>
<td>Technology</td>
<td>-0.0296</td>
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<td>0.7289</td>
<td>0.0664</td>
</tr>
</tbody>
</table>

Note: In this table, the dependent returns indicate excess returns on B/H, B/M, B/L, S/M, and S/L – six portfolio combinations formed from size and book-to-market equity. Size of firms is represented by B (big) and S (small) while book-to-market equity is represented by H (high), M (medium), and L (low); \(\alpha\) is the intercept and \(\beta\) is the slope coefficient for \(R_m - R_f\); Adj \(R^2\) is the adjusted value of \(R^2\); SE is the standard error; \(t()\) indicates the t-statistics with * represents 5% level of significance (critical value = 1.980) while + represents 10% level of significance (critical value = 1.680); n/a indicates unavailable data.

Table 8-10 represents the time series regression results for the four-factor model for Singapore. The results for size-BTME portfolios find negative intercepts in five of the six portfolios though none of them is significant. The market betas are positive, statistically significant and greater than 1. It is noted that a diminishing pattern exists for the \(s\)-coefficients on SMB from small to big portfolios, similar to Malaysia. The \(h\)-coefficients are negative except for two of the high BTME portfolios (B/H and S/H), reflecting that high value stocks out-performed low value stocks, consistent with Fama and French (1993). Yet, in general size effect is more prominent than value effect for the Singapore market. These results are consistent with Shum and Tang (2005) and Chen and Fang (2007).

In contrast to Malaysia, the \(m\)-coefficients for Singapore are positive and three of them are significant at the 10% level. Positive but insignificant momentum slopes are recorded in Hameed and Kusnadi (2002), while negative slopes are found in Chen and Fang (2007) where 14 of 27 coefficients are significant. The results thus suggest that momentum effects are not persistent in the stock market of Singapore, in line with
previous studies including those by Hameed and Kusnadi (2002) and McInish et al. (2008).

The results for industry excess portfolio returns indicate that most of the $\alpha$-coefficients are positive but not significantly different from zero. The $\beta$-coefficients on average are lower than those evident for the size-BTME portfolios. It is noted that the Financial and Consumer Services sectors are sensitive to size, value and momentum effects while the Oil & Gas, Telecom and Health Care sectors are not sensitive to any of the factors.
Table 8 - 10 Regression analysis of the four-factor model for Singapore

\[ R_{it} - R_{ft} = \alpha + \beta[Rm_t - Rf_t] + sSMB_t + hHML_t + mMOM_t + \epsilon_t \]

<table>
<thead>
<tr>
<th>Size-BTME portfolios</th>
<th>( \alpha )</th>
<th>( t(\alpha) )</th>
<th>( \beta )</th>
<th>( t(\beta) )</th>
<th>( s )</th>
<th>( t(s) )</th>
<th>( h )</th>
<th>( t(h) )</th>
<th>( m )</th>
<th>( t(m) )</th>
<th>( Adj \ R^2 )</th>
<th>SE</th>
</tr>
</thead>
<tbody>
<tr>
<td>B/H</td>
<td>0.0007</td>
<td>0.0951</td>
<td>1.1117*</td>
<td>21.5804</td>
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<td>4.0962</td>
<td>0.1618</td>
<td>1.3962</td>
<td>0.0836</td>
<td>1.0917</td>
<td>0.91958</td>
<td>0.0510</td>
</tr>
<tr>
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<td>0.3496*</td>
<td>3.4866</td>
<td>-0.1580</td>
<td>-1.0635</td>
<td>0.0495</td>
<td>0.5035</td>
<td>0.86803</td>
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</tr>
<tr>
<td>B/L</td>
<td>-0.0009</td>
<td>-0.1139</td>
<td>1.1343*</td>
<td>21.4486</td>
<td>0.2973*</td>
<td>3.7032</td>
<td>-0.7857*</td>
<td>-6.6040</td>
<td>0.1347+</td>
<td>1.7130</td>
<td>0.90381</td>
<td>0.0524</td>
</tr>
<tr>
<td>S/H</td>
<td>-0.0010</td>
<td>-0.1081</td>
<td>1.1719*</td>
<td>19.0704</td>
<td>1.2006*</td>
<td>12.8688</td>
<td>0.2421+</td>
<td>1.7515</td>
<td>0.1372</td>
<td>1.5015</td>
<td>0.93089</td>
<td>0.0609</td>
</tr>
<tr>
<td>S/M</td>
<td>-0.0064</td>
<td>-0.6974</td>
<td>1.1705*</td>
<td>18.3284</td>
<td>1.1850*</td>
<td>12.2225</td>
<td>-0.2929*</td>
<td>-2.0386</td>
<td>0.1747+</td>
<td>1.8395</td>
<td>0.91701</td>
<td>0.0632</td>
</tr>
<tr>
<td>S/L</td>
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<td>-0.3754</td>
<td>1.2205*</td>
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<td>1.2881*</td>
<td>12.7837</td>
<td>-0.8113*</td>
<td>-5.4337</td>
<td>0.1787+</td>
<td>1.8099</td>
<td>0.91510</td>
<td>0.0657</td>
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<tr>
<td>Industry portfolios</td>
<td>( \alpha )</td>
<td>( t(\alpha) )</td>
<td>( \beta )</td>
<td>( t(\beta) )</td>
<td>( s )</td>
<td>( t(s) )</td>
<td>( h )</td>
<td>( t(h) )</td>
<td>( m )</td>
<td>( t(m) )</td>
<td>( Adj \ R^2 )</td>
<td>SE</td>
</tr>
<tr>
<td>Oil &amp; Gas</td>
<td>-0.0076</td>
<td>-0.3569</td>
<td>1.0460*</td>
<td>6.7000</td>
<td>-0.0340</td>
<td>-0.1565</td>
<td>0.2875</td>
<td>0.8271</td>
<td>0.2200</td>
<td>1.0203</td>
<td>0.52798</td>
<td>0.1396</td>
</tr>
<tr>
<td>Basic Mats</td>
<td>0.0278</td>
<td>1.4484</td>
<td>1.2645*</td>
<td>9.4622</td>
<td>0.5816*</td>
<td>2.8666</td>
<td>-0.6227*</td>
<td>-2.0712</td>
<td>-0.2021</td>
<td>-1.0170</td>
<td>0.69109</td>
<td>0.1323</td>
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<tr>
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<td>-0.0011</td>
<td>-0.0121</td>
<td>-0.4295*</td>
<td>-3.2284</td>
<td>0.1657+</td>
<td>1.8842</td>
<td>0.81823</td>
<td>0.0586</td>
</tr>
<tr>
<td>Consumer Goods</td>
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<td>0.9789</td>
<td>1.3545*</td>
<td>11.5575</td>
<td>0.4773*</td>
<td>2.6824</td>
<td>-0.1408</td>
<td>-0.5341</td>
<td>0.4891*</td>
<td>2.8057</td>
<td>0.74883</td>
<td>0.1161</td>
</tr>
<tr>
<td>Consumer Services</td>
<td>0.0126*</td>
<td>2.0466</td>
<td>0.8994*</td>
<td>20.9578</td>
<td>0.1429*</td>
<td>2.1927</td>
<td>-0.1826*</td>
<td>-1.8917</td>
<td>0.1106+</td>
<td>1.7332</td>
<td>0.90172</td>
<td>0.0425</td>
</tr>
<tr>
<td>Telecom</td>
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<td>-0.0409</td>
<td>0.2646+</td>
<td>1.7658+</td>
<td>-0.0014</td>
<td>-0.0074</td>
<td>-0.0943</td>
<td>-0.2746</td>
<td>0.1467</td>
<td>0.7430</td>
<td>0.02205</td>
<td>0.1188</td>
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<tr>
<td>Utilities</td>
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<td>n/a</td>
<td>n/a</td>
<td>n/a</td>
<td>n/a</td>
<td>n/a</td>
<td>n/a</td>
<td>n/a</td>
<td>n/a</td>
<td>n/a</td>
<td>n/a</td>
<td>n/a</td>
</tr>
<tr>
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<td>-0.0020</td>
<td>-0.4291</td>
<td>1.0858*</td>
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<td>-0.0996*</td>
<td>-2.0623</td>
<td>0.2524*</td>
<td>3.5270</td>
<td>-0.0986*</td>
<td>-2.0828</td>
<td>0.96470</td>
<td>0.0315</td>
</tr>
<tr>
<td>Technology</td>
<td>0.0449</td>
<td>1.2864</td>
<td>1.4787*</td>
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<td>0.5273</td>
<td>1.5136</td>
<td>-2.0732*</td>
<td>-3.6991</td>
<td>0.3613</td>
<td>1.0543</td>
<td>0.44800</td>
<td>0.2213</td>
</tr>
<tr>
<td>Health Care</td>
<td>0.0086</td>
<td>0.8936</td>
<td>0.7130</td>
<td>10.6952</td>
<td>0.0520</td>
<td>0.5125</td>
<td>0.2150</td>
<td>1.4285</td>
<td>0.0159</td>
<td>0.1596</td>
<td>0.73011</td>
<td>0.0662</td>
</tr>
</tbody>
</table>

Note: In this table, the dependent returns indicate excess returns on B/H, B/M, B/L, S/M, and S/L - six portfolio combinations formed from size and book-to-market equity. Size of firms is represented by B (big) and S (small) while book-to-market equity is represented by H (high), M (medium), and L (low); \( \alpha \) is the intercept; \( \beta, s, h, \) and \( m \) are the slopes for \( Rm-Rf, SMB, HML, \) and \( MOM \) respectively.; \( Adj \ R^2 \) is the adjusted value of \( R^2 \); SE is the standard error; \( t() \) indicates the t-statistics with * represents 5% level of significance (critical value = 1.980) while + represents 10% level of significance (critical value = 1.658); n/a indicates unavailable data.
Overall the performance of the four-factor model is better in explaining the variation in returns for Singapore compared to the CAPM. The average adjusted $R^2$ for the CAPM is 0.6885 and 0.7538 for the four-factor model. The adjusted $R^2$ for the size-BTME portfolios is 0.7595 for the CAPM and 0.9091 for the four-factor model, while the average adjusted $R^2$ for industry excess returns are higher for the four-factor model at 0.6503 compared to 0.6243 for the CAPM. It is noted, though, that the Financial and Consumer Services sectors have adjusted $R^2$ of more than 90 percent for the four-factor model, suggesting that the models works well in explaining the excess returns for these industries.

8.3.3 Thailand

Results for the CAPM tests for Thailand are exhibited in Table 8-11. Negative $\alpha$-coefficients are more prominent with half of the intercept coefficients being statistically significant. The $\beta$-coefficients are statistically significant with most of them being smaller than one. Chen and Fang (2007) observe positive intercepts for their CAPM regressions for Thailand but the market beta is less than one, consistent with this study. For industry portfolio excess returns, most of the intercepts are not statistically significant while the market betas are significant. The average adjusted $R^2$ for the CAPM regressions is 0.6215.
Table 8 - 11 Regression analysis of the CAPM for Thailand

\[ \text{CAPM: } R_i - R_f = \alpha + \beta (R_m - R_f) + e_i \]

<table>
<thead>
<tr>
<th>Size-BTME portfolios</th>
<th>( \alpha )</th>
<th>( t(\alpha) )</th>
<th>( \beta )</th>
<th>( t(\beta) )</th>
<th>Adj ( R^2 )</th>
<th>SE</th>
</tr>
</thead>
<tbody>
<tr>
<td>B/H</td>
<td>0.0243</td>
<td>1.5509</td>
<td>1.0085*</td>
<td>13.1300</td>
<td>0.7355</td>
<td>0.0782</td>
</tr>
<tr>
<td>B/M</td>
<td>-0.0076</td>
<td>-0.9022</td>
<td>0.8464*</td>
<td>20.5555</td>
<td>0.8720</td>
<td>0.0622</td>
</tr>
<tr>
<td>B/L</td>
<td>-0.0384*</td>
<td>-3.7274</td>
<td>0.8163*</td>
<td>16.1735</td>
<td>0.8084</td>
<td>0.0784</td>
</tr>
<tr>
<td>S/H</td>
<td>0.0309*</td>
<td>1.9074</td>
<td>0.6699*</td>
<td>8.4366</td>
<td>0.5345</td>
<td>0.0772</td>
</tr>
<tr>
<td>S/M</td>
<td>-0.0091</td>
<td>-0.7638</td>
<td>0.7609*</td>
<td>13.0956</td>
<td>0.7345</td>
<td>0.0847</td>
</tr>
<tr>
<td>S/L</td>
<td>-0.0516*</td>
<td>-3.5387</td>
<td>0.6588*</td>
<td>9.2171</td>
<td>0.5781</td>
<td>0.0886</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Industry portfolios</th>
<th>( \alpha )</th>
<th>( t(\alpha) )</th>
<th>( \beta )</th>
<th>( t(\beta) )</th>
<th>Adj ( R^2 )</th>
<th>SE</th>
</tr>
</thead>
<tbody>
<tr>
<td>Oil &amp; Gas</td>
<td>0.0526*</td>
<td>2.5875</td>
<td>0.4209*</td>
<td>4.2260</td>
<td>0.2236</td>
<td>0.1574</td>
</tr>
<tr>
<td>Basic Mats</td>
<td>0.0219</td>
<td>1.4277</td>
<td>1.2069*</td>
<td>16.0789</td>
<td>0.8066</td>
<td>0.1077</td>
</tr>
<tr>
<td>Industrials</td>
<td>0.0391</td>
<td>1.1461</td>
<td>0.4483*</td>
<td>2.6626</td>
<td>0.1242</td>
<td>0.2481</td>
</tr>
<tr>
<td>Consumer Goods</td>
<td>0.0290*</td>
<td>1.8856</td>
<td>1.0350*</td>
<td>13.7399</td>
<td>0.7528</td>
<td>0.1206</td>
</tr>
<tr>
<td>Consumer Services</td>
<td>-0.0177</td>
<td>-1.4770</td>
<td>0.5503*</td>
<td>9.3836</td>
<td>0.5868</td>
<td>0.0935</td>
</tr>
<tr>
<td>Telecom</td>
<td>0.0230</td>
<td>1.3080</td>
<td>1.1406*</td>
<td>12.6559</td>
<td>0.7444</td>
<td>0.1304</td>
</tr>
<tr>
<td>Utilities</td>
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<td>0.5497*</td>
<td>6.1095</td>
<td>0.4705</td>
<td>0.1132</td>
</tr>
<tr>
<td>Financial</td>
<td>0.0204</td>
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<td>1.1966*</td>
<td>17.4463</td>
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</tr>
<tr>
<td>Technology</td>
<td>0.0426*</td>
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<td>1.3368*</td>
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</tr>
<tr>
<td>Health care</td>
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<td>0.8596</td>
<td>0.4975*</td>
<td>7.4346</td>
<td>0.4713</td>
<td>0.1095</td>
</tr>
</tbody>
</table>

Note: In this table, the dependent returns indicate excess returns on B/H, B/M, B/L, S/M, and S/L - six portfolio combinations formed from size and book-to-market equity. Size of firms is represented by B (big) and S (small) while book-to-market equity is represented by H (high), M (medium), and L (low); \( \alpha \) is the intercept and \( \beta \) is the slope coefficient for \( R_m - R_f \); Adj \( R^2 \) is the adjusted value of \( R^2 \); SE is the standard error; \( t() \) indicates the t-statistics with * represents 5% level of significance (critical value = 1.980) while + represents 10% level of significance (critical value = 1.680); n/a indicates unavailable data.

Table 8-12 represents the time series regression results for the four-factor model for Thailand. Negative intercepts are observed for all size-BTME portfolios and most of them are significant. The market betas are positive, statistically significant and less than one except for the B/H portfolio. It is noted that a diminishing pattern exists for the \( s \)-coefficients on SMB from small to big portfolios, similar to Malaysia and Singapore. The \( h \)-coefficients are positive except for the S/M and S/L portfolios, reflecting the fact that high value stocks out-performed low value stocks consistent with Fama and French (1993). It is noted that two of the high-value portfolios (B/H and S/H) have positive coefficients (0.8630 and 0.7860) and are statistically significant. There is some variation for the Thailand stock market between the \( s \) and \( h \)-coefficients. In general, size effect is more prominent than value effect for Thailand’s market, consistent with Chen and Fang (2007) and Chui and Wei (1998). Further, most of the momentum slopes are negative though none is statistically significant. The momentum effects are deemed not to be important in explaining portfolio excess returns for Thailand, consistent with Hameed and Yuanto (2002), Chen and Fang (2007) and McInish et al. (2008).
Table 8 - 12 Regression analysis of the four-factor model for Thailand

\( R_{i,t} - R_{f,t} = \alpha + \beta [R_{m,t} - R_{f,t}] + sSMB_t + hHML_t + mMOM_t + \epsilon_t \)

<table>
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<tr>
<th>Size-BTME portfolios</th>
<th>( \alpha )</th>
<th>( t(\alpha) )</th>
<th>( \beta )</th>
<th>( t(\beta) )</th>
<th>( s )</th>
<th>( t(s) )</th>
<th>( h )</th>
<th>( t(h) )</th>
<th>( m )</th>
<th>( t(m) )</th>
<th>Adj ( R^2 )</th>
<th>SE</th>
</tr>
</thead>
<tbody>
<tr>
<td>B/H</td>
<td>-0.0346*</td>
<td>-2.9458</td>
<td>1.0040*</td>
<td>16.1322</td>
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<td>-0.1285</td>
<td>0.8630*</td>
<td>7.8249</td>
<td>-0.0523</td>
<td>-0.5334</td>
<td>0.8963</td>
<td>0.0782</td>
</tr>
<tr>
<td>B/M</td>
<td>-0.0228*</td>
<td>-2.4385</td>
<td>0.8191*</td>
<td>16.5474</td>
<td>-0.1438</td>
<td>-0.8343</td>
<td>0.2667*</td>
<td>3.0404</td>
<td>-0.0507</td>
<td>-0.6503</td>
<td>0.8895</td>
<td>0.0622</td>
</tr>
<tr>
<td>B/L</td>
<td>-0.0307*</td>
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<td>11.2540</td>
<td>-0.6230*</td>
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<td>0.0917</td>
<td>0.8297</td>
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<tr>
<td>S/H</td>
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<td>S/L</td>
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<td>Industry portfolios</td>
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<td>( t(\alpha) )</td>
<td>( \beta )</td>
<td>( t(\beta) )</td>
<td>( s )</td>
<td>( t(s) )</td>
<td>( h )</td>
<td>( t(h) )</td>
<td>( m )</td>
<td>( t(m) )</td>
<td>Adj ( R^2 )</td>
<td>SE</td>
</tr>
<tr>
<td>Oil &amp; Gas</td>
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<tr>
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<td>-0.3187*</td>
<td>-2.1092</td>
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<td>0.1206</td>
</tr>
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<td>7.6038</td>
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<td>0.0575</td>
<td>-0.1106</td>
<td>-0.8387</td>
<td>0.1931*</td>
<td>1.6478</td>
<td>0.6027</td>
<td>0.0935</td>
</tr>
<tr>
<td>Telecom</td>
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<td>8.0040</td>
<td>0.0731</td>
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<td>-1.3592</td>
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<td>0.1846</td>
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<tr>
<td>Health care</td>
<td>0.0118</td>
<td>0.7196</td>
<td>0.5327*</td>
<td>6.1175</td>
<td>0.1270</td>
<td>-0.0384</td>
<td>-0.2486</td>
<td>0.1918</td>
<td>1.3982</td>
<td>0.4652</td>
<td>0.1095</td>
<td></td>
</tr>
</tbody>
</table>

Note: In this table, the dependent returns indicate excess returns on B/H, B/M, B/L, S/M, and S/L - size portfolio combinations formed from size and book-to-market equity. Size of firms is represented by B (big) and S (small) while book-to-market equity is represented by H (high), M (medium), and L (low); \( \alpha \) is the intercept; \( \beta, s, h \), and \( m \) are the slopes for \( R_m-R_f, SMB, HML, \) and \( MOM \), respectively.; \( \text{Adj } R^2 \) is the adjusted value of \( R^2 \); SE is the standard error; \( t() \) indicates the t-statistics with * represents 5% level of significance (critical value = 1.980) while + represents 10% level of significance (critical value = 1.658); n/a indicates unavailable data.
Most of the $\alpha$-coefficients for industry portfolio returns are positive but only some are statistically significant. The $\beta$-coefficients show high variation across industries, yet they are generally significant and more negative coefficients are found for HML slopes compared to SMB slopes. It is noted, however, that for industry excess returns neither size nor value effects has prominent explanatory power with respect to returns. Further, the momentum effects are limited to certain industries.

Overall, the performance of the four-factor model is better in explaining the variation in portfolio excess returns for Thailand compared to the CAPM. The average adjusted $R^2$ for the CAPM model is 0.6215 while the four-factor model commands 0.6762.

### 8.3.4 Indonesia

The CAPM tests results for the Indonesia are exhibited in Table 8-13. The intercepts are negative except for the S/H portfolio, with four statistically significant coefficients. The $\beta$-coefficients are significant and vary from 0.8011 to 1.2249, a finding that is in line with Chen and Fang (2007). For industry portfolio excess returns, almost all of the intercepts are not statistically significant. The market betas show substantial variations across industries yet most are significant.

Table 8-13: Regression analysis of the CAPM for Indonesia

<table>
<thead>
<tr>
<th>Size-BTME portfolios</th>
<th>$\alpha$</th>
<th>$t(\alpha)$</th>
<th>$\beta$</th>
<th>$t(\beta)$</th>
<th>Adj $R^2$</th>
<th>SE</th>
</tr>
</thead>
<tbody>
<tr>
<td>B/H</td>
<td>-0.0014</td>
<td>-0.0891</td>
<td>1.2249*</td>
<td>13.6175</td>
<td>0.7586</td>
<td>0.1111</td>
</tr>
<tr>
<td>B/M</td>
<td>-0.0283*</td>
<td>-2.3811</td>
<td>0.9449*</td>
<td>14.1599</td>
<td>0.7726</td>
<td>0.0921</td>
</tr>
<tr>
<td>B/L</td>
<td>-0.0606*</td>
<td>-6.0518</td>
<td>0.8274*</td>
<td>14.6995</td>
<td>0.7855</td>
<td>0.0677</td>
</tr>
<tr>
<td>S/H</td>
<td>0.0128</td>
<td>0.7005</td>
<td>0.8640*</td>
<td>8.3939</td>
<td>0.5443</td>
<td>0.1053</td>
</tr>
<tr>
<td>S/M</td>
<td>-0.0388*</td>
<td>-2.7536</td>
<td>0.8011*</td>
<td>10.1138</td>
<td>0.6342</td>
<td>0.0867</td>
</tr>
<tr>
<td>S/L</td>
<td>-0.0595*</td>
<td>-2.2760</td>
<td>1.0307*</td>
<td>7.0269</td>
<td>0.4642</td>
<td>0.1425</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Industry portfolios</th>
<th>$\alpha$</th>
<th>$t(\alpha)$</th>
<th>$\beta$</th>
<th>$t(\beta)$</th>
<th>Adj $R^2$</th>
<th>SE</th>
</tr>
</thead>
<tbody>
<tr>
<td>Oil &amp; Gas</td>
<td>0.0173</td>
<td>0.8052</td>
<td>0.5063*</td>
<td>4.2888</td>
<td>0.2996</td>
<td>0.1377</td>
</tr>
<tr>
<td>Basic Mats</td>
<td>-0.0157</td>
<td>-1.0117</td>
<td>0.8956*</td>
<td>10.2835</td>
<td>0.6419</td>
<td>0.1217</td>
</tr>
<tr>
<td>Industrials</td>
<td>0.0411</td>
<td>1.4770</td>
<td>0.1045</td>
<td>0.6744</td>
<td>0.0090</td>
<td>0.2014</td>
</tr>
<tr>
<td>Consumer Goods</td>
<td>0.0033</td>
<td>0.2032</td>
<td>1.0136*</td>
<td>10.9420</td>
<td>0.6699</td>
<td>0.1256</td>
</tr>
<tr>
<td>Consumer Services</td>
<td>-0.0042</td>
<td>-0.1833</td>
<td>0.9402*</td>
<td>7.3087</td>
<td>0.4752</td>
<td>0.1669</td>
</tr>
<tr>
<td>Telecom</td>
<td>n/a</td>
<td>n/a</td>
<td>n/a</td>
<td>n/a</td>
<td>n/a</td>
<td>n/a</td>
</tr>
<tr>
<td>Utilities</td>
<td>0.1651</td>
<td>1.3594</td>
<td>0.5489</td>
<td>0.3896</td>
<td>0.0212</td>
<td>0.1330</td>
</tr>
<tr>
<td>Financial</td>
<td>-0.0180</td>
<td>-0.9446</td>
<td>1.0967*</td>
<td>10.2575</td>
<td>0.6407</td>
<td>0.1482</td>
</tr>
<tr>
<td>Technology</td>
<td>n/a</td>
<td>n/a</td>
<td>n/a</td>
<td>n/a</td>
<td>n/a</td>
<td>n/a</td>
</tr>
<tr>
<td>Health care</td>
<td>0.0266+</td>
<td>1.8993</td>
<td>1.0045*</td>
<td>12.7670</td>
<td>0.7342</td>
<td>0.0983</td>
</tr>
</tbody>
</table>

Note: In Table 8-13 above, the dependent returns indicate excess returns on B/H, B/M, B/L, S/M, and S/L – six portfolios combinations formed from size and book-to-market equity. Size of firms is represented by B (big) and S (small) while book-to-market equity is represented by H (high), M (medium), and L (low); $\alpha$ is the intercept and $\beta$ is the slope coefficient for $R_m - R_f$; Adj $R^2$ is the adjusted value of $R^2$; SE is the standard error; $t()$ indicates the t-statistics with * represents 5% level of significance (critical value = 1.980) while + represents 10% level of significance (critical value = 1.658); n/a indicates unavailable data.
Table 8-14 represents the time series regression results for the four-factor model for Indonesia. Negative intercepts are observed for all size-BTME portfolios and most of them are significant. The market betas are positive and statistically significant. Diminishing patterns exist for the slopes on the SMB from small to big portfolios with statistically significant t-statistics exclusively for small stocks. The $h$-coefficients are positive for B/H and S/H portfolios but significant only for B/H portfolios. This lends limited support to the findings of Fama and French (1993). Most of the momentum slopes are negative and not significant. The momentum effect is thus negligible in terms of its ability to explain Indonesian excess returns. The findings for size, value and momentum effects are consistent with Chen and Fang (2007).

The intercepts for industry portfolio excess returns are insignificant except for Utilities. It is noted that $\beta$-coefficient for Utilities is negative but this is not surprising, given that the data for this sector is only available from q1:2004. The results for this sector do not reflect the whole sample period and should be interpreted with care. Size, value and momentum effects do not clearly emerge from the results of this analysis.

The four-factor model is better in explaining the variation in portfolio excess returns for Indonesia compared to the CAPM. The average adjusted $R^2$ for the overall CAPM regressions is 0.5322 while it is 0.6496 for the four-factor model. The average adjusted $R^2$ for size-BTME portfolios is 0.6599 (CAPM) and 0.7774 (four-factor model), while for the industry portfolios the average adjusted $R^2$ are 0.4365 and 0.5537 for the CAPM and four-factor model respectively.
Table 8 - 14 Regression analysis of the four-factor model for the stock market of Indonesia

\[ R_t - R_{f,t} = \alpha + \beta [R_{m,t} - R_{f,t}] + s_{SMB,t} + h_{HML,t} + m_{MOM,t} + e_t \]

<table>
<thead>
<tr>
<th>Size-BTME portfolios</th>
<th>( \alpha )</th>
<th>( t(\alpha) )</th>
<th>( \beta )</th>
<th>( t(\beta) )</th>
<th>( s )</th>
<th>( t(s) )</th>
<th>( h )</th>
<th>( t(h) )</th>
<th>( m )</th>
<th>( t(m) )</th>
<th>Adj ( R^2 )</th>
<th>SE</th>
</tr>
</thead>
<tbody>
<tr>
<td>B/H</td>
<td>-0.0448*</td>
<td>-2.4832</td>
<td>1.1543*</td>
<td>12.6540</td>
<td>0.1586</td>
<td>0.6393</td>
<td>0.6177*</td>
<td>3.1810</td>
<td>-0.1760</td>
<td>-1.4181</td>
<td>0.8068</td>
<td>0.1111</td>
</tr>
<tr>
<td>B/M</td>
<td>-0.0239</td>
<td>-1.5965</td>
<td>0.9880*</td>
<td>13.0721</td>
<td>0.3300</td>
<td>1.6059</td>
<td>-0.1948</td>
<td>-1.2109</td>
<td>0.0189</td>
<td>0.1841</td>
<td>0.7730</td>
<td>0.0921</td>
</tr>
<tr>
<td>B/L</td>
<td>-0.0374*</td>
<td>-3.4003</td>
<td>0.8166*</td>
<td>14.6858</td>
<td>0.0441</td>
<td>0.2919</td>
<td>-0.4256*</td>
<td>-3.5959</td>
<td>-0.2003*</td>
<td>-2.6475</td>
<td>0.8371</td>
<td>0.0677</td>
</tr>
<tr>
<td>S/H</td>
<td>-0.0295*</td>
<td>-1.7242</td>
<td>0.9152*</td>
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<td>1.2969*</td>
<td>5.5179</td>
<td>0.1647</td>
<td>0.8951</td>
<td>-0.1627</td>
<td>-1.3828</td>
<td>0.7498</td>
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</tr>
<tr>
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<td>-3.9789</td>
<td>0.8558*</td>
<td>12.0184</td>
<td>1.0048*</td>
<td>5.1902</td>
<td>-0.1266</td>
<td>-0.8349</td>
<td>-0.1393</td>
<td>-1.4376</td>
<td>0.7699</td>
<td>0.0867</td>
</tr>
<tr>
<td>S/L</td>
<td>-0.0615*</td>
<td>-2.6010</td>
<td>1.2413*</td>
<td>10.4440</td>
<td>2.3095*</td>
<td>7.0865</td>
<td>-0.9157*</td>
<td>-3.3372</td>
<td>-0.1259</td>
<td>-0.7896</td>
<td>0.7282</td>
<td>0.1425</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Industry portfolios</th>
<th>( \alpha )</th>
<th>( t(\alpha) )</th>
<th>( \beta )</th>
<th>( t(\beta) )</th>
<th>( s )</th>
<th>( t(s) )</th>
<th>( h )</th>
<th>( t(h) )</th>
<th>( m )</th>
<th>( t(m) )</th>
<th>Adj ( R^2 )</th>
<th>SE</th>
</tr>
</thead>
<tbody>
<tr>
<td>Oil &amp; Gas</td>
<td>0.0140</td>
<td>0.4843</td>
<td>0.4446*</td>
<td>3.4066</td>
<td>-0.8552*</td>
<td>-2.4128</td>
<td>0.4620</td>
<td>1.3241</td>
<td>0.0195</td>
<td>0.1147</td>
<td>0.3581</td>
<td>0.1377</td>
</tr>
<tr>
<td>Basic Mats</td>
<td>-0.0250</td>
<td>-1.2617</td>
<td>0.8417*</td>
<td>8.4244</td>
<td>-0.1814</td>
<td>-0.6677</td>
<td>0.2022</td>
<td>-0.5484</td>
<td>-0.1166</td>
<td>-0.8579</td>
<td>0.6332</td>
<td>0.1217</td>
</tr>
<tr>
<td>Industrials</td>
<td>0.0133</td>
<td>0.3492</td>
<td>0.1368</td>
<td>0.7586</td>
<td>0.0258</td>
<td>0.0513</td>
<td>0.4582</td>
<td>0.9640</td>
<td>0.2317</td>
<td>0.9574</td>
<td>0.0008</td>
<td>0.2014</td>
</tr>
<tr>
<td>Consumer Goods</td>
<td>-0.0198</td>
<td>-0.9706</td>
<td>1.0376*</td>
<td>10.0650</td>
<td>0.4005</td>
<td>1.4290</td>
<td>0.2301</td>
<td>1.0485</td>
<td>0.0443</td>
<td>0.3154</td>
<td>0.6817</td>
<td>0.1256</td>
</tr>
<tr>
<td>Consumer Services</td>
<td>0.0056</td>
<td>0.2058</td>
<td>0.8926*</td>
<td>6.5151</td>
<td>0.4034</td>
<td>1.0829</td>
<td>-0.3907</td>
<td>-1.3395</td>
<td>-0.4792*</td>
<td>-2.5704</td>
<td>0.5366</td>
<td>0.1669</td>
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<tr>
<td>Telecom</td>
<td>n/a</td>
<td>n/a</td>
<td>n/a</td>
<td>n/a</td>
<td>n/a</td>
<td>n/a</td>
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<td>n/a</td>
<td>n/a</td>
<td>n/a</td>
<td>n/a</td>
</tr>
<tr>
<td>Utilities</td>
<td>0.3500*</td>
<td>4.8988</td>
<td>-2.3089</td>
<td>-1.4192</td>
<td>-3.2690</td>
<td>-1.3948</td>
<td>-3.8444*</td>
<td>-3.0839</td>
<td>8.0042*</td>
<td>3.3961</td>
<td>0.7991</td>
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</tr>
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<td>0.0005</td>
<td>0.0206</td>
<td>1.1061*</td>
<td>9.0893</td>
<td>-0.2644</td>
<td>-0.7993</td>
<td>-0.1870</td>
<td>-0.7217</td>
<td>0.0740</td>
<td>0.4467</td>
<td>0.6377</td>
<td>0.1482</td>
</tr>
<tr>
<td>Technology</td>
<td>n/a</td>
<td>n/a</td>
<td>n/a</td>
<td>n/a</td>
<td>n/a</td>
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<td>n/a</td>
<td>n/a</td>
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<td>n/a</td>
</tr>
<tr>
<td>Health care</td>
<td>0.0109</td>
<td>0.6828</td>
<td>0.8881*</td>
<td>11.0063</td>
<td>-0.1234</td>
<td>-0.5626</td>
<td>0.2372</td>
<td>1.3811</td>
<td>-0.4079*</td>
<td>-3.7144</td>
<td>0.7824</td>
<td>0.0983</td>
</tr>
</tbody>
</table>

Note: In this table, the dependent returns indicate excess returns on B/H, B/M, B/L, S/M, and S/L – six portfolio combinations formed from size and book-to-market equity. Size of firms is represented by B (big) and S (small) while book-to-market equity is represented by H (high), M (medium), and L (low); \( \alpha \) is the intercept; \( \beta, s, h, \) and \( m \) are the slopes for \( Rm-Rf, SMB, HML, \) and \( MOM \) respectively; Adj \( R^2 \) is the adjusted value of \( R^2 \); SE is the standard error; \( t() \) indicates the t-statistics with * represents 5% level of significance (critical value = 1.980) while + represents 10% level of significance (critical value = 1.658); n/a indicates unavailable data.
8.3.5 Philippines

Results for the CAPM regressions for the Philippines are given in Table 8-15. The intercepts for size-BTME portfolios are negative except for the B/H portfolio and there are three significant coefficients. Unlike the CAPM results for other ASEAN5 members, the Philippines provide fewer portfolios with significant betas (only two are significant at the 10% level). Further, the results show that the industry portfolios have smaller intercepts and are statistically insignificant. However, the market betas are large and statistically significant.

Table 8 - 15 Regression analysis of the CAPM for the Philippines

<table>
<thead>
<tr>
<th>Size-BTME portfolios</th>
<th>α</th>
<th>t(α)</th>
<th>B</th>
<th>t(β)</th>
<th>Adj $R^2$</th>
<th>SE</th>
</tr>
</thead>
<tbody>
<tr>
<td>B/H</td>
<td>0.0014</td>
<td>0.0599</td>
<td>0.2110</td>
<td>1.6296</td>
<td>0.0417</td>
<td>0.1841</td>
</tr>
<tr>
<td>B/M</td>
<td>-0.0113</td>
<td>-0.6330</td>
<td>0.1807*</td>
<td>1.8410</td>
<td>0.0518</td>
<td>0.1212</td>
</tr>
<tr>
<td>B/L</td>
<td>-0.0451*</td>
<td>-2.7425</td>
<td>0.1746*</td>
<td>1.9270</td>
<td>0.0565</td>
<td>0.1097</td>
</tr>
<tr>
<td>S/H</td>
<td>-0.0164</td>
<td>-0.8553</td>
<td>0.0648</td>
<td>0.6126</td>
<td>0.0060</td>
<td>0.1145</td>
</tr>
<tr>
<td>S/M</td>
<td>-0.0675*</td>
<td>-2.9583</td>
<td>0.0850</td>
<td>0.6701</td>
<td>0.0073</td>
<td>0.1596</td>
</tr>
<tr>
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<td>-0.0769*</td>
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<td>0.1749</td>
<td>1.6434</td>
<td>0.0417</td>
<td>0.1471</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Industry portfolios</th>
<th>α</th>
<th>t(α)</th>
<th>B</th>
<th>t(β)</th>
<th>Adj $R^2$</th>
<th>SE</th>
</tr>
</thead>
<tbody>
<tr>
<td>Oil &amp; Gas</td>
<td>-0.0265</td>
<td>-1.0786</td>
<td>0.7513*</td>
<td>5.5535</td>
<td>0.3322</td>
<td>0.1935</td>
</tr>
<tr>
<td>Basic Mats</td>
<td>-0.0171</td>
<td>-0.4613</td>
<td>0.9149*</td>
<td>4.4916</td>
<td>0.2455</td>
<td>0.2936</td>
</tr>
<tr>
<td>Industrials</td>
<td>0.0082</td>
<td>0.6493</td>
<td>0.7865*</td>
<td>11.2799</td>
<td>0.6724</td>
<td>0.1011</td>
</tr>
<tr>
<td>Consumer Goods</td>
<td>0.0208</td>
<td>1.4438</td>
<td>0.8184*</td>
<td>10.3365</td>
<td>0.6328</td>
<td>0.1124</td>
</tr>
<tr>
<td>Consumer Services</td>
<td>0.0133</td>
<td>0.6307</td>
<td>0.9635*</td>
<td>8.2872</td>
<td>0.5255</td>
<td>0.1621</td>
</tr>
<tr>
<td>Telecom</td>
<td>0.0099</td>
<td>1.1861</td>
<td>0.8337*</td>
<td>18.1586</td>
<td>0.8437</td>
<td>0.0606</td>
</tr>
<tr>
<td>Utilities</td>
<td>n/a</td>
<td>n/a</td>
<td>n/a</td>
<td>n/a</td>
<td>n/a</td>
<td>n/a</td>
</tr>
<tr>
<td>Financial</td>
<td>n/a</td>
<td>n/a</td>
<td>n/a</td>
<td>n/a</td>
<td>n/a</td>
<td>n/a</td>
</tr>
</tbody>
</table>

Note: In this table, the dependent returns indicate excess returns on B/H, B/M, B/L, S/M, and S/L − six portfolio combinations formed from size and book-to-market equity. Size of firms is represented by B (big) and S (small) while book-to-market equity is represented by H (high), M (medium), and L (low); α is the intercept and β is the slope coefficient for $R_m - R_f$; Adj $R^2$ is the adjusted value of $R^2$; SE is the standard error; t() indicates the t-statistics with * represents 5% level of significance (critical value = 1.980) while + represents 10% level of significance (critical value = 1.680); n/a indicates unavailable data.

Table 8-16 exhibits the results for the four-factor model. Negative and significant intercepts are observed for all size-BTME portfolios. The market betas are relatively small but significant. Although the $s$-coefficients show diminishing values from small to big stocks, they are negative. The $h$-coefficients have positive signs and are significant except for the S/L portfolio. In this case, the findings for the Philippines stock market conform to the findings of Fama and French (1993) and Drew and Veeraraghavan (2003) in terms of HML slope but differ in terms of SMB slopes. The momentum slopes are negative and
insignificant except for the S/M portfolio, consistent with the momentum effect not being prominent for the Philippines.

Results for industry portfolios are much closer to expectation and more representative of the market than the size-BTME portfolios. The intercepts for industry excess returns are insignificant except for Telecom. The reason probably lies in the number of firms included in each of the six size-BTME portfolios, as the Philippines has the least number of firms available for this study. The results show that the intercepts are insignificant except for Telecom. The betas are larger than that of the size-BTME portfolios and are statistically significant. The Financial sector is sensitive to both size and value effect, yet in general both effects are limited for industry portfolios. Further, no support for momentum effect can be found either.
Table 8 - 16 Regression analysis of the four-factor model for the Philippines

\[ R_{i} - R_{f} = \alpha + \beta [R_{m} - R_{f}] + sSMB_t + hHML_t + mMOM_t + \epsilon_t \]

<table>
<thead>
<tr>
<th>Size-BTME portfolios</th>
<th>( \alpha )</th>
<th>( t(\alpha) )</th>
<th>( \beta )</th>
<th>( t(\beta) )</th>
<th>( s )</th>
<th>( t(s) )</th>
<th>( h )</th>
<th>( t(h) )</th>
<th>( m )</th>
<th>( t(m) )</th>
<th>Adj R(^2)</th>
<th>SE</th>
</tr>
</thead>
<tbody>
<tr>
<td>B/H</td>
<td>-0.0678*</td>
<td>-3.2255</td>
<td>0.2352*</td>
<td>2.4067</td>
<td>-1.2384*</td>
<td>-5.0660</td>
<td>1.2241*</td>
<td>5.4573</td>
<td>-0.1625</td>
<td>-0.9037</td>
<td>0.4580</td>
<td>0.1385</td>
</tr>
<tr>
<td>B/M</td>
<td>-0.0470*</td>
<td>-2.5602</td>
<td>0.2001*</td>
<td>2.3741</td>
<td>-0.8896*</td>
<td>-4.1718</td>
<td>0.5666*</td>
<td>2.9731</td>
<td>-0.1897</td>
<td>-1.2194</td>
<td>0.3083</td>
<td>0.1212</td>
</tr>
<tr>
<td>B/L</td>
<td>-0.0605*</td>
<td>-3.6394</td>
<td>0.1714*</td>
<td>2.2473</td>
<td>-0.9848*</td>
<td>-5.1037</td>
<td>0.1220</td>
<td>0.7076</td>
<td>-0.1236</td>
<td>-0.8778</td>
<td>0.3388</td>
<td>0.1097</td>
</tr>
<tr>
<td>S/H</td>
<td>-0.0799*</td>
<td>-4.6078</td>
<td>0.1163*</td>
<td>1.4611</td>
<td>-0.4564*</td>
<td>-2.2667</td>
<td>1.2210*</td>
<td>6.7862</td>
<td>-0.1094</td>
<td>-0.7447</td>
<td>0.4441</td>
<td>0.1145</td>
</tr>
<tr>
<td>S/M</td>
<td>-0.1056*</td>
<td>-4.3629</td>
<td>0.1167*</td>
<td>1.0358</td>
<td>-0.5157*</td>
<td>-1.8305</td>
<td>0.7334*</td>
<td>2.8370</td>
<td>-0.4886*</td>
<td>-2.3574*</td>
<td>0.2236</td>
<td>0.1596</td>
</tr>
<tr>
<td>S/L</td>
<td>-0.1005*</td>
<td>-4.5099</td>
<td>0.2044*</td>
<td>1.9981</td>
<td>-0.0156</td>
<td>-0.0602</td>
<td>0.5033*</td>
<td>2.1762</td>
<td>-0.2692</td>
<td>-1.4255</td>
<td>0.1247</td>
<td>0.1471</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Industry portfolios</th>
<th>( \alpha )</th>
<th>( t(\alpha) )</th>
<th>( \beta )</th>
<th>( t(\beta) )</th>
<th>( s )</th>
<th>( t(s) )</th>
<th>( h )</th>
<th>( t(h) )</th>
<th>( m )</th>
<th>( t(m) )</th>
<th>Adj R(^2)</th>
<th>SE</th>
</tr>
</thead>
<tbody>
<tr>
<td>Oil &amp; Gas</td>
<td>-0.0006</td>
<td>-0.0210</td>
<td>0.7264*</td>
<td>5.4002</td>
<td>-0.1300</td>
<td>-0.3818</td>
<td>-0.5567*</td>
<td>-1.8303</td>
<td>-0.0458</td>
<td>-0.1843</td>
<td>0.3469</td>
<td>0.1935</td>
</tr>
<tr>
<td>Basic Mats</td>
<td>-0.0439</td>
<td>-0.9871</td>
<td>0.9085*</td>
<td>4.4512</td>
<td>-0.8195</td>
<td>-1.5867</td>
<td>0.3518</td>
<td>0.7622</td>
<td>0.4340</td>
<td>1.1518</td>
<td>0.2503</td>
<td>0.2936</td>
</tr>
<tr>
<td>Industrials</td>
<td>-0.0080</td>
<td>-0.5032</td>
<td>1.2412*</td>
<td>16.9822</td>
<td>0.0948</td>
<td>0.5124</td>
<td>0.2127</td>
<td>1.2870</td>
<td>0.1785</td>
<td>1.3232</td>
<td>0.8238</td>
<td>0.1051</td>
</tr>
<tr>
<td>Consumer Goods</td>
<td>0.0114</td>
<td>0.7439</td>
<td>0.7871*</td>
<td>11.1974</td>
<td>-0.0911</td>
<td>-0.5119</td>
<td>-0.0709</td>
<td>-0.4460</td>
<td>-0.1794</td>
<td>-1.3823</td>
<td>0.6705</td>
<td>0.1011</td>
</tr>
<tr>
<td>Consumer Services</td>
<td>-0.0381</td>
<td>-1.5912</td>
<td>0.7912*</td>
<td>6.5649</td>
<td>-0.4379</td>
<td>-1.5740</td>
<td>0.2913</td>
<td>1.1422</td>
<td>0.3050</td>
<td>1.4595</td>
<td>0.4432</td>
<td>0.1575</td>
</tr>
<tr>
<td>Telecom</td>
<td>0.0375*</td>
<td>2.2033</td>
<td>0.8149*</td>
<td>10.4316</td>
<td>0.4281*</td>
<td>2.1658</td>
<td>-0.2503</td>
<td>-1.4171</td>
<td>-0.0845</td>
<td>-0.5860</td>
<td>0.6464</td>
<td>0.1124</td>
</tr>
<tr>
<td>Utilities</td>
<td>-0.0231</td>
<td>-0.9421</td>
<td>0.9896*</td>
<td>8.7792</td>
<td>-0.2797</td>
<td>-0.9808*</td>
<td>0.6908*</td>
<td>2.7101</td>
<td>0.0347</td>
<td>0.1667</td>
<td>0.5587</td>
<td>0.1621</td>
</tr>
<tr>
<td>Financial</td>
<td>-0.0021</td>
<td>-0.2248</td>
<td>0.8324*</td>
<td>19.7697</td>
<td>-3.8485*</td>
<td>-3.6088</td>
<td>0.1585*</td>
<td>1.6369</td>
<td>0.1293</td>
<td>1.6638</td>
<td>0.8680</td>
<td>0.0606</td>
</tr>
<tr>
<td>Technology</td>
<td>n/a</td>
<td>n/a</td>
<td>n/a</td>
<td>n/a</td>
<td>n/a</td>
<td>n/a</td>
<td>n/a</td>
<td>n/a</td>
<td>n/a</td>
<td>n/a</td>
<td>n/a</td>
<td>n/a</td>
</tr>
<tr>
<td>Health care</td>
<td>n/a</td>
<td>n/a</td>
<td>n/a</td>
<td>n/a</td>
<td>n/a</td>
<td>n/a</td>
<td>n/a</td>
<td>n/a</td>
<td>n/a</td>
<td>n/a</td>
<td>n/a</td>
<td>n/a</td>
</tr>
</tbody>
</table>

Note: In this table, the dependent returns indicate excess returns on B/H, B/M, B/L, S/M, and S/L – six portfolio combinations formed from size and book-to-market equity. Size of firms is represented by B (big) and S (small) while book-to-market equity is represented by H (high), M (medium), and L (low); \( \alpha \) is the intercept; \( \beta, s, h, \) and \( m \) are the slopes for \( R_{m} - R_{f}, \) SMB, HML, and MOM respectively. Adj R\(^2\) is the adjusted value of R\(^2\); SE is the standard error; \( t() \) indicates the t-statistics with * represents 5% level of significance (critical value = 1.980) while + represents 10% level of significance (critical value = 1.658); n/a indicates unavailable data.
The four-factor model appears to better explain the variation in portfolio excess returns for the Philippines compared to the CAPM, for both sets of portfolio returns as shown by the substantial increase in adjusted $R^2$. Market beta alone is not able to capture as much of the variation in returns, especially for the size-BTME portfolios. Yet it is found that the overall adjusted $R^2$ for the four-factor model for the Philippines is the lowest of the ASEAN5 at 0.4647. In addition, in both models, the $R^2$ parameters for the industry returns are also markedly higher than for the size-BTME portfolios. The rather strange results for the size-BTME portfolios in this study probably indicate an insufficient number of firms available for the Philippines.\(^69\)

### 8.3.6 Robustness tests

In order to test the robustness of the four-factor model used in this study, a seemingly unrelated regression estimation (SURE) model is employed to test the restrictions on the coefficients estimated for the ASEAN5.\(^70\) The SURE model is a well-known method and therefore it is not elaborated here (see Johnston and DiNardo, 1997; Greene, 2003). In this section SURE tests are estimated for the size-BTME portfolio for the four-factor model as used in the previous sections.\(^71\)

Table 8-17, Panels A to E present the results for the ASEAN5 SURE tests on the size-BTME portfolios. The results suggest that for Malaysia (Panel A), each of the four factors is individually and collectively significant in explaining portfolio returns for Malaysia. Therefore, these results are consistent with the four-factor model presented in Table 8-7. Panel B provides the results for Singapore where it is found that the intercept and MOM tested individually are not significant. However, the SMB, HML and MOM tested in a group are significant. In general, these results are consistent with that of Table 8-9. SURE test results for Thailand are presented in Panel C of Table 8-17. Like Malaysia, all four individual factors as well as the SMB, HML and MOM group tests are significant. Some variation exists in comparison with the four-factor results (Table 8-12) for MOM effect where none of the MOM is statistically significant for the size-BTME portfolios. In line with Malaysia and Thailand, the results for Indonesia also exhibit significant effects

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69 The Philippines has a total of 363 firms included in this study. More firms are available towards the end of the study, but not so in the early period of study. For example, in q1:1990 there are nine firms available for BTME while there are 243 firms in q1:2000 and 274 firms in q1:2006.

70 The author would like to thank Professor Richard Heaney for running the SURE tests for this section.

71 Separate industry tests are not undertaken due to variation in time series that is available for statistical analysis e.g. data for the Malaysian Technology sector starts at q4:1998 while data for the Thailand Utilities sector starts at q2:1995.
for all of the factors when tested individually and in a group (Panel D). However, a rather mild momentum (MOM) effect is recorded for the four-factor results presented in Table 8-14 where significant coefficient is limited for the B/L portfolio. All of the four individual factors, except MOM, are significant for the Philippines (Panel E) with the group test also showing significant results. As such, the results are consistent with the four-factor regression presented in Table 8-16.

**Table 8 - 17 SURE model based tests for coefficient restrictions on four-factor model**

<table>
<thead>
<tr>
<th>Panel A Malaysia:</th>
<th>Restrictions on coefficients</th>
<th>Chi-square statistics</th>
<th>Probability</th>
</tr>
</thead>
<tbody>
<tr>
<td>All intercept coefficients = 0</td>
<td>Chi-square (6)</td>
<td>21.36</td>
<td>0.0016</td>
</tr>
<tr>
<td>All SMB coefficients = 0</td>
<td>Chi-square (6)</td>
<td>363.93</td>
<td>0.0000</td>
</tr>
<tr>
<td>All HML coefficients = 0</td>
<td>Chi-square (6)</td>
<td>864.77</td>
<td>0.0000</td>
</tr>
<tr>
<td>All MOM coefficients = 0</td>
<td>Chi-square (6)</td>
<td>21.35</td>
<td>0.0016</td>
</tr>
<tr>
<td>All SMB, HML, MOM coefficients = 0</td>
<td>Chi-square (18)</td>
<td>1297.86</td>
<td>0.0000</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Panel B Singapore:</th>
<th>Restrictions on coefficients</th>
<th>Chi-square statistics</th>
<th>Probability</th>
</tr>
</thead>
<tbody>
<tr>
<td>All intercept coefficients = 0</td>
<td>Chi-square (6)</td>
<td>6.5200</td>
<td>0.3680</td>
</tr>
<tr>
<td>All SMB coefficients = 0</td>
<td>Chi-square (6)</td>
<td>714.4800</td>
<td>0.0000</td>
</tr>
<tr>
<td>All HML coefficients = 0</td>
<td>Chi-square (6)</td>
<td>1566.8600</td>
<td>0.0000</td>
</tr>
<tr>
<td>All MOM coefficients = 0</td>
<td>Chi-square (6)</td>
<td>10.3800</td>
<td>0.1094</td>
</tr>
<tr>
<td>All SMB, HML, MOM coefficients = 0</td>
<td>Chi-square (18)</td>
<td>2815.0500</td>
<td>0.0000</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Panel C Thailand:</th>
<th>Restrictions on coefficients</th>
<th>Chi-square statistics</th>
<th>Probability</th>
</tr>
</thead>
<tbody>
<tr>
<td>All intercept coefficients = 0</td>
<td>Chi-square (6)</td>
<td>18.8800</td>
<td>0.0044</td>
</tr>
<tr>
<td>All SMB coefficients = 0</td>
<td>Chi-square (6)</td>
<td>139.9700</td>
<td>0.0000</td>
</tr>
<tr>
<td>All HML coefficients = 0</td>
<td>Chi-square (6)</td>
<td>1933.2400</td>
<td>0.0000</td>
</tr>
<tr>
<td>All MOM coefficients = 0</td>
<td>Chi-square (6)</td>
<td>11.8700</td>
<td>0.0648</td>
</tr>
<tr>
<td>All SMB, HML, MOM coefficients = 0</td>
<td>Chi-square (18)</td>
<td>2788.5000</td>
<td>0.0000</td>
</tr>
</tbody>
</table>
Table 8-17 SURE model based tests for coefficient restrictions on four-factor model (continued)

<table>
<thead>
<tr>
<th>Panel D Indonesia:</th>
<th>Restrictions on coefficients</th>
<th>Chi-square statistics</th>
<th>Probability</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>All intercept coefficients = 0</td>
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<td></td>
</tr>
<tr>
<td></td>
<td>Chi-square (6)</td>
<td>38.4300</td>
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<tr>
<td></td>
<td>All SMB coefficients = 0</td>
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<tr>
<td></td>
<td>Chi-square (6)</td>
<td>306.1600</td>
<td>0.0000</td>
</tr>
<tr>
<td></td>
<td>All HML coefficients = 0</td>
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<tr>
<td></td>
<td>Chi-square (6)</td>
<td>712.3100</td>
<td>0.0000</td>
</tr>
<tr>
<td></td>
<td>All MOM coefficients = 0</td>
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<td></td>
<td>Chi-square (6)</td>
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</tr>
<tr>
<td></td>
<td>All SMB, HML, MOM coefficients = 0</td>
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<td></td>
<td>Chi-square (18)</td>
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<table>
<thead>
<tr>
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<th>Restrictions on coefficients</th>
<th>Chi-square statistics</th>
<th>Probability</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>All intercept coefficients = 0</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Chi-square (6)</td>
<td>26.1300</td>
<td>0.0002</td>
</tr>
<tr>
<td></td>
<td>All SMB coefficients = 0</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Chi-square (6)</td>
<td>88.4900</td>
<td>0.0000</td>
</tr>
<tr>
<td></td>
<td>All HML coefficients = 0</td>
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</tr>
<tr>
<td></td>
<td>Chi-square (6)</td>
<td>309.7300</td>
<td>0.0000</td>
</tr>
<tr>
<td></td>
<td>All MOM coefficients = 0</td>
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</tr>
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<td></td>
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<td>0.4721</td>
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<tr>
<td></td>
<td>All SMB, HML, MOM coefficients = 0</td>
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<td></td>
</tr>
<tr>
<td></td>
<td>Chi-square (18)</td>
<td>451.5200</td>
<td>0.0000</td>
</tr>
</tbody>
</table>

Note: SMB, HML and MOM indicate the size, value and momentum effects on the size-BTME portfolio returns.

8.3.7 Section summary

In summary, ASEAN5 equity markets are more sensitive to size effects than value effects, while the momentum effects generally have limited existence among the ASEAN5 markets. However, it is noted that the industry portfolios exhibit higher sensitivity towards momentum effects than do the size-BTME portfolios. In general, these results are robust, the estimated SURE tests providing very small variation from the results of the four-factor model regressions.
8.4 Conclusion

This chapter examines the relative explanatory power of the traditional CAPM and the four-factor model, and the effects of firm size, book-to-market equity and price momentum in the ASEAN5 equity markets. Quarterly data from January 1990 to March 2006 is used in the analysis. This study finds that the CAPM has lower explanatory power in comparison to the four-factor model for all of the ASEAN5 countries, consistent with the growing literature in the area. Further, it is found that small size and high book-to-market equity stocks generate higher returns than big size and low book-to-market equity stocks for the ASEAN5, consistent with Fama and French (1993). In particular, size effects are more prominent in explaining the variation in excess returns for size-BTME portfolios for most of the ASEAN5 markets except for the Philippines. For industry excess returns, the size and value effects vary across industries (i.e. the effects are industry-specific). In terms of momentum effects, the ASEAN5 evidence contrasts with the findings of Jegadeesh and Titman (1993) for the US, Carhart (1997) for the US mutual funds, and Rowenhurst (1998) for the European markets. There is limited support found for momentum effects for the ASEAN5 markets.

Variation in data source, frequency, methodology, and sample period exist between this study and the literature to date. Yet in general, the findings from this study are consistent with Chen and Fang (2007), Drew and Veeraraghavan (2002, 2003), Shum and Tang (2005), Hameed and Kusnadi (2002), Chui and Wei (1998) and McInish et al. (2008). Thus, size and value effects exist in international stock markets, and these are not isolated to certain developed markets such as the US and the European markets. However, the momentum effects gain limited evidence and this suggests that momentum effects may be more market-specific.
Chapter 9

ASEAN5: ASSET PRICING AND MACRO FACTORS

9.1 Introduction

In the previous chapter, asset pricing in the ASEAN5 is analysed using the traditional CAPM and the four-factor model. It is found that the four-factor model constantly outperforms the CAPM in all of the ASEAN5 countries. Furthermore, evidence shows that size and book-to-market equity effects are more prominent than the momentum effect in most of the ASEAN5 equity markets. The industry portfolios also provide an interesting insight into the factors that explain the variation of returns in the ASEAN5 where the effects of size, book-to-market equity and momentum are, in most cases, industry-specific. Based on these results, this chapter extends the analysis by incorporating the influence of four macro variables into the four-factor models. The macro variables are unexpected GDP, unexpected total trade, unexpected market returns and world excess returns (as a proxy of world effects).

The local and global factors used in this study are perceived to be important in determining equity return variations, in particular for the emerging markets of the ASEAN5 when it is found from the literature that these markets are partially cointegrated (for example see Bekaert and Harvey, 1995; Harvey, 1995; Bekaert, Harvey and Ng, 2002). While a global factor can easily be identified, questions regarding the choice of local macro factors are more difficult due to inherent subjectivity and the arbitrary nature of the selection process itself (Bilson, Brailsford and Hooper, 2001). This choice is further complicated given the notion that all economic variables are endogenous in some ultimate sense (Chen et al., 1986). In this study the choice of macroeconomic factors is limited to innovations in the GDP and total trade – a choice based on the availability of data and relevance to the economies of the ASEAN5. Overall local equity market condition is represented by unexpected market returns, while the proxy for world market effects is world excess returns. In this chapter, size-BTME portfolios and industry portfolios are explained in terms of size, book-to-market equity, momentum, local market and macroeconomic factors as well as the world excess equity market returns. The multifactor regressions based on these variables test whether the set of common factors explains return variation within the ASEAN5 equity markets.
There are four main contributions of this study. First, return variation is examined from size-BTME portfolios and industry portfolios, rather than on stock returns, thus expanding the scope of analysis. Second, the results from this study provide important insights into the impact of macro effects given the four-factor model as a base case. Third, the local macro factors are derived from comprehensive analyses of the cointegration existing between the ASEAN5 nations. Lastly, this chapter uses the ASEAN5 equity markets as the focus of study, employing approximately 16 years of data and providing a comprehensive analysis of asset pricing in these equity markets.

It is found that the multifactor models that incorporate macro factors – namely unexpected GDP, unexpected total trade, unexpected market returns and world excess market returns – do not substantially increase the explanatory power of the four-factor models described in the previous chapter (Chapter 8). The local macro factors and world excess returns exhibit limited influence in explaining portfolio returns across the ASEAN5 countries in general. Nonetheless, testing the macro factors separately shows some variation across the ASEAN5 countries as well as variation across size-BTME and industry portfolios.

The literature survey, methodology and data for this chapter are provided in Chapters 2, 3 and 4. The remainder of this chapter is organised as follows. Section 9.2 explains the origin of macro factors to the asset pricing data used in regressions for Chapter 8. Section 9.3 presents correlations for the explanatory variables and Section 9.4 presents the results and discussion of the findings. Further, Section 9.5 covers the regressions for each of the macro factors. Finally, Section 9.6 offers some conclusion for the findings of this chapter.

9.2 Additional data

Data employed in this chapter are derived from previous analysis chapters (Chapters 5, 6, 7 and 8). For the purpose of consistency, the weekly ASEAN5 returns data (Chapter 5) and the monthly data for total trade (Chapter 6) are transformed into quarterly observations, as the asset pricing regressions and the GDP are estimated quarterly. The MSCI World Index is obtained from Datastream and data are converted into continuously compounded returns.72 The GDP and total trade are adjusted for seasonal effects and the 1997 Asian crisis, while the regional indices are adjusted for the 1997 crisis.

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72 Bilson, Brailsford and Hooper (2001) use MSCI World Index as a proxy for world market index.
9.3 Correlations of the explanatory variables

a. Malaysia

Table 9-1 displays the correlation matrix for Malaysian explanatory variables. The strongest correlation is between the residuals for world returns with the GDP, followed by the correlation between total trade and the GDP. The correlation between total trade and GDP is expected since the GDP generally reflects economic conditions of a country heavily involved in trade. Further, the GDP also tends to be correlated with Malaysian world excess returns.

<table>
<thead>
<tr>
<th></th>
<th>Rm-Rf</th>
<th>SMB</th>
<th>HML</th>
<th>MOM</th>
<th>UGDP</th>
<th>UTT</th>
<th>URI</th>
<th>WRF</th>
</tr>
</thead>
<tbody>
<tr>
<td>Rm-Rf</td>
<td>0.3974</td>
<td>0.2633</td>
<td>-0.2319</td>
<td>-0.2070</td>
<td>-0.1003</td>
<td>0.4737</td>
<td>-0.0997</td>
<td></td>
</tr>
<tr>
<td>SMB</td>
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<td>-0.3514</td>
<td>-0.3366</td>
<td>-0.3027</td>
<td>0.0009</td>
<td>-0.1062</td>
<td></td>
</tr>
<tr>
<td>HML</td>
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<td>-0.0943</td>
<td>0.3363</td>
<td>0.2720</td>
<td>0.2429</td>
<td>0.2403</td>
<td></td>
</tr>
<tr>
<td>MOM</td>
<td>-0.2319</td>
<td>-0.3514</td>
<td>-0.0943</td>
<td>0.1497</td>
<td>0.0179</td>
<td>0.0033</td>
<td>0.0243</td>
<td></td>
</tr>
<tr>
<td>UGDP</td>
<td>-0.2070</td>
<td>-0.3366</td>
<td>0.3363</td>
<td>0.1497</td>
<td>0.5591</td>
<td>0.2217</td>
<td>0.6143</td>
<td></td>
</tr>
<tr>
<td>UTT</td>
<td>-0.1003</td>
<td>-0.3027</td>
<td>0.2720</td>
<td>0.0179</td>
<td>0.5591</td>
<td>0.1560</td>
<td>0.3547</td>
<td></td>
</tr>
<tr>
<td>URI</td>
<td>0.4737</td>
<td>0.0009</td>
<td>0.2429</td>
<td>0.0033</td>
<td>0.2217</td>
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<td></td>
</tr>
<tr>
<td>WRF</td>
<td>-0.0997</td>
<td>-0.1062</td>
<td>0.2403</td>
<td>0.0243</td>
<td>0.6143</td>
<td>0.3547</td>
<td>0.3169</td>
<td></td>
</tr>
</tbody>
</table>

Note: The explanatory returns are the average premium for the common factors represented by MKTRF (returns to the market portfolio minus risk-free rate), SMB (small minus big), HML (high minus low), MOM (winners minus losers). Macro explanatory variables include world excess returns (WR) and unexpected GDP (UGDP), unexpected total trade (UTT) and unexpected local market returns (URI).

b. Singapore

The correlation coefficients for explanatory variables for Singapore (Table 9-2) show some variation, with the highest correlation for unexpected market returns (URI) and overall market return (Rm-Rf) effects.

<table>
<thead>
<tr>
<th></th>
<th>Rm-Rf</th>
<th>SMB</th>
<th>HML</th>
<th>MOM</th>
<th>UGDP</th>
<th>UTT</th>
<th>URI</th>
<th>WRF</th>
</tr>
</thead>
<tbody>
<tr>
<td>Rm-Rf</td>
<td>0.2297</td>
<td>0.2947</td>
<td>-0.2713</td>
<td>0.0549</td>
<td>0.1237</td>
<td>0.6770</td>
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</tr>
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<td>0.0930</td>
<td>0.3091</td>
<td>0.1659</td>
<td>0.3057</td>
<td>0.2196</td>
<td></td>
</tr>
<tr>
<td>HML</td>
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<td>0.3622</td>
<td>-0.0105</td>
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</tr>
<tr>
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<td>0.2992</td>
<td>0.0659</td>
<td>0.0739</td>
<td>-0.1499</td>
<td>-0.0732</td>
<td></td>
</tr>
<tr>
<td>UGDP</td>
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<td>0.3091</td>
<td>-0.0606</td>
<td>0.0659</td>
<td>0.3923</td>
<td>0.2930</td>
<td>0.4425</td>
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</tr>
<tr>
<td>UTT</td>
<td>0.1237</td>
<td>0.1659</td>
<td>0.0091</td>
<td>0.0739</td>
<td>0.3923</td>
<td>0.4134</td>
<td>0.3454</td>
<td></td>
</tr>
<tr>
<td>URI</td>
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<td>0.3057</td>
<td>0.3622</td>
<td>-0.1499</td>
<td>0.2930</td>
<td>0.4134</td>
<td>0.4951</td>
<td></td>
</tr>
<tr>
<td>WRF</td>
<td>0.2452</td>
<td>0.2196</td>
<td>-0.0105</td>
<td>-0.0732</td>
<td>0.4425</td>
<td>0.3454</td>
<td>0.4951</td>
<td></td>
</tr>
</tbody>
</table>

Note: The explanatory returns are the average premium for the common factors represented by MKTRF (returns to the market portfolio minus risk-free rate), SMB (small minus big), HML (high minus low), MOM (winners minus losers). Macro explanatory variables include world excess returns (WR) and unexpected GDP (UGDP), unexpected total trade (UTT) and unexpected local market returns (URI).
c. Thailand

The correlation coefficient between UGDP and UTT is large at 0.8209 (Table 9-3). These two variables are also highly correlated with world excess returns (0.7353 and 0.7233). In addition, overall market return with SMB is large and negative while correlation between SMB and HML is large and positive. There appears to be some evidence of multicollinearity in the explanatory variables for Thailand.

| Table 9 - 3 Correlations among explanatory variables for Thailand |
|-----------------|-----------------|-----------------|-----------------|-----------------|-----------------|-----------------|-----------------|-----------------|
|                 | Rm-Rf           | SMB             | HML             | MOM             | UGDP            | UTT             | URI             | WRF             |
| Rm-Rf           | -0.5265         | -0.0071         | -0.1650         | -0.0279         | 0.0090          | 0.1160          | 0.1476          | 0.1464          |
| SMB             | -0.5265         | 0.5053          | -0.2322         | 0.3302          | 0.3370          | 0.1464          | 0.1572          | 0.1572          |
| HML             | -0.0071         | 0.5053          | -0.3440         | 0.2972          | 0.3536          | 0.3756          | 0.2375          | 0.2375          |
| MOM             | -0.1650         | -0.2322         | -0.3440         | -0.0926         | -0.0460         | -0.1405         | -0.0522         | -0.0522         |
| UGDP            | -0.0279         | 0.3302          | 0.2972          | -0.0926         | 0.9209          | 0.3266          | 0.3976          | 0.3976          |
| UTT             | 0.0990          | 0.3370          | 0.3536          | -0.0460         | 0.9209          | 0.3655          | 0.7233          | 0.7233          |
| URI             | 0.1160          | 0.1464          | 0.3756          | -0.1405         | 0.3266          | 0.3655          | 0.3976          | 0.3976          |
| WRF             | 0.1476          | 0.1572          | 0.2375          | -0.0522         | 0.7353          | 0.7233          | 0.3976          | 0.3976          |

Note: The explanatory returns are the average premium for the common factors represented by MKTRF (returns to the market portfolio minus risk-free rate), SMB (small minus big), HML (high minus low), MOM (winners minus losers). Macro explanatory variables include world excess returns (WR) and unexpected GDP (UGDP), unexpected total trade (UTT) and unexpected local market returns (URI).

d. Indonesia

Large correlation coefficients are observed in Table 9-4 among the macro explanatory variables (between 0.8798 and 0.5902). For Indonesia, it is interesting to note that world excess returns are highly correlated with unexpected components of GDP, total trade and local market returns. To some extent these results suggest that Indonesian markets are highly affected by local and world market conditions.

| Table 9 - 4 Correlations among explanatory variables for Indonesia |
|-----------------|-----------------|-----------------|-----------------|-----------------|-----------------|-----------------|-----------------|-----------------|
|                 | Rm-Rf           | SMB             | HML             | MOM             | UGDP            | UTT             | URI             | WRF             |
| Rm-Rf           | -0.2039         | 0.1549          | -0.3119         | -0.3959         | -0.2357         | 0.2775          | -0.1474         |                  |
| SMB             | -0.2039         | 0.3467          | -0.1919         | 0.3100          | 0.3212          | 0.3613          | 0.2266          |                  |
| HML             | 0.1549          | 0.3467          | -0.0969         | 0.0409          | 0.1029          | 0.1949          | 0.1133          |                  |
| MOM             | -0.3119         | -0.1919         | -0.0969         | 0.4407          | 0.3356          | 0.0961          | 0.4599          |                  |
| UGDP            | -0.3959         | 0.3100          | 0.0409          | 0.4407          | 0.9479          | 0.4625          | 0.9620          |                  |
| UTT             | -0.2357         | 0.3212          | 0.1029          | 0.3356          | 0.9479          | 0.5902          | 0.9799          |                  |
| URI             | 0.2775          | 0.3613          | 0.1949          | 0.0961          | 0.4625          | 0.5902          | 0.6250          |                  |
| WRF             | -0.1474         | 0.2266          | 0.1133          | 0.4599          | 0.9620          | 0.9799          | 0.6250          |                  |

Note: The explanatory returns are the average premium for the common factors represented by MKTRF (returns to the market portfolio minus risk-free rate), SMB (small minus big), HML (high minus low), MOM (winners minus losers). Macro explanatory variables include world excess returns (WR) and unexpected GDP (UGDP), unexpected total trade (UTT) and unexpected local market returns (URI).
e. The Philippines

Relatively large correlation coefficients exist between UTT-UGDP and UTT-WRF though in general the correlation coefficients for the Philippines are relatively low (Table 9-5). Multicollinearity among the explanatory variables does not appear to be a problem for this country.

Table 9 - 5 Correlations among explanatory variables for the Philippines

<table>
<thead>
<tr>
<th></th>
<th>Rm-Rf</th>
<th>SMB</th>
<th>HML</th>
<th>MOM</th>
<th>UGDP</th>
<th>UTT</th>
<th>URI</th>
<th>WRF</th>
</tr>
</thead>
<tbody>
<tr>
<td>Rm-Rf</td>
<td>-0.0279</td>
<td>-0.0572</td>
<td>0.0655</td>
<td>-0.1223</td>
<td>-0.0215</td>
<td>-0.1055</td>
<td>0.1630</td>
<td></td>
</tr>
<tr>
<td>SMB</td>
<td>-0.0279</td>
<td>0.2949</td>
<td>0.0996</td>
<td>0.2626</td>
<td>0.2139</td>
<td>-0.0504</td>
<td>0.1679</td>
<td></td>
</tr>
<tr>
<td>HML</td>
<td>-0.0572</td>
<td>0.2949</td>
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<td>-0.1434</td>
<td>0.1129</td>
<td>0.0975</td>
<td>0.3019</td>
<td></td>
</tr>
<tr>
<td>MOM</td>
<td>0.0655</td>
<td>0.0996</td>
<td>-0.2169</td>
<td>0.4117</td>
<td>0.2540</td>
<td>0.1319</td>
<td>0.1261</td>
<td></td>
</tr>
<tr>
<td>UGDP</td>
<td>-0.1223</td>
<td>0.2626</td>
<td>-0.1434</td>
<td>0.4117</td>
<td>0.5696</td>
<td>0.1969</td>
<td>0.2649</td>
<td></td>
</tr>
<tr>
<td>UTT</td>
<td>-0.0215</td>
<td>0.2139</td>
<td>0.1129</td>
<td>0.2540</td>
<td>0.5696</td>
<td>0.1319</td>
<td>0.5227</td>
<td></td>
</tr>
<tr>
<td>URI</td>
<td>-0.1055</td>
<td>-0.0504</td>
<td>0.0975</td>
<td>-0.0990</td>
<td>0.1969</td>
<td>0.1319</td>
<td>0.1261</td>
<td></td>
</tr>
<tr>
<td>WRF</td>
<td>0.1630</td>
<td>0.1679</td>
<td>0.3019</td>
<td>0.2559</td>
<td>0.2649</td>
<td>0.5227</td>
<td>0.1261</td>
<td></td>
</tr>
</tbody>
</table>

Note: The explanatory returns are the average premium for the common factors represented by MKTRF (returns to the market portfolio minus risk-free rate), SMB (small minus big), HML (high minus low), MOM (winners minus losers). Macro explanatory variables include world excess returns (WR) and unexpected GDP (UGDP), unexpected total trade (UTT) and unexpected local market returns (URI).

f. Summary

In summary, the correlation matrices do appear to differ somewhat across the ASEAN5 equity markets. In some cases, the correlation coefficients for the variables are large but they are far from perfectly correlated. High correlation is probably due to different levels of equity market development and particular macroeconomic and political factors specific to each of the ASEAN5 countries. However, further analysis of this issue is beyond the scope of this study.

9.4 Multifactor regression results

Regression analysis is used to examine the performance of multifactor models that include macro variables in explaining variation in size-BTME and industry portfolio returns. Regression results from tests of these models are presented in this section. Since the regression models used in this study are extensions of the four-factor models used in Chapter 8, the discussion of the results concentrates on the additional macro factors (UGDP, UTT, URI and WRF) unless stated otherwise.
9.4.1 Malaysia

Table 9-6 shows the time series regression results for the multifactor models for Malaysia. The coefficients estimated for the variables used in the basic four-factor model exhibit little variation and so they are not discussed in detail here. The results indicate that the unexpected GDP factor does not explain return variation in size-BTME portfolios but it has some explanatory power for industry portfolio returns. Statistically significant g-coefficients are found for Telecoms (at the 5% level), Oil & Gas, Industrial, and Consumer Services (at the 10% level).

A similar trend is found for the unexpected total trade factor for the size-BTME portfolios. None of the t-coefficients is statistically significant. The unexpected total trade factor impact appears to be negligible for industry portfolio returns as well, with only one industry return (Industrial) being sensitive to this factor. The sensitivity of the Industrial sector to trade is expected given that trade in Malaysia is mostly generated by industrial activities. The unexpected market return effect is important in explaining return variations for half of the size-BTME portfolio returns, in particular for the B/H, B/M and S/L portfolios. The effect is found across both size and value portfolios. However, industry returns do not exhibit sensitivity to this effect. Only the coefficient for Financial portfolio returns is statistically significant. The Malaysian equity market is relatively open and among the most developed markets within ASEAN5, yet the world returns do not have a significant explanatory impact on either the size-BTME portfolios or industry portfolios returns. The findings for unexpected equity market and world equity market effects could probably be explained by the size and the nature of the Malaysian equity market relative to regional (ASEAN5) equity markets and world markets.

The average adjusted R2 for the multifactor model is 0.8321, with average values for the size-BTME portfolios and industry portfolios of 0.9061 and 0.7828 respectively. These figures show that the multifactor models that account for macro factors work better for size-BTME portfolio returns than for industry returns. In comparison, however, the four-factor models employed in Chapter 8 performed almost as well as the multifactor models used in this study. The average adjusted R2 for the four-factor model is 0.8202 while it is 0.9030 for size-BTME portfolios and 0.7650 for industry portfolios. In summary, for Malaysian size-BTME and industry portfolios, the four-factor models are able to explain most of the variation in returns and adding the macro factors does not appear to substantially improve the explanatory power of these models. This effect is also evident in terms of the lack of statistically significant t-statistics on the macro factors coefficients.
Table 9 - 6 Regressions of the four-factor model with macro variables for Malaysia

<table>
<thead>
<tr>
<th>Size-BTME portfolios</th>
<th>Industry portfolios</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>O&amp;G</td>
</tr>
<tr>
<td>B/H</td>
<td>α</td>
</tr>
<tr>
<td>-0.0327*</td>
<td>1.1543*</td>
</tr>
<tr>
<td>-0.0209*</td>
<td>1.0926*</td>
</tr>
<tr>
<td>-0.0232*</td>
<td>0.9603*</td>
</tr>
<tr>
<td>-0.0255*</td>
<td>1.0711*</td>
</tr>
<tr>
<td>-0.0315*</td>
<td>1.0105*</td>
</tr>
<tr>
<td>-0.0442*</td>
<td>1.2509*</td>
</tr>
<tr>
<td></td>
<td>t(α)</td>
</tr>
<tr>
<td>-3.1141</td>
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</tr>
<tr>
<td>-3.3997</td>
<td>1.0926</td>
</tr>
<tr>
<td>-2.6453</td>
<td>0.9413</td>
</tr>
<tr>
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<td>0.7063</td>
</tr>
<tr>
<td>-3.6090</td>
<td>-1.0567</td>
</tr>
</tbody>
</table>

Note: In this table, the dependent returns indicate excess returns on B/H, B/M, B/L, S/H, S/M, and S/L – six portfolio combinations formed from size and book-to-market equity. Size of firms is represented by B (big) and S (small) while book-to-market equity is represented by H (high), M (medium), and L (low); Industry portfolios are represented by Oil & Gas (O&G), Basic Materials (BSM), Industrials (IND), Consumer Goods (CGD), Consumer Services (CSV), Telecommunications (TEL), Utilities (UTL), Financials (FIN), Technology (TECH), and Health Care (HC). The regressions include world excess returns (WRF) and residuals from macro factors of GDP (UGDP), total trade (UTT), and market returns (URI); α is the intercept; β, s, h, m, g, t, r and w are the slopes for Rm-Rf, SMB, HML, MOM, UGDP, URI, and WRF respectively. Adj R² is the adjusted value of R²; SE is the standard error; t(α) indicates the t-statistics with * represents 5% level of significance (critical value = 1.990) while + represents 10% level of significance (critical value = 1.659); n/a indicates unavailable data.
9.4.2 Singapore

Table 9-7 shows the time series regression results of the multifactor models for Singapore. The results for the intercepts, betas and \( s \)-coefficients are consistent with those reported in the four-factor models although there are some variations for size and momentum effects. From the multifactor results, the \( h \)-coefficients for B/H and S/M are statistically significant while the B/M and CSV portfolios are no longer statistically significant. In addition, the momentum effect reduces across the size-BTME and industry portfolios with inclusion of the macro factors.

Consistent with Malaysia, the unexpected GDP factor does not explain return variation in size-BTME portfolios. This result is also reflected in industry portfolios where none of the \( g \)-coefficients is statistically significant, except for the Consumer Goods portfolio. Similarly, total trade effects do not have strong support in explaining return variation across the size-BTME and industry portfolios. For Singapore, the \( t \)-coefficients for B/H, B/M, Consumer Services (CSV), and Financial (FIN) are statistically significant at the 10% level.

The unexpected equity market return \( r \)-coefficients for all the size-BTME portfolio returns are statistically significant, while the effect is rather mild for the industry portfolios with four significant coefficients (IND, FIN, CSV and HC) recorded from nine industry portfolios. Despite the openness of Singapore’s equity market, world excess returns have limited explanatory power over variation in portfolio returns. There are four significant \( w \)-coefficients across the 15 portfolio returns. Therefore, Singapore’s unexpected equity market returns are more important in explaining share returns than world returns.

The average adjusted \( R^2 \) for the multifactor model is 0.7601 with the average value for the size-BTME portfolios and industry portfolios equal to 0.9157 and 0.6564 respectively. These figures show that the multifactor models that accounted for macro factors have greater explanatory power for size-BTME portfolio returns than for industry portfolio returns. These models perform somewhat more strongly than the four-factor models employed in Chapter 8, in particular for the overall returns and the size-BTME portfolio returns. The average adjusted \( R^2 \) for the four-factor model is 0.7538, 0.9091 for size-BTME portfolios and 0.6503 for industry portfolios.
Table 9 - 7 Regressions of the four-factor model with macro variables for Singapore

<table>
<thead>
<tr>
<th>Size-BTME portfolios</th>
<th>Industry portfolios</th>
</tr>
</thead>
<tbody>
<tr>
<td>B/H</td>
<td>B/M</td>
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</tr>
<tr>
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</tr>
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<tr>
<td>s</td>
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<tr>
<td>t(s)</td>
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</tr>
<tr>
<td>h</td>
<td>0.2659*</td>
</tr>
<tr>
<td>t(h)</td>
<td>4.2097</td>
</tr>
<tr>
<td>m</td>
<td>0.0516</td>
</tr>
<tr>
<td>t(m)</td>
<td>1.7925</td>
</tr>
<tr>
<td>g</td>
<td>-0.1241</td>
</tr>
<tr>
<td>t(g)</td>
<td>1.7925</td>
</tr>
<tr>
<td>t</td>
<td>0.2652*</td>
</tr>
<tr>
<td>t(t)</td>
<td>1.7925</td>
</tr>
<tr>
<td>r</td>
<td>-0.2964*</td>
</tr>
<tr>
<td>t(r)</td>
<td>1.7925</td>
</tr>
<tr>
<td>w</td>
<td>0.1954</td>
</tr>
<tr>
<td>t(w)</td>
<td>1.7925</td>
</tr>
</tbody>
</table>

Note: In this table, the dependent returns indicate excess returns on B/H, B/M, B/L, S/H, S/M, and S/L − size portfolio combinations formed from book-to-market equity. Size of firms is represented by B (big) and S (small) while book-to-market equity is represented by H (high), M (medium), and L (low); Industry portfolios are represented by Oil & Gas (O&G), Basic Materials (BSM), Industrials (IND), Consumer Goods (CGD), Consumer Services (CSV), Telecom (TEL), Utilities (UTL), Financials (FIN), Technology (TECH) and Health Care (HC). The regressions include world excess returns (WRF), and residuals from macro factors (GDP, UGDP, total trade (UTT) and market returns (PRI)); α is the intercept; β, s, h, m, g, t, r and w are the slopes for Rm-Rf, SMB, HML, MOM, UGDP, UTT, URI and WRF respectively. Adj $R^2$ is the adjusted value of $R^2$; SE is the standard error; t indicates the t-statistics with * represents 5% level of significance (critical value = 1.990) while + represents 10% level of significance (critical value = 1.659); n/a indicates unavailable data.
9.4.3 Thailand
The regression results for Thailand’s multifactor models are presented in Table 9-8. Discussion of the results is provided for the macro factor variable since no substantial variation exists for the results of the four-factor models.\(^{73}\)

It is interesting to note that unexpected GDP has statistically significant coefficients for four of the size-BTME portfolio returns whereas this sensitivity is lacking for Malaysia and Singapore. Statistically significant coefficients are also evident for three of the industry portfolios (CGD, UTL and TCH). Furthermore, the unexpected total trade variable does have some influence across portfolio returns, mostly at the 10% level.

The unexpected equity market \(r\)-coefficients for predicted returns are rather limited with statistically significant coefficients for the B/H portfolio and two of the industry portfolios (TEL and FIN). The world excess returns also have no significant explanatory power for size-BTME portfolios although there are significant \(w\)-coefficients recorded for several industry portfolios (BSM, IND, TEL, and FIN). Briefly, Thailand’s industry portfolios show higher sensitivity to world excess returns and predicted returns than the size-BTME portfolios.

The average adjusted \(R^2\) for the multifactor model is 0.7010 with average values for the size-BTME portfolios and industry portfolios of 0.8526 and 0.6100 respectively. The multifactor models that account for macro factors work better for size-BTME portfolio returns than for industry portfolio returns. However, in comparison with the average adjusted \(R^2\) of the four-factor model found in Chapter 8, the figures do not vary substantially. The average adjusted \(R^2\) for the four-factor model is 0.6762 with average values of 0.8311 and 0.6762 for size-BTME and industry portfolios respectively, though the four-factor model (in Chapter 8) performs better in explaining return variation for industry portfolios.

\(^{73}\) It is noted, however, that the size effects appear to be slightly stronger in the multifactor models in Chapter 8.
Table 9 - 8 Regressions of the four-factor model with macro variables for Thailand

<table>
<thead>
<tr>
<th>Size-BTME portfolios</th>
<th>Industry portfolios</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>B/H</strong></td>
<td><strong>B/M</strong></td>
</tr>
<tr>
<td><strong>α</strong></td>
<td>-0.0296*</td>
</tr>
<tr>
<td><strong>t(α)</strong></td>
<td>-2.7720</td>
</tr>
<tr>
<td><strong>ß</strong></td>
<td>1.0267*</td>
</tr>
<tr>
<td><strong>s</strong></td>
<td>0.6669</td>
</tr>
<tr>
<td><strong>t(s)</strong></td>
<td>0.7994*</td>
</tr>
<tr>
<td><strong>h</strong></td>
<td>7.7939</td>
</tr>
<tr>
<td><strong>t(h)</strong></td>
<td>-0.3963*</td>
</tr>
<tr>
<td><strong>r</strong></td>
<td>1.9903</td>
</tr>
<tr>
<td><strong>t(r)</strong></td>
<td>1.457*</td>
</tr>
<tr>
<td><strong>w</strong></td>
<td>-0.2237</td>
</tr>
<tr>
<td><strong>t(w)</strong></td>
<td>-1.3134</td>
</tr>
<tr>
<td><strong>R²</strong></td>
<td>0.9296</td>
</tr>
<tr>
<td><strong>Adj R²</strong></td>
<td>0.9207</td>
</tr>
<tr>
<td><strong>SE</strong></td>
<td>0.0697</td>
</tr>
</tbody>
</table>

Note: In this table, the dependent returns indicate excess returns on B/H, B/M, B/L, S/M, and S/L – six portfolio combinations formed from size and book-to-market equity. Size of firms is represented by B (big) and S (small) while book-to-market equity is represented by H (high), M (medium), and L (low); Industry portfolios are represented by Oil & Gas (O&G), Basic Materials (BSM), Industrials (IND), Consumer Goods (CGD), Consumer Services (CSV), Telecom (TEL), Utilities (UTL), Financials (FIN), Technology (TECH) and Health Care (HC). The regressions include world excess returns (WRF), and residuals from macro factors GDP (UGDP), total trade (UTT), and market returns (PRI); α is the intercept; β, s, h, m, g, t, r and w are the slopes for Rm-Rf, SMB, HML, MOM, UGDP, UTT, URI and WRF respectively. Adj R² is the adjusted value of R²; SE is the standard error; t() indicates the t-statistics with * represents 5% level of significance (critical value = 1.990) while + represents 10% level of significance (critical value = 1.659); n/a indicates unavailable data.
9.4.4 Indonesia

Table 9-9 shows the regression results for the multifactor models for Indonesia. Other than some increment in the number of significant coefficients for size effects, the results show only small variation from the results reported in Chapter 8.

Unexpected GDP and unexpected total trade coefficients are rarely statistically significant. Likewise, the unexpected equity market returns and world excess returns have little influence over returns. The portfolio returns for Indonesia appear to be isolated from the effects of macro factors under study.

The average adjusted $R^2$ for the multifactor model is 0.6524 with the average value for the size-BTME portfolios and industry portfolios of 0.7807 and 0.5425 respectively. The differences in average $R^2$ between the multifactor models and the four-factor models are not substantial. The average $R^2$ values for the overall four-factor model in Chapter 8, size-BTME portfolios and industry portfolios are 0.6496, 0.7774 and 0.5537 respectively.
Table 9 - 9 Regressions of the four-factor model with macro variables for Indonesia

<table>
<thead>
<tr>
<th>Size-BTM portfolios</th>
<th>Industry portfolios</th>
</tr>
</thead>
<tbody>
<tr>
<td>B/H</td>
<td>O&amp;G</td>
</tr>
<tr>
<td>α</td>
<td>-0.0469*</td>
</tr>
<tr>
<td>t(α)</td>
<td>-2.4631</td>
</tr>
<tr>
<td>β</td>
<td>1.1304*</td>
</tr>
<tr>
<td>t(β)</td>
<td>9.2991</td>
</tr>
<tr>
<td>s</td>
<td>0.1279</td>
</tr>
<tr>
<td>t(s)</td>
<td>0.4279</td>
</tr>
<tr>
<td>h</td>
<td>0.6279*</td>
</tr>
<tr>
<td>t(h)</td>
<td>3.1324</td>
</tr>
<tr>
<td>m</td>
<td>-0.1111</td>
</tr>
<tr>
<td>t(m)</td>
<td>-0.7360</td>
</tr>
<tr>
<td>g</td>
<td>-0.1394</td>
</tr>
<tr>
<td>t(g)</td>
<td>-0.5221</td>
</tr>
<tr>
<td>t</td>
<td>0.2362</td>
</tr>
<tr>
<td>t(t)</td>
<td>1.0447</td>
</tr>
<tr>
<td>r</td>
<td>0.0535</td>
</tr>
<tr>
<td>t(r)</td>
<td>0.4312</td>
</tr>
<tr>
<td>w</td>
<td>-0.2106</td>
</tr>
<tr>
<td>t(w)</td>
<td>-0.7917</td>
</tr>
<tr>
<td>R²</td>
<td>0.9225</td>
</tr>
<tr>
<td>Adj R²</td>
<td>0.7991</td>
</tr>
<tr>
<td>SE</td>
<td>0.1134</td>
</tr>
</tbody>
</table>

Note: In this table, the dependent returns indicate excess returns on B/H, B/M, B/L, S/H, S/M, and S/L – six portfolio combinations formed from size and book-to-market equity. Size of firms is represented by B (big) and S (small) while book-to-market equity is represented by H (high), M (medium), and L (low); Industry portfolios are represented by Oil & Gas (O&G), Basic Materials (BSM), Industrials (IND), Consumer Goods (CGD), Consumer Services (CSV), Telecom (TEL), Utilities (UTL), Financials (FIN), Technology (TECH) and Health Care (HC). The regressions include world excess returns (WRF), and residuals from macro factors of GDP (UGDP), total trade (UTT), and market returns (PRI); α is the intercept; β, s, h, m, t, r and w are the slopes for Rm-Rf, SMB, HML, MOM, UGDP, UTT, URI and WRF respectively. Adj R² is the adjusted value of R²; SE is the standard error; t() indicates the t-statistics with * represents 5% level of significance (critical value = 1.990) while + represents 10% level of significance (critical value = 1.659); n/a indicates unavailable data.
9.4.5 Philippines

Table 9-10 presents the regression results of the multifactor models for the Philippines. In general, the results bear similarities to the four-factor models reported in Chapter 7 and therefore the discussion of the results starts with the unexpected GDP.

Unexpected GDP exhibits strong explanatory power on returns for size-BTME portfolios but not for industry portfolios. The unexpected total trade component is not important in explaining across-portfolio returns for the Philippines. Furthermore, the influence of unexpected equity market returns and world excess returns are also negligible in effect, indicating that the macro factors included in the models generally contribute little to explaining portfolio returns for the Philippines.

The average adjusted $R^2$ for the multifactor model is 0.5193 with the average value for the size-BTME portfolios and industry portfolios are 0.4366 and 0.5814 respectively. Unlike other ASEAN5 countries discussed previously, the multifactor models are more important in explaining variation in returns for industry portfolios than for size-BTME portfolios. For comparison, the average $R^2$ for overall model of the four-factor, size-BTME portfolios and industry portfolios are 0.4647, 0.3162 and 0.5760 respectively. Nonetheless, a caveat applies to this finding given that the adjusted $R^2$ for both the multifactor models and four-factor models provides the smallest adjusted $R^2$ within the ASEAN5 countries. Accordingly, the small adjusted $R^2$ values may emphasis the notion that other factors may be better able to explain the variation in the Philippines portfolio returns, though this question is left for future studies.
Table 9 - 10 Regressions of the four-factor model with macro variables for the Philippines

<table>
<thead>
<tr>
<th>Size-BTME portfolios</th>
<th>Industry portfolios</th>
</tr>
</thead>
<tbody>
<tr>
<td>B/H</td>
<td>O&amp;G</td>
</tr>
<tr>
<td>B/M</td>
<td>BSM</td>
</tr>
<tr>
<td>B/L</td>
<td>IND</td>
</tr>
<tr>
<td>S/H</td>
<td>CGD</td>
</tr>
<tr>
<td>S/M</td>
<td>CSV</td>
</tr>
<tr>
<td>S/L</td>
<td>TEL</td>
</tr>
<tr>
<td></td>
<td>UTL</td>
</tr>
<tr>
<td></td>
<td>FIN</td>
</tr>
<tr>
<td></td>
<td>TCH</td>
</tr>
<tr>
<td></td>
<td>HC</td>
</tr>
</tbody>
</table>

| B/H | -0.0419* | -0.0345* | -0.0509* | -0.0716* | -0.0665* | -0.0901* | 0.0043 | -0.0419 | -0.0095 | 0.0143 | -0.0159 | 0.0469* | -0.0069 | 0.0025 | n/a | n/a |
| B/M | 0.1351 | -0.9426 | -0.5290 | 0.9945 | -0.6366 | 2.5999 | -0.2564 | 0.2746 | n/a | n/a |
| B/L | 2.1999 | 1.9656 | 1.7707* | 0.9774 | 0.6446 | 1.9112 | 5.2575 | 4.1792 | 15.5967 | 10.3457 | 6.2029 | 9.3953 | 7.7666 | 20.9311 | n/a | n/a |
| S/H | 0.0749* | 0.9331* | 1.2542* | 0.7463* | 0.7493* | 0.7641* | 0.9353* | 0.9543* | n/a | n/a |
| S/M | 0.0666 | 0.2000 | -0.4391* | 0.6253* | 0.1225 | n/a | n/a |
| S/L | -0.0793 | -0.0975 | -0.1934 | 0.4446* | -0.1322 | -0.2932* | n/a | n/a |
| O&G | 1.1094* | 0.6291* | 0.2035 | 1.2373* | 0.4659* | 0.5573* | -0.6950* | 0.1702 | 0.1939 | -0.0660 | 0.2000 | -0.4391* | 0.6253* | 0.1225 | n/a | n/a |
| BSM | 4.9009 | 3.0672 | 1.1296 | 5.9901 | 2.0042 | 2.3659 | -1.9999 | 0.3114 | 0.9946 | -0.3739 | 0.7317 | -2.2005 | 2.1213 | 1.2204 | n/a | n/a |
| IND | 0.1753 | 0.0693 | 0.1276 | 0.0223 | -0.0570 | 0.1346 | -0.1511 | 0.3766 | 0.1605 | -0.1324 | 0.5735* | -0.1979 | 0.2090 | 0.2130* | n/a | n/a |
| CGD | 0.9721 | 0.4109 | 0.9732 | 0.1329 | -0.3025 | 0.7052 | -0.5362 | 0.9503 | 1.0061 | -0.9251 | 2.5429 | -1.1646 | 0.9749 | 2.6179 | n/a | n/a |
| CSV | -1.1490* | -0.7422* | -0.7995* | -0.5091 | -2.1007* | -1.1575* | 0.5023 | -0.2671 | 0.0490 | -0.4959 | -1.1519* | -0.1159 | -0.9974* | -0.2299 | n/a | n/a |
| TEL | 3.7279 | -2.0135 | -2.4366 | -1.3664 | -5.0299 | -2.7342 | 0.9039 | -0.2719 | 0.1359 | -1.5313 | -2.3446 | -0.3236 | -1.6751 | -1.2741 | n/a | n/a |
| UTL | 1.3755 | -0.0995 | 0.1699 | 0.0294 | 0.1734 | -0.1949 | -0.9492* | 0.4912 | 0.0696 | 0.4649* | -0.0529 | -0.1772 | 0.0529 | -0.0415 | n/a | n/a |
| FIN | 0.4366 | -0.3391 | 0.6656 | 0.1004 | 0.5271 | -0.5942 | -1.7234 | 0.6350 | 0.2497 | 1.9601 | -0.1366 | -0.6299 | 0.1269 | -0.2922 | n/a | n/a |
| TCH | 0.1129 | 0.0752 | 0.0719 | 0.0064 | 0.2459* | 0.1491* | 0.0439 | 0.192 | 0.0404 | -0.0709 | 0.0547 | -0.0655 | -0.0054 | 0.1060* | n/a | n/a |
| HEALTH | 1.6295 | 1.1776 | 1.2909 | 0.0991 | 3.3995 | 2.0194 | 0.4046 | 0.7536 | 0.6590 | -1.2992 | 0.6416 | -1.0569 | -0.0593 | 3.391 | n/a | n/a |
| W | -0.2491 | -0.1650 | -0.2799 | -0.0093 | -0.0945 | -0.4001 | 0.5032 | 0.0395 | -0.0216 | -0.0626 | -0.1010 | 0.6379* | 0.0412 | -0.1491 | n/a | n/a |
| W | -0.9537 | -0.6161 | -1.1940 | -0.0343 | -0.2795 | -1.3006 | 1.1092 | 0.0553 | -0.0940 | -0.2714 | -0.2929 | 2.4537 | 0.1071 | -1.1377 | n/a | n/a |
| R² | 0.6196 | 0.4497 | 0.4766 | 0.5139 | 0.5525 | 0.3992 | 0.4355 | 0.3049 | 0.9320 | 0.7101 | 0.5447 | 0.6971 | 0.6033 | 0.9023 | n/a | n/a |
| Adj R² | 0.5712 | 0.3796 | 0.4519 | 0.4596 | 0.4956 | 0.3115 | 0.3637 | 0.2164 | 0.9106 | 0.6732 | 0.4957 | 0.6596 | 0.5529 | 0.9999 | n/a | n/a |
| SE | 0.1233 | 0.1169 | 0.5095 | 0.1299 | 0.1305 | 0.3646 | 0.1926 | 0.3029 | 0.1091 | 0.0979 | 0.1515 | 0.1103 | 0.1633 | 0.0556 | n/a | n/a |

Note: In this table, the dependent returns indicate excess returns on B/H, B/M, B/L, S/M, and S/L – size portfolio combinations formed from size and book-to-market equity. Size of firms is represented by B (big) and S (small) while book-to-market equity is represented by H (high), M (medium), and L (low); Industry portfolios are represented by Oil & Gas (O&G), Basic Materials (BSM), Industrials (IND), Consumer Goods (CGD), Consumer Services (CSV), Telecom (TEL), Utilities (UTL), Financials (FIN), Technology (TECH) and Health Care (HC). The regressions include world excess returns (WRF), and residuals from macro factors of GDP (UGDP), total trade (UTT), and market returns (PRI); α is the intercept; β, s, h, m, g, t, r, and w are the slopes for Rm-Rf, SMB, HML, MOM, UGDP, UTT, URI and WRF respectively. Adj R² is the adjusted value of R²; SE is the standard error; t() indicates the t-statistics with * represents 5% level of significance (critical value = 1.990) while * represents 10% level of significance (critical value = 1.659); n/a indicates unavailable data.
9.5 Regressions of the four-factor models with single macro factors

In Section 9.6, the multifactor regression models incorporate all four macro factors in addition to the basic four-factor pricing models employed in Chapter 8 to examine the explanatory power of the macro variables on size-BTME and industry portfolio returns. In this section, the regressions for the basic four-factor models plus each of the macro factors are examined individually to provide further insight into the explanatory power of these macro variables. The tables present extractions from the full results, focusing on the unexpected GDP, unexpected total trade, unexpected equity market returns and world excess returns.

9.5.1 Macro factors for Malaysia

The results in Table 9-11 show little variation from those presented in Table 9-6, thus only the changes are reported here. The results for the unexpected GDP variables now indicate that the B/M portfolio is significant (at the 10% level) while the industrial portfolio is no longer significant. The unexpected total trade shows sensitivity to Telecom portfolio returns (at the 10% level). The industrial portfolio is sensitive to unexpected equity market returns. It is noted that world excess returns explain returns on Consumer Services and Technology portfolios, when tested separately.

It is expected that the full multifactor models should perform better than the model with a single additional macro factor, although adjusted R\(^2\) does include an adjusted number of explanatory variables included in the regression. However, this is not always the case for Malaysia. Based on portfolio R\(^2\) values, the full multifactor models have smaller R\(^2\) than that of the B/L, S/H, S/M, Basic Materials and Utilities portfolios, for each of the single macro-factor models. It is found that at least one of the single macro-factor models has R\(^2\) that exceed the full model R\(^2\) (Table 9-6).

9.5.2 Macro-factor models for Singapore

The results for single macro-factor models are given in Table 9-12. Some variation exists in the results in relation to the results reported in Table 9-7. In particular, some results that are statistically significant in Table 9-7 become statistically insignificant in Table 9-12 and this is apparent for each of the macro variables. This occurs for one of the g-coefficients (B/M), three of the t-coefficients (B/H, B/M and FIN), three of the w-coefficients (B/M,}

74 The full results are available upon request.
S/L, and FIN) and six of the $r$-coefficients (B/H, B/M, B/L, S/L, CSV, and FIN). This is unexpected although not inconsistent with the nature of multifactor analysis.

As expected, the full multifactor models (Table 9-7) perform better than the model with one single macro factor (Table 9-11) for most of the cases for Singapore. For example, only three of the industry-based portfolios have at least three individual $R^2$ values that are greater than the $R^2$ for the full models (O&G, BSM and CGD) reported in Table 9-7.
Table 9 - 11 Regressions of the four-factor model with single macro factor for Malaysia

Panel A: \( R_i - R_f = \alpha + \beta [R_m - R_f] + \delta \text{SMB} + \gamma \text{HML} + \mu \text{MOM} + \nu \text{UGDP} + \epsilon \)

<table>
<thead>
<tr>
<th>Panel A</th>
<th>B/H</th>
<th>B/M</th>
<th>B/L</th>
<th>S/H</th>
<th>S/M</th>
<th>S/L</th>
<th>O&amp;G</th>
<th>BSM</th>
<th>IND</th>
<th>CGD</th>
<th>CSV</th>
<th>TEL</th>
<th>UTL</th>
<th>FIN</th>
<th>TCH</th>
<th>HC</th>
</tr>
</thead>
<tbody>
<tr>
<td>( g )</td>
<td>-0.1990</td>
<td>-0.3394*</td>
<td>-0.2026</td>
<td>-0.1745</td>
<td>-0.2242</td>
<td>-0.1946</td>
<td>-0.4142*</td>
<td>-0.1019</td>
<td>-0.0727</td>
<td>-0.1005</td>
<td>0.3291*</td>
<td>0.7963*</td>
<td>0.0094</td>
<td>-0.0597</td>
<td>3.7433*</td>
<td>n/a</td>
</tr>
<tr>
<td>( t(g) )</td>
<td>-0.7962</td>
<td>-1.7690</td>
<td>-1.0934</td>
<td>-0.7676</td>
<td>-1.0155</td>
<td>-0.6990</td>
<td>-1.7226</td>
<td>-0.4166</td>
<td>-0.2927</td>
<td>-0.3115</td>
<td>2.5111</td>
<td>3.1771</td>
<td>0.0435</td>
<td>-0.3944</td>
<td>2.1507</td>
<td>n/a</td>
</tr>
<tr>
<td>( R^2 )</td>
<td>0.9954</td>
<td>0.9139</td>
<td>0.9999</td>
<td>0.9263</td>
<td>0.9239</td>
<td>0.9022</td>
<td>0.7292</td>
<td>0.9521</td>
<td>0.9171</td>
<td>0.7467</td>
<td>0.9376</td>
<td>0.9372</td>
<td>0.9479</td>
<td>0.9495</td>
<td>0.5332</td>
<td>n/a</td>
</tr>
<tr>
<td>Adj ( R^2 )</td>
<td>0.9992</td>
<td>0.9079</td>
<td>0.9919</td>
<td>0.9212</td>
<td>0.9197</td>
<td>0.9555</td>
<td>0.7094</td>
<td>0.9419</td>
<td>0.9045</td>
<td>0.7292</td>
<td>0.9322</td>
<td>0.9259</td>
<td>0.9356</td>
<td>0.9460</td>
<td>0.4595</td>
<td>n/a</td>
</tr>
<tr>
<td>( SE )</td>
<td>0.0759</td>
<td>0.0614</td>
<td>0.0595</td>
<td>0.0729</td>
<td>0.0709</td>
<td>0.0995</td>
<td>0.0772</td>
<td>0.0795</td>
<td>0.0799</td>
<td>0.1036</td>
<td>0.0419</td>
<td>0.0904</td>
<td>0.0697</td>
<td>0.0496</td>
<td>0.2100</td>
<td>n/a</td>
</tr>
</tbody>
</table>

Panel B

<table>
<thead>
<tr>
<th>Panel B</th>
<th>( t )</th>
<th>( t(g) )</th>
<th>( R^2 )</th>
<th>Adj ( R^2 )</th>
<th>( SE )</th>
</tr>
</thead>
<tbody>
<tr>
<td>( r )</td>
<td>-0.2449*</td>
<td>-0.1951*</td>
<td>-0.0614</td>
<td>-0.0979</td>
<td>0.0722</td>
</tr>
<tr>
<td>( t(r) )</td>
<td>-2.7606</td>
<td>-2.4921</td>
<td>-0.9299</td>
<td>-1.0975</td>
<td>-0.7629</td>
</tr>
<tr>
<td>( R^2 )</td>
<td>0.9069</td>
<td>0.9190</td>
<td>0.9990</td>
<td>0.9270</td>
<td>0.9233</td>
</tr>
<tr>
<td>Adj ( R^2 )</td>
<td>0.9003</td>
<td>0.9124</td>
<td>0.9910</td>
<td>0.9220</td>
<td>0.9190</td>
</tr>
<tr>
<td>( SE )</td>
<td>0.0716</td>
<td>0.0599</td>
<td>0.0597</td>
<td>0.0726</td>
<td>0.0711</td>
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</tbody>
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Panel C

<table>
<thead>
<tr>
<th>Panel C</th>
<th>( w )</th>
<th>( t(w) )</th>
<th>( R^2 )</th>
<th>Adj ( R^2 )</th>
<th>( SE )</th>
</tr>
</thead>
<tbody>
<tr>
<td>( r )</td>
<td>-0.0311</td>
<td>-0.1179</td>
<td>-0.0199</td>
<td>-0.0944</td>
<td>-0.0026</td>
</tr>
<tr>
<td>( t(r) )</td>
<td>-0.2203</td>
<td>-1.0159</td>
<td>-1.1971</td>
<td>-0.6973</td>
<td>-0.0194</td>
</tr>
<tr>
<td>( R^2 )</td>
<td>0.9944</td>
<td>0.9107</td>
<td>0.9969</td>
<td>0.9261</td>
<td>0.9225</td>
</tr>
<tr>
<td>Adj ( R^2 )</td>
<td>0.9971</td>
<td>0.9046</td>
<td>0.9979</td>
<td>0.9210</td>
<td>0.9172</td>
</tr>
<tr>
<td>( SE )</td>
<td>0.0762</td>
<td>0.0625</td>
<td>0.0601</td>
<td>0.0730</td>
<td>0.0715</td>
</tr>
</tbody>
</table>

Note: In this table, the dependent returns indicate excess returns on size-BTME portfolios (B/H, B/M, B/L, S/H, S/M, and S/L) and industry portfolios [Oil & Gas (O&G), Basic Materials (BSM), Industrials (IND), Consumer Goods (CGD), Consumer Services (CSV), Telecom (TEL), Utilities (UTL), Financials (FIN), Technology (TECH) and Health Care (HC)]. Each of the macro factors is represented as \( g, t, r \) and \( w \) respectively. These are the slopes for UGDP, UTT, URI and WRF accordingly; Adj \( R^2 \) is the adjusted value of \( R^2 \); SE is the standard error; \( t(s) \) indicates the t-statistics with * represents 5% level of significance (critical value = 1.990) while * represents 10% level of significance (critical value = 1.659); n/a indicates unavailable data.
Table 9 - 12 Regressions of the four-factor model with single macro factor for Singapore

<table>
<thead>
<tr>
<th>Panel A</th>
<th>B/H</th>
<th>B/M</th>
<th>B/L</th>
<th>S/H</th>
<th>S/M</th>
<th>S/L</th>
<th>O&amp;G</th>
<th>BSM</th>
<th>IND</th>
<th>CGD</th>
<th>CSV</th>
<th>TEL</th>
<th>UTL</th>
<th>FIN</th>
<th>TCH</th>
<th>HC</th>
</tr>
</thead>
<tbody>
<tr>
<td>g</td>
<td>-0.01291</td>
<td>-0.4215</td>
<td>-0.0947</td>
<td>-0.2363</td>
<td>-0.1544</td>
<td>-0.2071</td>
<td>-0.6993</td>
<td>-0.2279</td>
<td>0.3097</td>
<td>-0.5253</td>
<td>0.6961*</td>
<td>0.3225</td>
<td>n/a</td>
<td>-0.2123</td>
<td>1.0123</td>
<td>-0.5341</td>
</tr>
<tr>
<td>t(g)</td>
<td>-0.1067</td>
<td>-1.2119</td>
<td>-0.3391</td>
<td>-0.7295</td>
<td>-0.4605</td>
<td>-0.5995</td>
<td>-0.9141</td>
<td>-0.3202</td>
<td>0.9969</td>
<td>-0.9461</td>
<td>3.3260</td>
<td>0.4590</td>
<td>n/a</td>
<td>-1.2741</td>
<td>0.9472</td>
<td>-1.5599</td>
</tr>
<tr>
<td>R²</td>
<td>0.9246</td>
<td>0.9775</td>
<td>0.9103</td>
<td>0.9357</td>
<td>0.9234</td>
<td>0.9201</td>
<td>0.5593</td>
<td>0.7061</td>
<td>0.9299</td>
<td>0.7639</td>
<td>0.9217</td>
<td>0.0976</td>
<td>n/a</td>
<td>0.9676</td>
<td>0.4942</td>
<td>0.7612</td>
</tr>
<tr>
<td>Adj R²</td>
<td>0.9194</td>
<td>0.9690</td>
<td>0.9041</td>
<td>0.9312</td>
<td>0.9191</td>
<td>0.9146</td>
<td>0.5267</td>
<td>0.6959</td>
<td>0.9190</td>
<td>0.7477</td>
<td>0.9163</td>
<td>0.0047</td>
<td>n/a</td>
<td>0.9653</td>
<td>0.4452</td>
<td>0.7447</td>
</tr>
<tr>
<td>SE</td>
<td>0.0515</td>
<td>0.0657</td>
<td>0.0527</td>
<td>0.0612</td>
<td>0.0633</td>
<td>0.0665</td>
<td>0.1399</td>
<td>0.1345</td>
<td>0.0591</td>
<td>0.1173</td>
<td>0.0395</td>
<td>0.1199</td>
<td>n/a</td>
<td>0.0315</td>
<td>0.2219</td>
<td>0.0647</td>
</tr>
</tbody>
</table>

Panel B

| t               | 0.1215 | 0.1146 | 0.0471 | -0.0495 | -0.0924 | -0.0595 | 0.2649 | -0.0254 | 0.0599 | -0.0994 | 0.2536* | 0.4932 | n/a | -0.0990 | 0.7439 | -0.0505 |
| t(t)            | 0.9159 | 0.6654 | 0.3439 | -0.3043 | -0.5015 | -0.3394 | 0.7257 | -0.0726 | 0.3910 | -0.3247 | 2.3695 | 1.4146 | n/a | -1.2099 | 1.2614 | -0.2946 |
| R²              | 0.9257 | 0.9753 | 0.9103 | 0.9352 | 0.9235 | 0.9199 | 0.5559 | 0.7056 | 0.9273 | 0.7614 | 0.9149 | 0.1239 | n/a | 0.9675 | 0.4926 | 0.7514 |
| Adj R²          | 0.9205 | 0.9667 | 0.9041 | 0.9307 | 0.9192 | 0.9143 | 0.5241 | 0.6953 | 0.9154 | 0.7450 | 0.9090 | 0.0443 | n/a | 0.9652 | 0.4543 | 0.7342 |
| SE              | 0.0511 | 0.0663 | 0.0527 | 0.0614 | 0.0633 | 0.0666 | 0.1402 | 0.1346 | 0.0595 | 0.1179 | 0.0412 | 0.1175 | n/a | 0.0315 | 0.2200 | 0.0660 |

Panel C

| r               | -0.1371 | -0.1979 | -0.1475 | -0.1506 | -0.2519* | -0.1302 | -0.0147 | -0.1519 | -0.1951* | -0.2399 | 0.0196 | 0.0001 | n/a | 0.0972 | 0.3142 | -0.2609* |
| t(r)            | -1.5059 | -1.5995 | -1.5927 | -1.3912 | -2.3005 | -1.0941 | -0.0559 | -0.6273 | -1.9700 | -1.1345 | 0.2522 | 0.0004 | n/a | 1.5463 | 0.7520 | -2.2971 |
| R²              | 0.9275 | 0.9797 | 0.9139 | 0.9372 | 0.9297 | 0.9213 | 0.5516 | 0.7076 | 0.9369 | 0.7663 | 0.9066 | 0.0932 | n/a | 0.9690 | 0.4927 | 0.7719 |
| Adj R²          | 0.9225 | 0.9714 | 0.9079 | 0.9329 | 0.9249 | 0.9159 | 0.5196 | 0.6974 | 0.9256 | 0.7501 | 0.9002 | -0.0002 | n/a | 0.9659 | 0.4436 | 0.7562 |
| SE              | 0.0505 | 0.0651 | 0.0517 | 0.0605 | 0.0607 | 0.0660 | 0.1409 | 0.1342 | 0.0579 | 0.1167 | 0.0432 | 0.1202 | n/a | 0.0313 | 0.2222 | 0.0632 |

Panel D

| w               | 0.0716 | 0.1194 | 0.0552 | 0.0792 | -0.0110 | 0.1771 | 0.1914 | 0.0702 | 0.0730 | -0.3113 | 0.1573* | 0.2632 | n/a | -0.1017 | 1.3472* | -0.1171 |
| t(w)            | 0.6696 | 0.6649 | 0.5021 | 0.6115 | -0.0930 | 1.2912 | 0.5749 | 0.2499 | 0.5993 | -1.2914 | 1.7927 | 0.9553 | n/a | -1.5595 | 2.6745 | -0.9543 |
| R²              | 0.9252 | 0.9760 | 0.9105 | 0.9355 | 0.9231 | 0.9219 | 0.5543 | 0.7059 | 0.9279 | 0.7677 | 0.9115 | 0.0995 | n/a | 0.9690 | 0.5403 | 0.7541 |
| Adj R²          | 0.9200 | 0.9674 | 0.9043 | 0.9310 | 0.9179 | 0.9165 | 0.5224 | 0.6956 | 0.9160 | 0.7516 | 0.9054 | 0.0166 | n/a | 0.9659 | 0.5056 | 0.7372 |
| SE              | 0.0513 | 0.0661 | 0.0527 | 0.0613 | 0.0634 | 0.0657 | 0.1405 | 0.1345 | 0.0594 | 0.1163 | 0.0420 | 0.1192 | n/a | 0.0313 | 0.2094 | 0.0657 |

Note: In this table, the dependent returns indicate excess returns on size-BTME portfolios (B/H, B/M, B/L, S/M, and S/L) and industry portfolios [Oil & Gas (O&G), Basic Materials (BSM), Industrials (IND), Consumer Goods (CGD), Consumer Services (CSV), Telecom (TEL), Utilities (UTL), Financials (FIN), Technology (TECH) and Health Care (HC)]. Each of the macro factors is represented as g, t, r and w respectively. These are the slopes for UGDP, UTI, URI and WRF accordingly; Adj R² is the adjusted value of R²; SE is the standard error; t(t) indicates the t-statistics with * represents 5% level of significance (critical value = 1.990) while ** represents 10% level of significance (critical value = 1.659); n/a indicates unavailable data.
9.5.3 Macro-factor models for Thailand

The results for single macro-factor models are given in Table 9-13. Unlike Malaysia and Singapore, there is greater variation observed for the Thailand-based regressions when compared to the full models in Table 9-8. Most of the variation is found for the unexpected total trade and world excess returns variables while not so much happening for unexpected GDP and unexpected equity market returns.

Five of the coefficients for unexpected total trade become statistically significant (S/H, S/M, S/L, IND and TCH) while there are five coefficients (B/H, B/M, BSM, CGD and UTL) that lose their statistical significance for these single models. The world excess return variables appear to be important in explaining portfolio returns for Thailand with five significant variables (B/H, B/M, S/H and TECH). However, three of the industry portfolios (B/M, TEL and UTL) show little sensitivity to this effect compared with the full model results (Table 9-8), while the Technology portfolio shows sensitivity to the influence of world returns with a significant \( w \)-coefficient. The variation in results may be due to multicollinearity reported in Table 9-3, particularly between GDP, trade and world equity market effects.

In general, however, the full models reported in Table 9-8 perform better than the incremental macro-factor models except for Oil & Gas and Consumer Services portfolios (for all four single models), and S/M (single models for UTT and UGDP). This comparison is based on the adjusted \( R^2 \) values.
<table>
<thead>
<tr>
<th>Panel A</th>
<th>B/H</th>
<th>B/M</th>
<th>B/L</th>
<th>S/H</th>
<th>S/M</th>
<th>O&amp;G</th>
<th>BSM</th>
<th>IND</th>
<th>CGD</th>
<th>CSV</th>
<th>TEL</th>
<th>UTL</th>
<th>FIN</th>
<th>TCH</th>
<th>HC</th>
</tr>
</thead>
<tbody>
<tr>
<td>$g$</td>
<td>-0.4613*</td>
<td>-0.3674*</td>
<td>-0.2647*</td>
<td>-0.4596*</td>
<td>-0.3473*</td>
<td>0.6749*</td>
<td>0.4659</td>
<td>0.1249</td>
<td>1.4592*</td>
<td>-0.3333</td>
<td>0.0963</td>
<td>0.1909</td>
<td>0.4200*</td>
<td>-0.2192</td>
<td>0.9536*</td>
</tr>
<tr>
<td>$t(g)$</td>
<td>-3.1921</td>
<td>-3.1942</td>
<td>-1.7276</td>
<td>-3.2264</td>
<td>-2.1237</td>
<td>-4.3962</td>
<td>1.5059</td>
<td>0.5941</td>
<td>1.3951</td>
<td>-1.4067</td>
<td>0.4665</td>
<td>0.4123</td>
<td>1.9614</td>
<td>-1.1431</td>
<td>2.7647</td>
</tr>
<tr>
<td>$R^2$</td>
<td>0.9156</td>
<td>0.9097</td>
<td>0.9399</td>
<td>0.9650</td>
<td>0.9076</td>
<td>0.9232</td>
<td>0.3303</td>
<td>0.9596</td>
<td>0.3113</td>
<td>0.7779</td>
<td>0.6112</td>
<td>0.7675</td>
<td>0.5737</td>
<td>0.9762</td>
<td>0.7243</td>
</tr>
<tr>
<td>Adj $R^2$</td>
<td>0.9099</td>
<td>0.9034</td>
<td>0.9299</td>
<td>0.9557</td>
<td>0.7943</td>
<td>0.9110</td>
<td>0.2941</td>
<td>0.9499</td>
<td>0.2526</td>
<td>0.7626</td>
<td>0.5944</td>
<td>0.7496</td>
<td>0.5300</td>
<td>0.9677</td>
<td>0.7050</td>
</tr>
<tr>
<td>$SE$</td>
<td>0.0732</td>
<td>0.0593</td>
<td>0.0777</td>
<td>0.0722</td>
<td>0.0929</td>
<td>0.0779</td>
<td>0.1567</td>
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<td>0.2269</td>
<td>0.1201</td>
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<td>0.1314</td>
<td>0.1099</td>
<td>0.0972</td>
<td>0.1747</td>
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</table>

<table>
<thead>
<tr>
<th>Panel B</th>
<th>$t$</th>
<th>$t(g)$</th>
<th>$R^2$</th>
<th>Adj $R^2$</th>
<th>$SE$</th>
</tr>
</thead>
<tbody>
<tr>
<td>$g$</td>
<td>-0.1729</td>
<td>-0.1663</td>
<td>-0.0664</td>
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<td>-0.2936*</td>
</tr>
<tr>
<td>$t(g)$</td>
<td>-1.2962</td>
<td>-1.5764</td>
<td>-0.4905</td>
<td>-2.4395</td>
<td>-2.0779</td>
</tr>
<tr>
<td>$R^2$</td>
<td>0.9034</td>
<td>0.9979</td>
<td>0.9322</td>
<td>0.9555</td>
<td>0.9070</td>
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<tr>
<td>Adj $R^2$</td>
<td>0.9967</td>
<td>0.9909</td>
<td>0.9206</td>
<td>0.9455</td>
<td>0.7936</td>
</tr>
<tr>
<td>$SE$</td>
<td>0.0794</td>
<td>0.0620</td>
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<td>0.0747</td>
<td>0.0930</td>
</tr>
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</table>

<table>
<thead>
<tr>
<th>Panel C</th>
<th>$r$</th>
<th>$t(r)$</th>
<th>$R^2$</th>
<th>Adj $R^2$</th>
<th>$SE$</th>
</tr>
</thead>
<tbody>
<tr>
<td>$g$</td>
<td>0.0959</td>
<td>0.0393</td>
<td>0.0274</td>
<td>0.0603</td>
<td>0.0239</td>
</tr>
<tr>
<td>$t(g)$</td>
<td>1.3610</td>
<td>-0.7740</td>
<td>0.4295</td>
<td>-0.9611</td>
<td>0.3457</td>
</tr>
<tr>
<td>$R^2$</td>
<td>0.9037</td>
<td>0.9946</td>
<td>0.9320</td>
<td>0.9429</td>
<td>0.7929</td>
</tr>
<tr>
<td>Adj $R^2$</td>
<td>0.9970</td>
<td>0.9973</td>
<td>0.9204</td>
<td>0.9321</td>
<td>0.7795</td>
</tr>
<tr>
<td>$SE$</td>
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<td>0.0795</td>
<td>0.0779</td>
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</table>

<table>
<thead>
<tr>
<th>Panel D</th>
<th>$w$</th>
<th>$t(w)$</th>
<th>$R^2$</th>
<th>Adj $R^2$</th>
<th>$SE$</th>
</tr>
</thead>
<tbody>
<tr>
<td>$g$</td>
<td>-0.2979*</td>
<td>-0.2792*</td>
<td>-0.1994</td>
<td>-0.4035*</td>
<td>-0.1259</td>
</tr>
<tr>
<td>$t(g)$</td>
<td>-2.3499*</td>
<td>-2.9196</td>
<td>-1.5017</td>
<td>-3.5106</td>
<td>-0.9120</td>
</tr>
<tr>
<td>$R^2$</td>
<td>0.9093</td>
<td>0.9073</td>
<td>0.9379</td>
<td>0.9697</td>
<td>0.7953</td>
</tr>
<tr>
<td>Adj $R^2$</td>
<td>0.9031</td>
<td>0.9009</td>
<td>0.9267</td>
<td>0.9597</td>
<td>0.7959</td>
</tr>
<tr>
<td>$SE$</td>
<td>0.0759</td>
<td>0.0590</td>
<td>0.0791</td>
<td>0.0712</td>
<td>0.0955</td>
</tr>
</tbody>
</table>

Note: In this table, the dependent returns indicate excess returns on size-BTME portfolios (B/H, B/M, B/L, S/H, and S/M) and industry portfolios [Oil & Gas (O&G), Basic Materials (BSM), Industrials (IND), Consumer Goods (CGD), Consumer Services (CSV), Telecom (TEL), Utilities (UTL), Financials (FIN), Technology (TECH) and Health Care (HC)]. Each of the macro factors is represented as $g$, $t$, $r$ and $w$ respectively. These are the slopes for UGDP, UTT, URI and WRF accordingly; Adj $R^2$ is the adjusted value of $R^2$; SE is the standard error; $t$ represents the t-statistics with * represents 5% level of significance (critical value = 1.990) whereas + represents 10% level of significance (critical value = 1.659); n/a indicates unavailable data.
9.5.4 Macro-factor models for Indonesia

The results for single macro-factor models for Indonesia are given in Table 9-14. The results exhibit some variation from the full model results (Table 9-9). It is noted that an increase in the number of statistically significant coefficients prevails in Table 9-14.

There is one statistically significant g-coefficient (B/M) recorded for the full model, yet when tested separately seven additional coefficients are found to be significant. As such, three of the size-BTME portfolios (B/M, S/M and S/L) and five of the industry portfolios (BSM, IND, CGD, CSV and FIN) are sensitive to the unexpected GDP component of the model. While none of the unexpected total trade variables is significant for the full model, six significant coefficients are observed from these results (B/M, S/M, BSM, IND, CSV and FIN). These results are not unexpected given the multicollinearity reported in Table 9-4 for these variables.

The unexpected equity market returns variable is more important to industry portfolio returns than that for size-BTME returns, with five versus one statistically significant coefficient respectively (BSM, IND, CSV, FIN and S/M). It is noted that similar levels of statistically significant coefficients are documented for the world excess returns variable. To some extent, the results indicate that the four-factor models explain most of the variation in Indonesian portfolio returns although only separate models are able to capture the sensitivity of returns to these macro components. Furthermore, this proposition is supported by the adjusted $R^2$ values where, in most cases, the single macro-factor model adjusted $R^2$ values exceed those of the full model values reported in Table 9-9.
Table 9 - 14 Regressions of the four-factor model with single macro factor for Indonesia

Panel A: $R^*_t = \alpha + \beta [R_m-R_f] + \theta SMB + \gamma HML + m MOM + g UGDP + \epsilon$

Panel B: $R^*_t = \alpha + \beta [R_m-R_f] + \theta SMB + \gamma HML + m MOM + t UTT + \epsilon$

Panel C: $R^*_t = \alpha + \beta [R_m-R_f] + \theta SMB + \gamma HML + m MOM + r URI + \epsilon$

Panel D: $R^*_t = \alpha + \beta [R_m-R_f] + \theta SMB + \gamma HML + m MOM + w WRF + \epsilon$

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<th>B/H</th>
<th>B/M</th>
<th>B/L</th>
<th>S/H</th>
<th>S/M</th>
<th>S/L</th>
<th>O&amp;G</th>
<th>BSM</th>
<th>IND</th>
<th>CGD</th>
<th>CSV</th>
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<td>-0.0356</td>
<td>-0.3311*</td>
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<td>0.9199</td>
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<td>0.9457</td>
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<td>0.9199</td>
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<td>0.7127</td>
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<td>0.0692</td>
<td>0.1053</td>
<td>0.0795</td>
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<td>0.1392</td>
<td>0.1100</td>
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<td>0.1235</td>
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<td>n/a</td>
<td>0.7099</td>
<td>n/a</td>
<td>0.7919</td>
</tr>
</tbody>
</table>

| Panel B | t | -0.0141 | -0.1556+ | 0.0294 | -0.0476 | -0.2319* | -0.1961 | 0.1660 | 0.3045* | 0.4066+ | -0.1793 | -0.3495* | n/a | n/a | 0.4149* | n/a | -0.0297 |
|---------|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|
| $R^2$   | 0.9165 | 0.7959 | 0.9457 | 0.7632 | 0.9109 | 0.7506 | 0.4199 | 0.6926 | 0.1299 | 0.7091 | 0.5962 | n/a | n/a | 3.0969 | n/a | -0.2975 |
| Adj $R^2$ | 0.9165 | 0.7959 | 0.9457 | 0.7632 | 0.9109 | 0.7506 | 0.4199 | 0.6926 | 0.1299 | 0.7091 | 0.5962 | n/a | n/a | 3.0969 | n/a | -0.2975 |
| SE      | 0.1121 | 0.0904 | 0.0692 | 0.1061 | 0.0914 | 0.1415 | 0.1373 | 0.1153 | 0.1959 | 0.1243 | 0.1613 | n/a | n/a | 0.1391 | n/a | 0.0991 |

| Panel C | r | 0.0175 | -0.0909 | -0.0299 | -0.1025 | -0.1661* | -0.1512 | 0.1255 | 0.2265* | 0.2904+ | -0.0435 | -0.2710* | n/a | n/a | 0.4003* | n/a | -0.0297 |
|---------|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|
| $R^2$   | 0.9165 | 0.7996 | 0.9460 | 0.7692 | 0.9023 | 0.7499 | 0.4177 | 0.6931 | 0.1151 | 0.6994 | 0.5673 | n/a | n/a | 0.6957 | n/a | 0.7939 |
| Adj $R^2$ | 0.9165 | 0.7996 | 0.9460 | 0.7692 | 0.9023 | 0.7499 | 0.4177 | 0.6931 | 0.1151 | 0.6994 | 0.5673 | n/a | n/a | 0.6957 | n/a | 0.7939 |
| SE      | 0.1121 | 0.0904 | 0.0692 | 0.1061 | 0.0914 | 0.1415 | 0.1373 | 0.1153 | 0.1959 | 0.1243 | 0.1613 | n/a | n/a | 0.1391 | n/a | 0.0991 |

| Panel D | w | -0.0549 | -0.1509 | -0.0205 | -0.0361 | -0.2550* | -0.2107 | 0.0205 | 0.3499* | 0.4115* | -0.2022 | -0.3117* | n/a | n/a | 0.5229* | n/a | -0.0350 |
|---------|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|
| $R^2$   | 0.9172 | 0.7942 | 0.9455 | 0.7629 | 0.9139 | 0.7522 | 0.4292 | 0.7009 | 0.1332 | 0.7111 | 0.5961 | n/a | n/a | 0.7292 | n/a | 0.7939 |
| Adj $R^2$ | 0.9172 | 0.7942 | 0.9455 | 0.7629 | 0.9139 | 0.7522 | 0.4292 | 0.7009 | 0.1332 | 0.7111 | 0.5961 | n/a | n/a | 0.7292 | n/a | 0.7939 |
| SE      | 0.1119 | 0.0907 | 0.0693 | 0.1062 | 0.0909 | 0.1411 | 0.1362 | 0.1139 | 0.1955 | 0.1239 | 0.1633 | n/a | n/a | 0.1327 | n/a | 0.0991 |

Note: In this table, the dependent returns indicate excess returns on size-BTME portfolios (B/H, B/M, B/L, S/M, and S/L) and industry portfolios [Oil & Gas (O&G), Basic Materials (BSM), Industrials (IND), Consumer Goods (CGD), Consumer Services (CSV), Telecom (TEL), Utilities (UTL), Financials (FIN), Technology (TECH) and Health Care (HC)]. Each of the macro factors is represented as $g$, $t$, $r$, and $w$ respectively. These are the slopes for UGDP, UTT, PRI and WRF accordingly; Adj $R^2$ is the adjusted value of $R^2$; SE is the standard error; $t()$s indicates the t-statistics with * represents 5% level of significance (critical value = 1.990) while + represents 10% level of significance (critical value = 1.659); n/a indicates unavailable data.
9.5.5 Macro-factor models for the Philippines

The results for single macro-factor models are given in Table 9-14. There is no change observed for the unexpected GDP variable but some variation is evident for unexpected equity market returns and for world excess returns. Tested separately, portfolio returns remain insensitive to unexpected equity market return and world excess return variables. However, the unexpected total trade variable comes through with five significant coefficients, in particular for size-BTME portfolios (B/H, B/M, S/M, S/L and CSV) in this model, rather than two coefficients (O&G and CSV) from the full models reported in Table 9-10. The results lend support to the importance of unexpected total trade for the Philippines. This variation in significance could also be the result of multicollinearity given the correlation coefficient reported in Table 9-5.

The single macro facto models consistently exhibit larger adjusted $R^2$ values than the full models for the S/H, BSM, IND and UTL portfolios while the full models in general have larger $R^2$ for other portfolios.
Table 9 - 15 Regressions of the four-factor model with single macro factor for the Philippines

Panel A: \( R_i - R_f = \alpha + \beta (R_m - R_f) + \gamma SMMB + \delta HML + \epsilon UGDP_t + \epsilon_i \)

Panel B: \( R_i - R_f = \alpha + \beta (R_m - R_f) + \gamma SMMB + \delta HML + \epsilon UTI + \epsilon_i \)

Panel C: \( R_i - R_f = \alpha + \beta (R_m - R_f) + \gamma SMMB + \delta HML + \epsilon URI_t + \epsilon_i \)

Panel D: \( R_i - R_f = \alpha + \beta (R_m - R_f) + \gamma SMMB + \delta HML + \epsilon WRF + \epsilon_i \)

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<tr>
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<th>B/H</th>
<th>B/M</th>
<th>B/L</th>
<th>S/H</th>
<th>S/M</th>
<th>S/L</th>
<th>O&amp;G</th>
<th>BSM</th>
<th>IND</th>
<th>CGD</th>
<th>CSV</th>
<th>TEL</th>
<th>UTL</th>
<th>FIN</th>
<th>TCH</th>
<th>HC</th>
</tr>
</thead>
<tbody>
<tr>
<td>( g )</td>
<td>-1.3151*</td>
<td>-0.7630*</td>
<td>-0.6593*</td>
<td>-0.4909</td>
<td>-1.6569*</td>
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<td>-1.9915</td>
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Panel B

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Panel D

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Note: In this table, the dependent returns indicate excess returns on size-BTME portfolios (B/H, B/M, B/L, S/H, and S/L) and industry portfolios [Oil & Gas (O&G), Basic Materials (BSM), Industrials (IND), Consumer Goods (CGD), Consumer Services (CSV), Telecom (TEL), Utilities (UTL), Financials (FIN), Technology (TECH) and Health Care (HC)]. Each of the macro factors is represented as \( g, t, r \) and \( w \) respectively. These are the slopes for UGDP, UTI, URI and WRF accordingly; \( \text{Adj } R^2 \) is the adjusted value of \( R^2 \); SE is the standard error; \( t(s) \) indicates the t-statistics with * represents 5% level of significance (critical value = 1.990) while + represents 10% level of significance (critical value = 1.659); n/a indicates unavailable data.
9.5.6 Robustness tests

Similar to Chapter 8, seemingly unrelated regression estimation (SURE) model is used to test the robustness of the macro-factor model used in this study by employing restrictions on the coefficients estimated for the macro factor asset pricing of the ASEAN5.\textsuperscript{75} Estimation for the SURE model is performed for the size-BTME portfolios due to variation in the time series available for each of the industry portfolios. Table 9-16 (Panels A to E) presents the macro factor SURE test results for the ASEAN5 on the size-BTME portfolios.

The results in Panel A for Malaysia suggest that individually, UGDP and UTT are not significant in explaining variation in portfolio returns though collectively all of the macro factors (UGDP, UTT, URI and WRF) are found to be significant. These results are generally consistent with those found in Table 9-6 with a small variation existing for the results in Table 9-11 for the WRF effect.

Panel B of Table 9-16 provides the SURE results for Singapore. It is found that the UGD factor is not individually significant in explaining returns as the other three factors. Yet as a group, all of the macro variables are important in explaining size-BTME portfolio returns for Singapore. In general, these results are consistent with that of Table 9-7, while some variations exist with the results found in Table 9-12.

SURE test results for Thailand are presented in Panel C. Like Malaysia, all of the four individual macro factors as well as the group tests are significant. These results are consistent with the macro factor results documented in Table 9-8, although a small variation exists for URI effect as found in Table 9-13.

The results for Indonesia (Panel D) indicate the insignificance of UGD and WRF factors in explaining size-BTME portfolio returns. Nonetheless, the group test results suggest that all the macro factors contribute in the explanation of returns for Indonesia. It is interesting to note that these results differ from the results for the macro-factor model (Table 9-9) where none of these factors is statistically significant. However, consistency exists between results in this section and those in Table 9-14, where single macro factors are tested individually.

\textsuperscript{75} The author would like to express her gratitude to Professor Richard Heaney for running the SURE tests for this section.
Panel E of Table 9-16 presents the results for the Philippines where individual macro factors are significant except for UTT. The group tests also produce significant results, implying that all the macro factors are important in explaining the portfolio returns for the Philippines. These results show small variation from those of Table 9-10 and 9-14 in terms of WRF effect and UTT effect respectively.

### Table 9 - 16 SURE model based tests for coefficient restrictions for macro-factor model

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<thead>
<tr>
<th>Panel A Malaysia:</th>
<th>Restrictions on coefficients</th>
<th>Chi-square statistics</th>
<th>Probability</th>
</tr>
</thead>
<tbody>
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<td>All UGDP coefficients = 0</td>
<td>Chi-square (6)</td>
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<td>Chi-square (6)</td>
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<td>All URI coefficients = 0</td>
<td>Chi-square (6)</td>
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<td>0.0000</td>
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<tr>
<td>All WRF coefficients = 0</td>
<td>Chi-square (6)</td>
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<td>0.0888</td>
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<tr>
<td>All UGDP, UTT, URI, WRF coefficients = 0</td>
<td>Chi-square (24)</td>
<td>56.4500</td>
<td>0.0002</td>
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</table>

<table>
<thead>
<tr>
<th>Panel B Singapore:</th>
<th>Restrictions on coefficients</th>
<th>Chi-square statistics</th>
<th>Probability</th>
</tr>
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<tbody>
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<th>Panel C Thailand:</th>
<th>Restrictions on coefficients</th>
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<th>Probability</th>
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<td>Chi-square (24)</td>
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Note: The regressions include world excess returns (WRF) and residuals from macro factors of GDP (UGDP), total trade (UTT), and market returns (URI).
Table 9 – 16 SURE model based tests for coefficient restrictions for macro-factor model (continued)

<table>
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<th>Panel D Indonesia:</th>
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9.5.7 Section summary

The results from the full macro-factor models present an overall effect of the macro factors when tested simultaneously with the four-factor asset pricing model. These combined effects vary across the ASEAN5 equity markets. Further tests on single macro factors seem to enhance the understanding of each of the macro factors’ influence on portfolio returns. In order to test the robustness of these results, the seemingly unrelated estimation (SURE) model is employed on the macro factors, individually and collectively. Apart from a small variation, SURE test results are generally consistent with the macro-factor models and the single macro-factor model. The variation is expected due to the nature and purpose of the SURE model in testing the restrictions on the estimated coefficients. As such, the results show marginal effects of the macro factors on ASEAN5 asset pricing.
9.6 Conclusion

This study seeks to find whether four macro variables comprising unexpected GDP (UGDP), unexpected total trade (UTT), unexpected equity market return (PRI) and world excess return (WRF) have explanatory power over size-BTME and industry portfolio returns for the ASEAN5 countries. These additional macro factors are included in the four-factor models (previously examined in Chapter 8), giving rise to the macro-factor models in this study. The results suggest that the macro-factor models perform at different levels across ASEAN5 countries. Moreover, variation in results exists between size-BTME and industry portfolios for each of the countries. These models are generally found to perform better in explaining returns for the size-BTME portfolios than for the industry portfolios. Nonetheless, when comparing the macro-factor models with the four-factor models, the adjusted R\(^2\) values are generally slightly higher than the four-factor models.

To gauge further the explanatory power of each of these macro variables, each of the four macro factors are then tested individually as an additional factor to the four-factor model (this model is called the single macro-factor model). It is noted that the explanatory power of the macro factors taken individually seems to contribute more to the portfolio returns, although the intensity of the effect varies across the ASEAN5 countries and portfolio types. Taken together, the unexpected GDP, unexpected total trade, unexpected equity market return and world excess returns have limited impact on the returns of size-BTME and industry portfolio across the ASEAN5, suggesting that the overall market, size, value and momentum effects capture most of the variation in portfolio returns. Macroeconomic variables appear to have little incremental effect on portfolio returns. This lends support to Campbell and Mei (1993), who suggest that even good news about production growth has little impact on current stock returns. The limited world effects documented in this study are also consistent with Bilson et al. (2001).
Chapter 10

CONCLUSION

10.1 Introduction

This thesis focuses on five of the ASEAN countries that include Malaysia, Singapore, Thailand, Indonesia and the Philippines, known as the ASEAN5. There are five analysis chapters included in this thesis, three of which (Chapter 5, 6 and 7) examine the linkages that exist between the equity markets, GDP and trade within the ASEAN5. These are followed by two chapters that test asset pricing models for the ASEAN5 equity markets. Analysis in Chapter 8 is based on a four-factor model while Chapter 9 adds four macro factors to the basic four-factor model tested in Chapter 8. The data analysed for each of these chapters spans the period from January 1990 to March 2006 (approximately 16 years of data).

Chapter 5 examines the short-run and long-run linkages that exist between the ASEAN5 equity markets as well as links with the developed equity markets of the US, Japan and Australia. The Full period, pre-crisis and post-crisis sub-periods are included in analysis to identify possible changes in the links existing over the period of the analysis. Key findings from this chapter suggest that the equity markets of ASEAN5 are highly correlated, with cointegration analysis showing that these equity markets also share a long-term equilibrium relationship. The finding is robust to the inclusion of the US, Japanese or Australian equity markets in the analysis. Moreover, the linkages between the ASEAN5 equity markets vary over the different sub-periods with tighter links recorded in the post-crisis period. The US equity market is generally more influential than either the Japanese or Australian equity markets.

Cointegration tests for GDP links examined in Chapter 6 suggest that real and nominal GDP growth of the ASEAN5 is cointegrated over the full period and the post-crisis period, supporting the notion that economic links among the ASEAN5 increased after the 1997 crisis. It is important to note that a longer crisis period (six quarters) is needed for analysis used in this GDP chapter than for the equity markets chapter (four quarters), which is consistent with the ‘stickiness’ of macroeconomic variables.

The economic growth of the ASEAN5 countries has been driven by trade. Analysis of the ASEAN5 trade in Chapter 7 provides a deeper understanding of different patterns of
trade linkages that prevail within these economies. Initially, the analyses point to several important aspects of ASEAN5 trade. It is found that the value of intra-ASEAN5 imports is less than the value of intra-ASEAN exports, the ASEAN5 countries trade more with non-ASEAN countries, and the 1997 crisis resulted in increased levels of ASEAN5 export competitiveness, apparently supported by currency devaluation for most of the ASEAN5 countries.

Cointegration tests highlight the variation that exists in long-term relationships for various ASEAN5 trade measures. First, there is limited evidence of cointegration between imports and exports for the ASEAN5 countries, suggesting that country imports and exports are not tightly linked within the ASEAN5 economies. Second, ASEAN5 total trade exhibits tighter links after the crisis – most probably driven by exports. Third, ASEAN5 exports are cointegrated in the full period analysis but this is mostly driven by strong export links existing before the 1997 crisis. Lastly, there is no evidence to support the existence of cointegrating relationships for ASEAN5 imports in any of the study periods, indicating that other factors may be more important in determining ASEAN5 imports.

The traditional CAPM and the four-factor asset pricing models (market, size, value and momentum effects) are used in Chapter 8 to analyse the variation in size-BTME and industry portfolio returns; the results of these analyses support the greater explanatory power of the four-factor model relative to the CAPM for all of the ASEAN5 countries. In general, size and value effects are more prominent than the momentum effects in explaining the variation in portfolio returns. In most cases, small size and high-value stocks generate higher returns than big size and low-value stocks, consistent with previous studies.

Analysis in Chapter 9 extends the four-factor model asset pricing with four additional macro factors. The macro factors employed to examine the variation in size-BTME and industry returns for the ASEAN5 include local macro factors represented by unexpected GDP (UGDP), unexpected total trade (UTT) and unexpected equity market returns (PRI), while a global macro factor is represented by the world excess market returns (WRF). The local macro factors are derived from VECMs or VARs developed for ASEAN5 GDP, trade and equity markets.

This analysis indicates that the explanatory power of macro factor variables varies across the ASEAN5. In most cases, the macro factors tend to provide higher explanatory power when a single factor is added to the basic four-factor model, and this is expected
given some multicollinearity that exists among the macro variables. The world excess returns exhibits limited impact on asset pricing for ASEAN5 portfolio returns. In addition, the size-BTME portfolios generally exhibit greater sensitivity to macro variables than the industry portfolios. While the marginal effects of the macro factor analysis are non-substantial compared to the four-factor analysis, they are important nonetheless in explaining the ASEAN5 equity markets returns.

In summary, the overall findings from this thesis give rise to several important conclusions. The equity markets within the ASEAN5 are closely related. GDP growth within the ASEAN5 economies is also closely related. Further, long-term trade links differ somewhat based on chosen trade measures. These findings have important implications for ASEAN as a whole. ASEAN5 asset pricing is yet to receive much attention in the mainstream literature and this thesis provides further insight into ASEAN5 asset pricing.

10.2 Limitations of study

Care should be taken in generalisation of the results of GDP analysis to other macroeconomic variables. The limited sample period of the pre-crisis and post-crisis periods may affect the generalisation of the sub-period findings for the cointegration tests reported in this thesis. Furthermore, cointegration analysis is useful for distinguishing whether a long-run relationship exists during the period but it cannot test for a gradual movement towards integration.

Chapter 5 uses the US equity market returns as a proxy for world effects and this may impose some limits on the interpretation and generalisation of results, given the emergence of the economic power of China and India during the study period.

The data used for the formation of size-BTME portfolios are based on availability from Datastream. As such, some caveat applies to the generalisation of results due to data limitations. This was one of the reasons for analysing industry portfolios as well as the size-BTME portfolios.

The macro factors employed in Chapter 9 are limited to unexpected GDP, unexpected total trade, unexpected market returns and world excess returns (as a proxy of world effects). Therefore, some caveats should be kept in mind when interpreting these results because of the limited range of macro factors included in this chapter.
10.3 Suggestions for further studies

First, the period of study used throughout this thesis is from January 1990 to March 2006 and the data is mostly obtained from Datastream. A longer study period with different sources of data could be an important extension to test the robustness of the results found in this thesis.

Second, instead of using the US equity market returns as a proxy for the world effect, it would be interesting to examine the changes in cointegration results for the equity markets within the ASEAN5 when the proxy for world effect uses a broader index with adequate coverage of the Chinese and Indian stock markets.

Third, there is an extensive literature dealing with size and value effects in the asset pricing literature, but this is not the case for momentum effects. The momentum effect is difficult to interpret at times and so extension of this analysis might prove fruitful.

Fourth, the macro-factor model used in Chapter 9 is limited to four macro-factor variables. Further analysis employing other factors would certainly enrich our understanding of ASEAN5 asset pricing and the links that exist between the ASEAN5 countries.
BIBLIOGRAPHY


