# THE DETERMINANTS OF STOCK MARKET INTEGRATION: A PANEL DATA INVESTIGATION[*]

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## ABSTRACT

This study contributes to understand the driving forces for the process of stock market integration. Based on 26 stock markets of countries affiliated to five trading blocs, the results show that market attributes, economic fundamentals and world information are significant in explaining world stock market integration. The integration process is found to be significantly weakened during the world recession in 2001. The results highlight that regionalism due to economic bloc plays an important role in stock market integration. The level of integration is highest among stock markets in the EU countries, while those in EFTA and AFTA are most segmented.



*Keywords*: CAPM, economic blocs, panel data models, regionalism

*JEL classification*: F02, F15, G12

# THE DETERMINANTS OF STOCK MARKET INTEGRATION: A PANEL DATA INVESTIGATION*

## 1. INTRODUCTION

Whether stock markets across national borders are integrated is important for several reasons. For global investors and country funds, a highly integrated world stock market indicates that the returns of securities are similarly priced internationally. As a result, there is little differential in risk premiums and the potential for cross-border diversification diminishes (Akdogan, 1996). For corporate finance, a highly integrated stock market implies that there is less opportunity to acquire capital at lower costs across borders. This discourages activities of foreign listings. The third issue relates to the market efficiency hypothesis. The degree of market integration indicates the level of information efficiency in the presence of geographic boundaries and technological constraints. Last but not least, the issue of market integration has increasingly received attention from international and development economists. The concern of the international economists is related to the potential gains of public welfare stemming from market integration (see Cole and Obstfeld, 1992; Lewis, 1996; Van Wincoop, 1994). Development economists are interested in the contribution of market integration to economic development and growth (see Obstfeld, 1994; Devereux and Smith, 1994; Levine and Zervos, 1996, 1998; Bekaert et al. 2001a, 2001b; and Henry, 2000). Market integration is also an important aspect in understanding the international financial architecture.

The empirical literature generally agrees that market integration is a time-varying process. Little insight, however, has been offered to explain what causes market to become more integrated at one point in time and less so at another point in time. Existing studies on market integration are predominantly based on market linkages, which is essentially a loose measure for market integration.[1] The evidence of market linkages is at best a weak inference, but not a sufficient condition for market integration.[2]

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[1] Studies on market linkages include those on stock returns lead-lag relationship, comovement, correlation, cointegration, volatility spillover, and event study of news transmission. Such linkages are only a reflection of ex-post causalities.

[2] Adler and Dumas (1983) point out that correlation among integrated markets depend in part on the industrial composition of output. The argument is that even two completely integrated markets, for example NYSE and AMEX, may reveal imperfect correlations and linkages. This is also highlighted in Bekaert and Harvey (1995, p. 463).

For stock markets, a commonly accepted definition for integration is based on the law of one price. This is essentially an asset pricing point of view, where stocks with similar risk in future cash flows should be similarly priced regardless of where they are listed (Adler, 1995; Bekaert and Harvey, 1995; and Bekaert et al, 2002). Stock market linkages therefore are not a sufficient condition to indicate the validity of the law of one price. Tests for market integration should be built on asset pricing models which offer a fundamental ex-ante framework. International stock market integration needs to be benchmarked to a common world portfolio or a list of risk factors.

To our knowledge, Carrieri et al. (2006) remains the only study that explores on the determinants of market integration as defined from the asset pricing perspective. The current paper seeks to fill this research gap. Market segmentation may arise due to investment barriers, home investment preference, limitations to cross-border arbitrage, or even institutional inefficiency. In searching for possible determinants on how a market could differ with another in achieving the efficiency in pricing, this paper looks at an information set that matters to the asset pricing process.

The objective of this study is to examine the major driving forces to the international stock market integration process. In particular, we focus on three different aspects of information, namely, the market attributes, economic fundamentals and world information. They are tested using the approach of panel regressions. We focus on a sample of 26 stock markets of member countries of five different economic blocs, for we also intend to investigate whether real sector integration due to economic cooperation among bloc members helps to explain stock market integration.

This rest of the paper is organized as follows. Section 2 defines the scope of this study. Section 3 discusses the empirical model for stock market integration, the framework of our analysis and the sources of data. Section 4 presents the results and discussion on the major findings. Concluding remarks are in the final section of the paper.

## 2. SCOPE OF STUDY

This study uses monthly data for the period January 1991-August 2005. Stock markets of member countries of five trading blocs are selected for the analysis. A total of 26 stock markets are considered. These blocs have progressed economically and a majority of the stock markets of member countries are well structured with some developed stock markets. They are EU (European Union), EFTA (European Free Trade Agreement), NAFTA (North American Free Trade Agreement), CER (Australia-New Zealand Closer Economic Relations), and AFTA (Association of South-East Asia Nations (ASEAN) Free Trade Areas).

The level of economic integration in these trading blocs is different. Table 1 provides a summary of some relevant information for the trading blocs and their member countries. EU is a monetary union; EFTA, NAFTA and CER are free trade areas; while AFTA was established on the basis of a preferential trade agreement. Nevertheless, the free trade

commitment in some of these trading blocs is far more in depth than suggested by their set up. For example, members of EFTA and NAFTA have services agreement under GATS Article V, and this represents a higher degree of integration than suggested by that of a conventional free trade area.

## 3. THE EMPIRICAL MODEL

### 3.1 Determinants of Market Integration

This section describes the variables that enter the empirical model through the search of evidence in the literature on factors that affect stock returns and market integration. A number of studies found that intra-regional correlation in stock returns tends to be higher than inter-regional correlations (see, for example, Eun and Shim, 1989). The correlation patterns seem to mimic the degree of economic integration between countries (Rahman and Yung, 1994). A recent debate is whether such pattern of correlation is due to "contagion" which takes place only in the occurrence of a "surprising" event. These views are not based on fundamental factors that drive market co-movements. The role of fundamental factors as a driving force for market linkages is also debated in some early studies (Campbell and Mei, 1993; Erb et al., 1994; Longin and Solnik, 1995; Ammer and Mei, 1996 and Karolyi and Stulz, 1996). More recent studies reported positive roles of some fundamental factors based on the method of pooled regression (Bracker and Koch, 1999; Flavin et al., 2002; Dumas et al., 2003; Dellas and Hess, 2005; Wäiti, 2005; and Liu et al. 2006). These fundamental factors include economic growth, market liquidity, banking system quality, trade intensity, financial openness, overlapping trading hours, and common borders.

Bracker et al. (1999) reported that macroeconomic variables do affect bilateral lead-lag linkages - a measure proposed by Geweke (1982). Cheung and Lai (1999), however, found weak contribution from macroeconomic fundamentals in explaining long-run cointegration of stock returns. In a recent study, Chinn and Forbes (2004) show that direct trade with large economies (top five global markets) appear to be the only important factor in explaining cross sectional market linkages with the large economies. Trade competition, bank lending and foreign investment have no significant effect.

In this study, we examine three categories of potential factors that explain the time-varying stock market integration process.[3] We postulate that the market integration process is driven by the development of the market itself, performance of the economic fundamentals, as well as the global economic climate.

[3] Fundamental determinants for stock returns are mostly based on the APT model of Roll and Ross (1980). See also works on stock returns and output growth by Fama (1981, 1990), Canova and De Nicolo (1995) and Choi et al. (1999); and works on global conditional asset pricing model by Ferson and Harvey (1993, 1994, 1998), Bekaert and Harvey (1995), Chuah (2004) and Bekaert et al. (2005).

Table 1 Summary Information of Trading Blocs

| Trading Bloc | Date of entry into force | GATT/WTO notification | | |
|---|---|---|---|---|
| | | Date | Related provisions | Agreement Type |
| EU (Austria, Belgium, Denmark, Finland, France, Germany, Greece, Italy, Ireland, Netherlands, Portugal, Spain, Sweden and UK) | 1-Jan-58 | 10-Nov-95 | GATS Art. V | Services agreement |
| | 1-Jan-58 | 24-Apr-57 | GATT Art. XXIV | Customs union |
| EFTA (Norway and Switzerland) | 1-Jun-02 | 3-Dec-02 | GATS Art. V | Services agreement |
| | 3-May-60 | 14-Nov-59 | GATT Art. XXIV | Free trade agreement |
| NAFTA (Canada, Mexico, and the US) | 1-Apr-94 | 1-Mar-95 | GATS Art. V | Services agreement |
| | 1-Jan-94 | 1-Feb-93 | GATT Art. XXIV | Free trade agreement |
| CER (Australia and New Zealand) | 1-Jan-89 | 22-Nov-95 | GATS Art. V | Services agreement |
| | 1-Jan-83 | 14-Apr-83 | GATT Art. XXIV | Free trade agreement |
| AFTA (Indonesia, Malaysia, Philippines, Singapore and Thailand) | 28-Jan-92 | 30-Oct-92 | Enabling Clause | Preferential arrangement |

Source: WTO, http://www.wto.org/

### 3.1.1 Market Attributes

As market integration is a process of adjustment to achieve market efficiency, attributes of the market are expected to play a role in explaining the integration dynamics. The following three market variables are included:

(i) Market development measured by changes in market value over GDP. This is one of the popular information variable used in conditional asset pricing test for integration (see Bekaert and Harvey, 1995, 1997; Bekaert et al. 2002). Carrieri et al. (2006) tested the role of this variable in explaining market integration and it is found to have a positive effect on market integration. The significance of stock market size relative to GDP is also positively correlated with reduction in information asymmetry (Chuhan, 2003), increase in capital mobility and opportunities for risk diversification (Levine and Zervos, 1996).

(ii) Dividend yield differential measured by the difference between local and world dividend yield. The notion that dividend yield predicts stock returns can be traced back to Ball (1978). Dividend yield is closely related to the cost of firm capital. Lagged dividend yield is popularly used in the international conditional asset pricing models (see Ferson and Harvey, 1993, 1994, 1998; and Bekaert and Harvey, 1995) and as a pricing factor for international equity risk premium (see Fama and French, 1998). Kasa (1992) shows that the common trend in stock returns of developed markets mirrors the trend of unit root and cointegration of their dividend yields. Bekaert and Harvey (2000) also highlight that dividend yield is a determinant for integration of emerging markets. In this study, instead of dividend yield, dividend yield differential (relative to the world dividend yield) is employed to explain how relative market performance affects market integration. A higher dividend yield differential with the world market is expected to lead to lower level of integration with the world market. In other words, if there is a big gap between the local market performance and world market performance, the market is expected to be more segmented from the rest of the world.

(iii) Market volatility measured by conditional volatility of market returns. The "volatility feedback" effect is emphasized by a large numbers of researchers for explaining the pattern of movements in stock prices.[4] Many researchers attribute much of the price declines in bear market to increases in market volatility; see, for example, Pindyck, (1984) on the 1970s oil crises, and King and Wahwani (1990) on the 1987 US stock market crash. While finance theory infers a positive relationship between expected returns and risk, Glosten, et al. (1993) point out the possibility that both positive and negative tradeoffs would be consistent with the theory because risky periods could coincide with periods when investors are better able to bear particular types of risks. Some investors may want to save more when the future is foreseen to entail higher risks and when no risk free investment opportunities are available. Prices of risky assets may bid up considerably, thereby reducing the returns. Fraser and Groenewold (2000), on the other hand, argue that if the economic agents exhibit a consumption smoothing behavior, they may be willing to accept lower expected returns during good times and higher expected return during bad times. The expected returns may even become negative when the agents hedge against risk. In this study, an AR(1) process of the market returns with GARCH(1,1) errors is used to generate conditional volatility that represents market volatility. The order, although simple, is sufficient for most empirical modeling purposes (Engle and Ng, 1993).

### 3.1.2 Economic Fundamentals

As an immense amount of evidence shows that stock prices are affected by economic fundamentals, stock market integration is expected to be affected by the fundamental

[4] In general, the GARCH methodology predominates this area of studies, see Bollerslev et al. (1992) for a survey on GARCH processes and volatility.

factors that determine the state of the economy. Two economic stability indicators, two price indicators and two international trade variables are considered as below:

(i) Economic stability measured by exchange rate volatility and international currency reserves. Strong macroeconomic performance is expected to stimulate investment activities while economic instability hinders financial development. The literature on capital flights generally shows that economic instability is a cause for wealth outward shifting (see, for example, Collier et al. 2001; Schineller 1997; and Sheets 1996). With uncertainty and adverse effect on financial development, the volatility of economic fundamentals might dampen market integration. Exchange rate dynamics affect a firm's net balance sheet position and indirectly affect aggregate demand through the cost of traded inputs, or competing imported goods (see Jorion, 1991). Exchange rate volatility is also important in asset pricing test for market integration (see De Santis and Gerard, 1998; Tai, 2004; and Ng, 2004). Exchange rate volatility is thus an indicator of macroeconomic stability. The other stability indicator is changes in international currency reserves. This variable is seen as an indicator of the economy's ability to finance international trade. For an open economy, it serves as a measure of the economic performance.

(ii) Price level measured by inflation rate and interest rate. These two indicators are commonly accepted measures of prices for goods and capital. They serve as proxies to confidence shocks on consumption and investment opportunities, respectively, and are likely to shape the expected cash flow of listed firms and hence determining the pricing of their stocks.

(iii) Trade openness measured by the ratio of total trade to GDP. Sachs and Warner (1995) found that trade liberalization represents a reform that is most closely tied to future economic growth. Several studies reported that economic integration is an explanatory factor for stock market integration. For example, Bekaert and Harvey (1997, p.38) point out that trade openness induces correlation between consumption and business cycle, resulting in a higher risk pricing synchronization. Chuah (2004, p.9), on the other hand, argues that trade openness can be a proxy for the country sovereign risk and economic development, so it should play a positive role in promoting market integration. Bekaert and Harvey (2000) reported that this variable has a negative impact on dividend yield and positively affects GDP growth. The findings of Carrieri et al. (2006), however, do not show that trade openness has an effect on market integration.

(iv) Regional trade intensity measured by the ratio of total bloc trade to total trade. WTO and APEC are of the opinion that regionalism is a complementary process to the multilateral trade system as long as open regionalism is promoted, i.e., when barriers on trade with non-bloc members are not raised (see GATT Article XXIV). If this is true, Frankel and Wei (1998) suggested that integration in capital markets is likely to be driven by trade regionalism. Many stock market studies point out the role of

economic integration on market integration; see, for example, Heaney and Hooper (1999) and Ng (2002) on AFTA; Akdogan (1992), Johnson and Soenen (1993), Johnson et al. (1994) and Fratzscher (2002) on EMU; Edwards and Susmel (2001), Heaney et al. (2002) and Johnson and Soenen (2003) on MERCOSUR; and Adler (1995), Ewing et al. (1999), Adler and Qi (2003) on NAFTA. More generally, Heaney et al. (2000) and Heaney and Hooper (2001) recorded clear evidence that world stock market integration is consistent with the existence of economic bloc or trading bloc groupings. These works provide grounds that regional trade intensity, which is a measure of the level of economic integration, does have a role in driving stock market integration. The ratio of total trade in a trading bloc to total trade is essentially the intra-bloc trade ratio commonly used in international economics.

### 3.1.3 World Information

Information at the world level is important for studying the integration with the world market. Three set of world information, namely, the world market attributes, world economic stability and world investment sentiments and are considered below:

(i) World market attributes measured by world market liquidity, world dividend yield and world market volatility. These three variables are commonly applied in the literature on conditional asset pricing (see Ferson and Harvey, 1993, 1994, 1998; Bekaert et al., 2002; Gérard, et al., 2003; and De Santis et al., 2003). The inclusion of these variables serves to indicate the world economic uncertainty. A higher world market liquidity means better investment flow internationally, while a higher world dividend yield means better market climate overall. These two variables are expected to have a positive impact on financial market development. As is the case for market volatility discussed above, the impact of world market volatility on stock returns is not clear. Carrieri et al. (2006) obtained a negative impact of world market volatility on market integration in their one-factor panel integration model, but the impact is positive after controlling for market size, trade and financial liberalization.

(ii) World business cycle measured by the G6 industrial production (G7 excluding Canada) and changes in oil price. Information set on the G7 countries is commonly used to represent the world information set in the literature on conditional asset pricing. Here we use the industrial production of the G6 countries is taken due to incomplete data series for Canada. The G6 industrial production serves to gauge the output performance of the world market. This variable also captures the general direction of the world business cycle, and is hence an indicator of world economic stability. Changes in oil price, measured by the average US dollar price per barrel of crude oil, is an important variable as suggested by Chen et al. (1986) and Hamao (1988). Oil price has been used as an instrument variable in the study of Ferson and Harvey (1993, 1994). Chen et al. (1986) used it as a measure for economic risk for the US market while Ferson and Harvey (1994) used it as a measure for the potential

source of global market risk. To a large extent, this variable is an indicator of the global inflation pressure.

(iii) World investment sentiments measured by market premium, term premium, default premium and credit premium. A premium variable generally indicates the investors' risk tolerance over business cycle and over period of booms and bust in the market. The four premiums measure investment sentiments from different financial aspects. The market premium of stock market is included as a measure for investment sentiment on the performance of world stock market over the risk free rate. Stulz (1999) indicates that changes in equity premium depend much on the diversification potential of the stock market. The process of market liberalization generally leads to a fall in equity premium when the local price of risk exceeds the global price of risk (see Bekaert and Harvey, 2000; Errunza and Miller, 2000; and Henry, 2000). Thus, if the world stock market is getting more integrated, the potential for global portfolio diversification will disappear. This implies that equity premium should have a negative relationship with market integration. In this study, the ex-post world market excess return is used as the proxy for world equity premium.

The term premium, measured by the yield spread between the US 10-year bond and the 3-month Treasury bill, is a pricing factor for fixed income securities. It is also a good predictor for output and inflation (see Estrella and Mishkin, 1997 and Cuaresma et al., 2005). Fama and French (1986) suggest that the term premium is a type of reward for taking risk that changes over business cycles. A higher term premium means that investors are less willing to commit in long-term investments. This variable thus has a positive relationship with stock market integration if equity investment is a substitute for long-term investment.

Default Premium, measured by the yield spread between the US Baa and Aaa corporate bonds, serve as a proxy for business cycle risk. Fama and French (1986) point out that default premium tends to get higher during recession. A higher default premium means that investors are less willing to commit in risky investments. If equity investment is viewed as a risky investment, the default premium is expected to be negatively related to stock market integration.

Credit Premium, measured by the yield spread between the Eurodollar 3-month deposit rate and US 3-month Treasury bill, can be interpreted as part of the confidence risk that reflects the willingness of investors to undertake relatively risky investment, desired time to payouts and willingness to invest locally (Aquino, 2004). As is the case of default premium, the relationship of credit premium and market integration is expected to be negative.

Table 1 shows the list of variables to be considered as determinants of the stock market integration process and the notations used for each of these variables.

### 3.2 The Time-Varying Market Integration Index

To understand the behavior of market integration over time, a time-varying market integration index, $MII_{it}$ (integration index henceforth) is constructed for every market-*i* over time period *t*, using the asset pricing approach suggested by Korajczyk (1996). Here, $i = 1, 2, \ldots, M$, and $t = 1, 2, \ldots, T$, where $M$ refers to the number of stock markets and $T$ is the total number of time-series observations for each market. Korajczyk (1996) postulates that pricing errors estimated from an international asset pricing model can be used as a measure for market segmentation. If assets are all priced to the same systematic risk, then the world market is said to be perfectly integrated. The pricing error, given by the intercept term in the asset pricing model, should be equal to zero. Korajczyk (1996) shows that pricing error increases with higher official barriers and taxes to international asset trading, larger transaction costs, and larger impediments to the flow of firm information. Levine and Zervos (1998) establish a cross-section stock market integration index with some adjustment to the pricing errors. The pricing error used in this study is generated from the time series International Capital Asset Pricing Model (ICAPM) model, given by the following specification:

$$R_{it} - R_{F,t} = \alpha_i + \beta_i (R_{W,t} - R_{F,t}) + \varepsilon_{it}; \qquad (1)$$

where $R_{it}$, $R_{F,t}$ and $R_{W,t}$ are returns for the portfolio of market-*i*, risk free asset and world portfolio, respectively. To obtain a time series of the market integration index, a 5-year rolling regression is adopted. The following regression is estimated recursively for market-*i*,

$$R_{it} - R_{F,t} = \alpha_{it} + \beta_{it} (R_{W,t} - R_{F,t}) + \varepsilon_{it};$$

using monthly observations of 5 years, i.e., observation *t-59, t-58, …, t* for $t = 60, 61, \ldots, T$. A series of $\alpha_t$ is then obtained. The Levine-Zervos adjusted market integration index is given as follows:

$$MII_{it} = -|\alpha_{it}|$$

An index that takes a zero value indicates perfect integration of market-*i* with the world market. The index is positively correlated with the degree of market integration.

### 3.3 The Empirical Panel Models

This paper uses panel models to explore for determinants of stock market integration. A panel regression has several advantages in that it offers more flexibility in modeling the heterogeneity bounded in the market integration process across individual markets. Pooling both time-series and cross-section data provides reduces colinearity, provides a higher degrees of freedom and increases the efficiency of the estimator. More importantly, the

panel approach is able to detect more sophisticated behavioral models with less restrictive assumptions (Baltagi, 2002, p.307). The empirical models are explained in this section.

### 3.3.1 Pooled Regression, and Fixed and Random Effects Panel Models

The basic panel framework for the market integration model is a regression of the form:

$$MII_{it} = \mu + z'_{it}\delta + \varepsilon_{it}, \qquad i = 1,...,M; \qquad t = 1,...,T \tag{2}$$

where $\delta$ is vector of $k$ x 1 coefficients and $z_{it}$ is the vector of $k$ number of independent variables across country $i$ and month $t$. The time-series observations are grouped together before the cross-section observations. This model is known as a simple cross-section time-series model or a pooled regression.

The integration index might contain cross-section and/or period effects, with the error process is given by $\varepsilon_{it} = \eta_i + \xi_t + v_{it}$, and the model is:

$$y_{it} = \mu + z'_{it}\delta + \eta_i + \xi_t + v_{it} \tag{3}$$

where $\eta_i$ is the cross-section component of the disturbance terms, $\xi_t$ captures the period effects across observations and $v_{it}$ is the remainder disturbance effects. This is referred to as a two-way fixed effects model. For estimation purposes, a least squares dummy variable (LSDV) or the generalized least squares (GLS) method can be used.

The cross-section or period effects, however, may not be fixed but can be randomly distributed. A two-way random effects model is considered where the error components have the following properties:

$$\begin{aligned}
&E\eta_i = E\xi_t = Ev_{it} = 0,\\
&E\eta_i\xi_t = E\eta_i v_{it} = E\xi_t v_{it} = 0,\\
&E\eta_i\eta_j = \begin{cases}\sigma_\eta^2 & \text{if } i = j,\\ 0 & \text{if } i \neq j,\end{cases}\\
&E\xi_t\xi_s = \begin{cases}\sigma_\xi^2 & \text{if } t = s,\\ 0 & \text{if } t \neq s,\end{cases}\\
&Ev_{it}v_{it} = \begin{cases}\sigma_v^2 & \text{if } i = j,\ t = s,\\ 0 & \text{otherwise,}\end{cases}\\
&E\eta_i z'_{it} = E\xi_t z'_{it} = Ev_{it} z'_{it} = 0'
\end{aligned}$$

Note that both $\eta_i$ and $\xi_t$ are random error terms, not directly observable and thus are a form of latent variables (Hsiao, 2003). The variance component of the dependent variable can be decomposed into:

$$\sigma^2_{MII} = \sigma^2_\eta + \sigma^2_\xi + \sigma^2_v$$

If $\sigma^2_\eta$ and $\sigma^2_\xi$ are both zero, equation (3) collapses to a simple pooled regression. In the above specification, the disturbance term $\varepsilon_{it}$ is correlated, where the correlation is given by:

$$corr(\varepsilon_{it}, \varepsilon_{is}) = \frac{\sigma^2_\eta}{\sigma^2_\eta + \sigma^2_v}$$

If this is the case, the OLS estimator becomes inefficient. To overcome the correlation problem, model (3) can be estimated using the method of GLS (see Baltagi (2002), Hsiao (2003) and Greene (2003)).

The world information is a set of common time-series regressors that are identical for every market. In constructing the panel data, the same time series are repeated for each cross section units. Singularity problem may arise from this panel structure. A model without the world information variables is firstly considered. We refer to this as the restricted model, given by:

$$\begin{aligned} MII_{it} = \mu &+ \delta_1 FD_{it} + \delta_2 DYD_{it} + \delta_3 \sigma_{it} + \delta_4 \sigma_{EX,it} + \delta_5 \Delta CR_{it} + \delta_6 IFL_{it} \\ &+ \delta_7 INT_{it} + \delta_8 TOP_{it} + \delta_9 RTI_{it} + \eta_i + \xi_t + v_{it} \end{aligned} \qquad (4)$$

In the pooled regression, both $\eta_i$ and $\xi_t$ collapse to zero. Both $\eta_i$ and $\xi_t$ are non-random error terms in the fixed effects model, and they are randomly distributed in a random effects model.

The random effects model can reduce the total number of parameters to be estimated. However, if the underlying assumptions are invalid, we may obtain inconsistent estimates. We need to decide which of the pooled regression, fixed effects model and random effects model is more appropriate. In order to conclude whether a fixed effects specification is superior to the pooled regression specification, a F-test is conducted. To verify whether a random effects model is more superior to the fixed effects model, the specification test constructed by Hausman (1978) is used to test for the orthogonality of the random effects and the independent variables. If $E(\varepsilon_{it} z'_{it}) \neq 0$, the GLS estimator becomes biased and inconsistent. The null hypothesis under Hausman test is that the LSDV fixed effects and GLS random effects estimators are consistent, while the alternative is that GLS estimators are not consistent.

We also consider an unrestricted specification that includes the world information variables, three period dummy variables and four trading bloc dummy variables in addition to those in the restricted model. The unrestricted model is:

$$\begin{aligned} MII_{it} = {} & \mu + \delta_1 FD_{it} + \delta_2 DYD_{it} + \delta_3 \sigma_{it} + \delta_4 \sigma_{EX,it} + \delta_5 \Delta CR_{it} + \delta_6 IFL_{it} \\ & + \delta_7 INT_{it} + \delta_8 TOP_{it} + \delta_9 RTI_{it} + \delta_{10} WLQ_{it} + \delta_{11} \Delta WDY_{it} + \delta_{12} \sigma_{W,it} \\ & + \delta_{13} IP_{G6,it} + \delta_{14} \Delta P_{oil,it} + \delta_{15} MarketP_{it} + \delta_{16} TermP_{it} + \delta_{17} DefaultP_{it} \\ & + \delta_{18} CreditP_{it} + \delta_{19} D_{97-99,it} + \delta_{20} D_{01-03,it} + \delta_{21} D_{04-05,it} \\ & + \delta_{22} D_{EU,it} + \delta_{23} D_{EFTA,it} + \delta_{24} D_{NAFTA,it} + \delta_{25} D_{AFTA,it} + v_{it} \end{aligned} \quad (5)$$

where the period dummy variables are:

$D_{97\text{-}99}$ = 1 for the period January 1997 – December 1999, and 0 otherwise
$D_{01\text{-}03}$ = 1 for the period January 2001– 2003 December, and 0 otherwise
$D_{04\text{-}05}$ = 1 for the period January 2004 – August 2005, and 0 otherwise

and the trading bloc dummy variables are:

$D_{EU}$ = 1 for stock markets in EU, and 0 otherwise
$D_{EFTA}$ = 1 for stock markets in EFTA, and 0 otherwise
$D_{NAFTA}$ = 1 for stock markets in NAFTA, and 0 otherwise
$D_{AFTA}$ = 1 for stock markets in AFTA, and 0 otherwise

The period dummy variables are identified according to three major events which occurred during the period of study: (i) the period that hovers around the 1997 East Asian financial crisis (January 1997 – December 1999), (ii) the recession during the early part of the new millennium (January 2001– 2003 December), and (iii) the recent oil price crisis (January 2004 – August 2005). The market integration process is assumed to be common in the remaining periods. The trading bloc dummy variables are created on the assumption that the markets of the same trading bloc share similar behaviour. In this case, CER remains as the reference trading bloc. Note that the period and trading bloc dummy variables are included for us to examine the fixed period and cross-section effects. They will be included only if the fixed effects models are found to be significant.

### 3.4 Sources of Data

This study uses stock market indices collected from Morgan Stanley Capital International (MSCI) to compute market returns. The MSCI All Country World Index is used as the proxy for the world portfolio. The trading bloc portfolios are constructed through a market capitalization weighted average of all the indices of the markets in the bloc, excluding that of the market of interest. This is to ensure that the local dynamics are excluded from the trading bloc portfolio. In the computation of excess returns, the global risk free rate is

proxies by the US Treasury bill rate downloaded from the website of the Federal Reserve Bank.

The determinant variables are obtained from various sources. Market value, nominal GDP, dividend yield, USD exchange rate, CPI, interest rate, market liquidity (volume) are collected from the DataStream database. International currency reserve, CPI (Australia and New Zealand) and industrial production are downloaded from the International Financial Statistic (IFS). Trade data are extracted from the IMF Direction of Trade Statistics. Eurodollar interest rate, the US AAA bond and BAA bond rates are downloaded from the EconStats website (www.econstats.com), and crude oil prices are downloaded from the WTRG Economics website (wtrg@wtrg.com).

## 4 RESULTS AND DISCUSSION

### 4.1 Descriptive Statistics and Panel Unit Root Tests

Descriptive statistics for all the panel variables are reported in Table 3.[5] The mean value for the market integration index is -0.4787 with a standard deviation of 0.6314, indicating that there is a big variation in the level of world market integration across the markets. From the standard deviation, it is clear that market volatility, world volatility and market premium exhibit the most volatile behaviour while the change in world dividend yield is the least volatile series. The conditional volatility for the exchange rate is relatively stable.

In Table 4, the results of five panel unit root tests are reported to establish their stationarity properties. All the tests have a null hypothesis of a unit root. The tests of Levin et al. (2002) and Breitung (2000) assume that there is a common unit root process that is identical across the cross section units. The tests of Im et al. (2003), Maddala and Wu (1999) and Choi (2001) allow the unit root processes to vary across the cross-section units. The tests by Maddala and Wu (1999) and Choi (2001) are also known as the ADF-Fisher and PP-Fisher tests, respectively. For the most part, the results indicate no unit root process. The null hypothesis is rejected by at least three out of five tests. The null cannot be rejected in two tests only for the market integration index, G6 industrial production and term premium In general, all the panel series are I(0).

[5] The correlation matrix for all the variables is computed but not reported here. Generally, the series are not highly correlated.

Table 2 Summary List of Determinant Variables

| Category | Variable | Definition | Unit of Measurement |
|---|---|---|---|
| Market Attributes | Financial Development | $FD$ = changes of (Market value / Nominal GDP) | Ratio |
| | Dividend Yield Differential | $DYD = DY$ country $i$ - $DY$ world; $DY$ = dividend/price | Ratio |
| | Market Volatility | $\sigma$ = conditional volatility generated from an AR(1) process with GARCH(1,1) errors on log ($P_t/P_{t-1}$) | - |
| Economic Fundamentals | Exchange Rate Volatility | $\sigma_{EX}$ = conditional volatility generated from an AR(1) process with GARCH(1,1) errors on log($Ex_t$) | Domestic currency per unit of USD |
| | Currency Reserve Changes | $\Delta CR$ = changes of log (international currency reserve) | Rate |
| | Inflation Rate | $IFL = (CPI_t - CPI_{t-1})/CPI_{t-1}$ | Rate |
| | Interest Rate | $INT$ = log (Short term interest rate, TB rate or interbank rate) | Rate |
| | Trade Openness | $TOP$ = total trade with the world / Nominal GDP | Ratio |
| | Regional Trade Intensity | $RTI$ = total trade with bloc members / Total trade with the world | Ratio |
| World Information | World Liquidity | $WLQ$ = log [Turnover by volume] | Billion USD |
| | World Dividend Yield Changes | $\Delta WDY$ = changes of world dividend yield | Ratio |
| | World Volatility | $\sigma_W$ = conditional volatility generated from an AR(1) process with GARCH(1,1) errors on log ($P_{W,t}/P_{W,t-1}$) | Ratio |
| | G6 Industrial Production | $IP_{G6}$ = equal weighted log of industrial production of G6 countries | Index |
| | Oil Price Changes | $\Delta P_{oil}$ = log ($P_{oil,t}$ - $P_{oil,t-1}$ ) (month end crude oil price) | Rate |
| | Market Premium | $MarketP$ = MSCI World – US 3-month TB rate | Spread |
| | Term Premium | $TermP$ = US 10-year Bond rate – US 3-month TB rate | Spread |
| | Default Premium | $DefaultP$ = BAA bond rate – AAA bond rate | Spread |
| | Credit Premium | $CreditP$ = Eurodollar 3-month interest rate – US 3-month TB rate | Spread |

Table 3 Descriptive Statistics of the Panel Variables

| Variables | Mean | Std. Dev. | Max | Min | Skewness | Kurtosis |
|---|---|---|---|---|---|---|
| Market Integration Index | -0.4787 | 0.6314 | -0.0001 | -4.2268 | -2.7984 | 11.3152 |
| Financial Development | 0.0134 | 0.2993 | 4.1126 | -3.1459 | -0.3408 | 27.1705 |
| Dividend Yield Differential | 0.0045 | 0.0094 | 0.0474 | -0.0218 | 0.7394 | 4.1026 |
| Market Volatility | 10.3581 | 11.9855 | 162.7204 | 0.9547 | 4.8154 | 36.9180 |
| Exchange Rate Volatility | 0.0012 | 0.0052 | 0.2955 | 0.0000 | 42.0021 | 2259.6320 |
| Currency Reserve Changes | 0.0013 | 0.0753 | 0.7892 | -0.7876 | -1.0677 | 25.6977 |
| Inflation Rate | 0.0025 | 0.1239 | 3.3214 | -4.9412 | -7.6977 | 805.7831 |
| Interest Rate | -2.9967 | 0.7630 | -0.1076 | -6.9078 | -0.3725 | 4.8837 |
| Trade Openness | 0.2626 | 0.4296 | 2.4166 | 0.0000 | 2.6720 | 9.8658 |
| Regional Trade Intensity | 0.4551 | 0.2583 | 0.8374 | 0.0000 | -0.4366 | 1.7004 |
| World Liquidity | 0.0057 | 0.1350 | 0.3807 | -1.0301 | -2.5548 | 22.1772 |
| World Dividend Yield Changes | 0.0000 | 0.0008 | 0.0029 | -0.0015 | 0.7887 | 3.9016 |
| World Volatility | 3.0612 | 1.1210 | 6.3135 | 1.5295 | 0.9004 | 3.1047 |
| G6 Industrial Production | -0.0004 | 0.0890 | 0.2385 | -0.2175 | 0.3185 | 4.7871 |
| Oil Price Changes | 0.0066 | 0.0857 | 0.2591 | -0.2005 | -0.0529 | 2.8195 |
| Market Premium | 0.1754 | 1.7189 | 3.6948 | -6.6765 | -0.7377 | 4.0538 |
| Term Premium | 0.0186 | 0.0116 | 0.0368 | -0.0070 | -0.1587 | 1.8342 |
| Default Premium | -0.0081 | 0.0020 | -0.0055 | -0.0141 | -1.1598 | 3.6844 |
| Credit Premium | 0.0027 | 0.0019 | 0.0110 | 0.0003 | 1.6050 | 6.5194 |

Table 4 Panel Unit Root Test

| | Null: Unit Root (assumes common unit root process) | | | |
|---|---|---|---|---|
| | Levin, Lin & Chu t-stat | | Breitung t-stat | |
| Market Integration Index | 0.15444 | (0.5614) | 1.17741 | (0.8805) |
| Financial Development | -67.4575 | (0.0000)*** | -45.4436 | (0.0000)*** |
| Dividend Yield Differential | -2.9675 | (0.0015)*** | -1.9254 | (0.0271)** |
| Market Volatility | -11.6287 | (0.0000)*** | -3.5014 | (0.0002)*** |
| Exchange Rate Volatility | -55.8171 | (0.0000)*** | 0.4438 | (0.6714) |
| Currency Reserve Changes | -69.3339 | (0.0000)*** | -25.2236 | (0.0000)*** |
| Inflation Rate | -31.5769 | (0.0000)*** | -15.2384 | (0.0000)*** |
| Interest Rate | -0.3085 | (0.3788) | -2.7741 | (0.0028)*** |
| Trade Openness | -5.0778 | (0.0000)*** | -5.7316 | (0.0000)*** |
| Regional Trade Intensity | -3.2950 | (0.0005)*** | -2.0430 | (0.0205)** |
| World Liquidity | -70.5754 | (0.0000)*** | -35.6429 | (0.0000)*** |
| World Dividend Yield Changes | -75.4723 | (0.0000)*** | -51.3928 | (0.0000)*** |
| World Volatility | -4.5774 | (0.0000)*** | -5.2929 | (0.0000)*** |
| G6 Industrial Production | 908.9420 | (1.0000) | -5.26283 | (0.0000)*** |
| Oil Price Changes | -73.4133 | (0.0000)*** | -53.0760 | (0.0000)*** |
| Market Premium | -78.2287 | (0.0000)*** | -40.6883 | (0.0000)*** |
| Term Premium | -1.0577 | (0.1451) | -7.2975 | (0.0000)*** |
| Default Premium | -4.1026 | (0.0000)*** | -4.1384 | (0.0000)*** |
| Credit Premium | -23.8864 | (0.0000)*** | -18.2721 | (0.0000)*** |

Note: Figures in parentheses are p-values. *, ** and *** denote significance at the 0.10, 0.05 and 0.01 levels, respectively. All unit root tests are based on an equation with intercept, except for interest rate where a time trend is included in the test equation. For unit root tests that involve regressions on lagged difference terms (Levin, Lin and Chu, Breitung, Im, Pesaran, and Shin, Fisher-ADF), the optimal lag length is chosen according to the Schwarz information criterion. For the tests involving kernel weighting (Levin, Lin, and Chu, and Fisher-PP), the Bartlett kernel is employed with Newey-West selected bandwidth. Probabilities for Fisher tests are computed using an asymptotic Chi-square distribution.

Table 4 (continued) Panel Unit Root Test

| | Null: Unit Root (assumes individual unit root process) | | | | | |
|---|---|---|---|---|---|---|
| | Im, Pesaran and Shin W-stat | | ADF - Fisher Chi-square | | PP - Fisher Chi-square | |
| Market Integration Index | -1.88337 | (0.0298)** | 71.5987 | (0.037)** | 76.8571 | (0.0141)** |
| Financial Development | -59.7375 | (0.0000)*** | 2122.3500 | (0.0000)*** | 2225.0200 | (0.0000)*** |
| Dividend Yield Differential | -4.9924 | (0.0000)*** | 117.2670 | (0.0000)*** | 115.8340 | (0.0000)*** |
| Market Volatility | -20.1081 | (0.0000)*** | 522.6270 | (0.0000)*** | 542.3830 | (0.0000)*** |
| Exchange Rate Volatility | -128.6410 | (0.0000)*** | 1201.5600 | (0.0000)*** | 1208.0800 | (0.0000)*** |
| Currency Reserve Changes | -63.6100 | (0.0000)*** | 2187.1300 | (0.0000)*** | 2414.6300 | (0.0000)*** |
| Inflation Rate | -32.6414 | (0.0000)*** | 1104.6200 | (0.0000)*** | 2093.7900 | (0.0000)*** |
| Interest Rate | -2.0273 | (0.0213)** | 75.0142 | (0.0020)*** | 67.1057 | (0.0775)* |
| Trade Openness | -8.9207 | (0.0000)*** | 246.4950 | (0.0000)*** | 663.7790 | (0.0000)*** |
| Regional Trade Intensity | -4.4346 | (0.0000)*** | 95.6874 | (0.0002)*** | 254.0900 | (0.0000)*** |
| World Liquidity | -61.7441 | (0.0000)*** | 2241.1200 | (0.0000)*** | 2798.5400 | (0.0000)*** |
| World Dividend Yield Changes | -66.2121 | (0.0000)*** | 2372.0500 | (0.0000)*** | 2371.5200 | (0.0000)*** |
| World Volatility | -9.6692 | (0.0000)*** | 193.2820 | (0.0000)*** | 193.2820 | (0.0000)*** |
| G6 Industrial Production | -1.67912 | (0.0466)** | 47.3452 | (0.6572) | 478.938 | (0.0000)*** |
| Oil Price Changes | -65.0747 | (0.0000)*** | 2336.8400 | (0.0000)*** | 2334.1800 | (0.0000)*** |
| Market Premium | -69.9921 | (0.0000)*** | 2485.1300 | (0.0000)*** | 2485.8100 | (0.0000)*** |
| Term Premium | -3.5787 | (0.0002)*** | 75.1912 | (0.0194)** | 51.9445 | (0.4761) |
| Default Premium | -7.0950 | (0.0000)*** | 137.6360 | (0.0000)*** | 118.4800 | (0.0000)*** |
| Credit Premium | -16.2887 | (0.0000)*** | 379.1440 | (0.0000)*** | 350.2460 | (0.0000)*** |

Note: Figures in parentheses are p-values. *, ** and *** denote significance at the 0.10, 0.05 and 0.01 levels, respectively. All unit root tests are based on an equation with intercept, except for interest rate where a time trend is included in the test equation. For unit root tests that involve regressions on lagged difference terms (Levin, Lin and Chu, Breitung, Im, Pesaran, and Shin, Fisher-ADF), the optimal lag length is chosen according to the Schwarz information criterion. For the tests involving kernel weighting (Levin, Lin, and Chu, and Fisher-PP), the Bartlett kernel is employed with Newey-West selected bandwidth. Probabilities for Fisher tests are computed using an asymptotic Chi-square distribution.

**4.2 Estimation Results**

A series of tests are conducted to decide on the appropriate specification for the market integration model. Panel A in Table 5 provides the results of the F-test on the restricted model given by equation (4). The null hypothesis of no fixed effect is rejected in favour of at least one-way fixed effect. However, the null of one-way fixed effect is rejected in favour of two-way fixed effects. It is clear that for the restricted model, both cross-section and period fixed effects are significant. Note that the two-way fixed effects specification has the highest adjusted $R^2$. Panel B of the table reports the findings of the Hausman tests. In general, there is no statistical evidence to support any of the random effects specifications over the fixed effects models, whether one or two-way effects. Again, the findings indicate that the two-way fixed effects specification is preferred. Note that the two-way fixed effects specification has the highest adjusted $R^2$ compared to all the random effects specifications.

The estimates for the restricted model with the two-way fixed effects specification are reported in Table 6. Besides the usual standard errors, several robust standard errors are also reported for the LSDV estimates. The White cross-section standard errors (I) is robust to cross equation (contemporaneous) correlation as well as different error variances in each cross section. It is obtained by treating the panel regression as a multivariate regression (with an equation for each cross-section unit), and the robust standard errors are computed based on White's (1980) method for the system of equations. The White period standard errors (II), on the other hand, are robust to arbitrary serial correlation and time varying variances in the disturbances.

In addition to LSDV, two sets of GLS estimates are reported. The two GLS transformations are based on the assumptions that there are cross-section specific heteroskedasticity (I), and period specific heteroskedasticity (II). GLS I allows for a different residual variance for each cross-section unit, while correlation between different cross-section units and different periods is assumed to be zero. GLS II allows for a different residual variance for each period, while correlation between different cross-section units and different periods is still assumed to be zero.

In Table 6, the direction and magnitude of the LSDV coefficients are generally consistent with the GLS estimates. The GLS (II) coefficient for exchange rate volatility is the only exception where the sign is different from the other estimates, but the coefficient is statistically insignificant. The market development measure, dividend yield differential, market volatility, interest rate, trade openness and regional trade intensity are the significant variables for the different estimates. The market development measure is the only variable that does not have the expected sign. With a negative sign, the result implies that higher market development reduces market integration. Higher dividend yield differential, market volatility, interest rate, and regional trade intensity reduces the level of integration into the world market. On the other hand, trade openness promotes integration of the stock market.

Table 5 Specification Tests for the Panel Models

| Test | $R^2$ | Adj $R^2$ | Chi-Sq | |
|---|---|---|---|---|
| Panel A: F-Test | | | | |
| $H_0$: Without Fixed Effects | 0.3133 | 0.3120 | 1517.3729 | (0.0000)*** |
| $H_1$: One-Way Cross-section Fixed Effects | 0.5100 | 0.5062 | | |
| $H_0$: Without Fixed Effects | 0.3133 | 0.3120 | 912.9440 | (0.0000)*** |
| $H_1$: One-Way Period Fixed Effects | 0.4395 | 0.4160 | | |
| $H_0$: Without Fixed Effects | 0.3133 | 0.3120 | 2294.7664 | (0.0000)*** |
| $H_1$: Two-Way Fixed Effects | 0.5877 | 0.5679 | | |
| $H_0$: One-Way Cross-section Fixed Effects | 0.5100 | 0.5062 | 777.3935 | (0.0000)*** |
| $H_1$: Two-Way Fixed Effects | 0.5877 | 0.5679 | | |
| $H_0$: One-Way Period Fixed Effects | 0.4395 | 0.4160 | 1381.8225 | (0.0000)*** |
| $H_1$: Two-Way Fixed Effects | 0.5877 | 0.5679 | | |
| Panel B: Hausman Test | | | | |
| $H_0$: One-Way Cross-section Random Effects (Period Fixed Effects) | 0.0974 | 0.0956 | 22.4647 | (0.0075)*** |
| $H_1$: One-Way Cross-section Fixed Effects (Period Random Effects) | 0.5100 | 0.5062 | | |
| $H_0$: One-Way Period Random Effects (Cross-section Fixed Effects) | 0.3175 | 0.3162 | 135.9908 | (0.0000)*** |
| $H_1$: One-Way Period Fixed Effects (Cross-section Random Effects) | 0.4395 | 0.4160 | | |
| $H_0$: Two-Way Random Effects | 0.0666 | 0.0647 | 20.5260 | (0.0149)** |
| $H_1$: One-Way Cross Section Fixed Effects (Period Random Effects) | 0.5222 | 0.5186 | | |
| $H_0$: Two-Way Random Effects | 0.0666 | 0.0647 | 113.8638 | (0.0000)*** |
| $H_1$: One-Way Period Fixed Effects (Cross-section Random Effects) | 0.2554 | 0.2242 | | |
| $H_0$: Two-Way Random Effects | 0.0666 | 0.0647 | 103.7145 | (0.0000)*** |
| $H_1$: Two-Way Fixed Effects | 0.5877 | 0.5679 | | |

Note: Figures in parentheses are p-values. *, ** and *** denote significance at the 0.10, 0.05 and 0.01 levels, respectively.

The unrestricted model given by equation (5) is estimated as a pooled regression to further understand the fixed effects model reported above. The results are given in Table 7. This equation includes the world information variables, and replaces the cross-section and period-fixed effects with the predetermined event and trading-bloc dummy variables. As before, the White robust standard errors (I and II) and the two sets of GLS estimates are reported. Generally, all three set of estimates are close in magnitude and are of the same sign, except for inflation rate (which is not significant) and exchange rate. The market development measure, dividend yield differential, market volatility, interest rate, trade openness and regional trade intensity are again found to be significant, as is the case for the fixed effects model. The coefficient of the market development measure is negative, contrary to expectation. Two of the estimates of exchange rate volatility coefficient are significantly positive, which is not expected because high exchange rate volatility destabilizes the market and hence has a negative impact on the level of market integration. Higher dividend yield differential, market volatility, interest rate, and regional trade intensity increases market segmentation, while trade openness promotes integration as expected.

Some significant results are found from the addition of the world information variables in the model. The coefficient of the world dividend yield changes is significantly positive, showing that better investment incentive induces market integration. The term premium variable has a significant positive impact on market integration since equity investments are preferable if short term rates are low. High market premium segments a particular market from the rest of the world, high credit premium reduces willingness of investors to invest in risky equities, and high market volatility destabilizes the market. The estimates for these three variables are significantly negative.

The three period dummy variables are significantly negative. The East Asian financial crisis, world recession and oil price crisis have impacted negatively on the integration of the stock market. These shocks have increased market volatility and led to segmentation of the stock market. The magnitude of the coefficients shows that the world recession has the worst impact, while the impact of the financial crisis is the least of the three, on the stock market integration. This is perhaps because the financial crisis has less adverse effects on some of the non Asia-Pacific markets, but the world recession affected all the markets.

All the trading-bloc dummy variables are significant except the dummy for NAFTA. The average level of integration in the EU markets is the highest. On average, EU is about 7% to 14% more integrated compared to the CER markets. The level of integration of the NAFTA markets is not found to be significantly different from that of the CER markets. On the other hand, the markets in both EFTA and AFTA are less integrated compared to the CER markets. The magnitude of the coefficients suggests that the level of integration of the AFTA markets is the lowest.

Table 6 Two-Way Fixed Effects Panel Regression for the Restricted Model

$$MII_{it} = \mu + \delta_1 FD_{it} + \delta_2 DYD_{it} + \delta_3 \sigma_{it} + \delta_4 \sigma_{EX,it} + \delta_5 \Delta CR_{it} + \delta_6 IFL_{it} + \delta_7 INT_{it} + \delta_8 TOP_{it} + \delta_9 RTI_{it} + \eta_i + \xi_t + v_{it}$$

| | LSDV | | White standard error ( I) | White standard error (II) | GLS (I) | | GLS (II) | |
|---|---|---|---|---|---|---|---|---|
| $\mu_M$ | -0.0495 | (0.1291) | (0.1477) | (0.5146) | -0.5835 | (0.0741)*** | -0.3551 | (0.1087)*** |
| $\delta_1$ | -0.0684 | (0.0234)*** | (0.0208)*** | (0.0258)** | -0.0447 | (0.0131)*** | -0.0564 | (0.0219)** |
| $\delta_2$ | -4.2893 | (1.0163)*** | (1.1746)*** | (6.0824) | -3.8931 | (0.6184)*** | -3.0563 | (0.8385)** |
| $\delta_3$ | -0.0064 | (0.0008)*** | (0.0026)** | (0.0047) | -0.0060 | (0.0008)*** | -0.0080 | (0.0007)*** |
| $\delta_4$ | 0.8613 | (1.3015)* | (1.2435) | (1.1905) | 3.0488 | (1.9324) | -0.3693 | (0.9733) |
| $\delta_5$ | -0.0375 | (0.0859) | (0.0720) | (0.0501) | -0.0182 | (0.0484) | -0.0392 | (0.0661) |
| $\delta_6$ | 0.0115 | (0.0510) | (0.0289) | (0.0203) | 0.0027 | (0.0146) | 0.0019 | (0.0380) |
| $\delta_7$ | -0.0702 | (0.0189)*** | (0.0289)** | (0.0578) | -0.0391 | (0.0107)** | -0.1029 | (0.0159)*** |
| $\delta_8$ | 0.1949 | (0.0672)*** | (0.0416)*** | (0.3758) | 0.3777 | (0.0434)*** | 0.1910 | (0.0596)*** |
| $\delta_9$ | -1.3283 | (0.2225)*** | (0.2333)*** | (1.0491) | -0.0773 | (0.1319) | -0.8434 | (0.1832)** |
| $R^2$ | 0.5877 | | | | 0.2524 | | 0.5575 | |
| Adj $R^2$ | 0.5679 | | | | 0.2165 | | 0.5363 | |
| RSS | 739.0791 | | | | 714.0237 | | 735.3375 | |

Note: Figures in parentheses are standard errors. *, ** and *** denote significance at the 0.10, 0.05 and 0.01 levels, respectively.

Table 7 Pooled Regression for the Unrestricted Model

$$MII_{it} = \mu + \delta_1 FD_{it} + \delta_2 DYD_{it} + \delta_3 \sigma_{it} + \delta_4 \sigma_{EX,it} + \delta_5 \Delta CR_{it} + \delta_6 IFL_{it} + \delta_7 INT_{it} + \delta_8 TOP_{it} + \delta_9 RTI_{it} + \delta_{10} WLQ_{it} + \delta_{11} \Delta WDY_{it} + \delta_{12} \sigma_{W,it} + \delta_{13} IP_{G6,it} + \delta_{14} \Delta P_{oil,it} + \delta_{15} MarketP_{it} + \delta_{16} TermP_{it} + \delta_{17} DefaultP_{it} + \delta_{18} CreditP_{it} + \delta_{19} D_{97-99,it} + \delta_{20} D_{01-03,it} + \delta_{21} D_{04-05,it} + \delta_{22} D_{EU,it} + \delta_{23} D_{EFTA,it} + \delta_{24} D_{NAFTA,it} + \delta_{25} D_{AFTA,it} + v_{it}$$

| | OLS | | White standard error ( I) | White standard error ( II) | GLS ( I) | | GLS (II) | |
|---|---|---|---|---|---|---|---|---|
| $\mu$ | -0.1841 | (0.0586)*** | (0.0793)** | (0.2097) | -0.2960 | (0.0290)*** | -0.2293 | (0.0520)*** |
| $\delta_1$ | -0.0651 | (0.0240)*** | (0.0245)*** | (0.0266) | -0.0301 | (0.0123)** | -0.0535 | (0.0218)** |
| $\delta_2$ | -3.5914 | (0.8879)*** | (0.7609)*** | (3.7928) | -0.7474 | (0.4449)* | -1.9129 | (0.6813)*** |
| $\delta_3$ | -0.0111 | (0.0008)*** | (0.0024)*** | (0.0049)** | -0.0102 | (0.0007)*** | -0.0125 | (0.0007)*** |
| $\delta_4$ | 3.1363 | (1.3402)** | (2.0061) | (2.5169) | -2.6468 | (2.0325) | 3.9200 | (1.2442)*** |
| $\delta_5$ | -0.0356 | (0.0894) | (0.0719) | (0.0478) | -0.0138 | (0.0437) | -0.0600 | (0.0638) |
| $\delta_6$ | -0.0115 | (0.0539) | (0.0191) | (0.0221) | -0.0178 | (0.0190) | -0.0049 | (0.0419) |
| $\delta_7$ | -0.0787 | (0.0124)*** | (0.0189)*** | (0.0410)* | -0.0539 | (0.0069)*** | -0.0824 | (0.0105)*** |
| $\delta_8$ | 0.1514 | (0.0178)*** | (0.0164)*** | (0.1124) | 0.0732 | (0.0116)*** | 0.0860 | (0.0145)*** |
| $\delta_9$ | -0.1486 | (0.0686)** | (0.0326)*** | (0.2049) | -0.0371 | (0.0299) | -0.1854 | (0.0577)*** |
| $\delta_{10}$ | -0.0635 | (0.0528) | (0.0692) | (0.0281)** | -0.0173 | (0.0250) | -0.0649 | (0.0485) |
| $\delta_{11}$ | 48.0483 | (22.6692)** | (40.0232) | (23.2891)** | 8.4467 | (10.7167) | 31.6273 | (17.4417)* |
| $\delta_{12}$ | -0.0338 | (0.0097)*** | (0.0162)** | (0.0206)* | -0.0094 | (0.0046)** | -0.0196 | (0.0089)** |
| $\delta_{13}$ | 0.0186 | (0.0772) | (0.1109) | (0.0168) | 0.0015 | (0.0365) | 0.0292 | (0.0617) |

Note: Figures in parentheses are standard errors. *, ** and *** denote significance at the 0.10, 0.05 and 0.01 levels, respectively. White I and GLS I refereeing to cross section while White II and GLS II referring to period.

Table 7 (continued) Pooled Regression for the Unrestricted Model

$$MII_{it} = \mu + \delta_1 FD_{it} + \delta_2 DYD_{it} + \delta_3 \sigma_{it} + \delta_4 \sigma_{EX,it} + \delta_5 \Delta CR_{it} + \delta_6 IFL_{it} + \delta_7 INT_{it} + \delta_8 TOP_{it} + \delta_9 RTI_{it} + \delta_{10} WLQ_{it} + \delta_{11} \Delta WDY_{it} + \delta_{12} \sigma_{W,it} + \delta_{13} IP_{G6,it} + \delta_{14} \Delta P_{oil,it} + \delta_{15} MarketP_{it} + \delta_{16} TermP_{it} + \delta_{17} DefaultP_{it} + \delta_{18} CreditP_{it} + \delta_{19} D_{97-99,it} + \delta_{20} D_{01-03,it} + \delta_{21} D_{04-05,it} + \delta_{22} D_{EU,it} + \delta_{23} D_{EFTA,it} + \delta_{24} D_{NAFTA,it} + \delta_{25} D_{AFTA,it} + v_{it}$$

| | OLS | | White standard error ( I) | White standard error ( II) | GLS ( I) | | GLS (II) | |
|---|---|---|---|---|---|---|---|---|
| $\delta_{14}$ | -0.1282 | (0.0800) | (0.1249) | (0.0762)* | -0.0096 | (0.0379) | -0.0792 | (0.0681) |
| $\delta_{15}$ | 0.0352 | (0.0102)*** | (0.0205) | (0.0149)** | 0.0113 | (0.0048)** | 0.0245 | (0.0083)*** |
| $\delta_{16}$ | 3.1241 | (0.8001)*** | (1.6025)* | (1.2899)** | 2.1234 | (0.3793)*** | 0.7166 | (0.6874) |
| $\delta_{17}$ | 7.1622 | (5.9185) | (9.1903) | (6.1143) | 1.1234 | (2.7997) | 1.1157 | (5.6065) |
| $\delta_{18}$ | -30.8816 | (5.4024)** | (9.7971)*** | (9.7419)*** | -12.2407 | (2.5565)*** | -18.4872 | (4.7820)*** |
| $\delta_{19}$ | 0.0332 | (0.0249) | (0.0479) | (0.0459) | -0.0283 | (0.0117)** | -0.0701 | (0.0248)*** |
| $\delta_{20}$ | -0.3743 | (0.0281)*** | (0.0425)*** | (0.0986)*** | -0.1840 | (0.0136)*** | -0.4244 | (0.0268)*** |
| $\delta_{21}$ | -0.2960 | (0.0259)*** | (0.0507)*** | (0.0873)*** | -0.1390 | (0.0126)*** | -0.3008 | (0.0230)*** |
| $\delta_{22}$ | 0.1305 | (0.0470)*** | (0.0215)*** | (0.1473) | 0.0719 | (0.0209)*** | 0.1413 | (0.0386)*** |
| $\delta_{23}$ | -0.1090 | (0.0388)*** | (0.0244)*** | (0.1346) | -0.0670 | (0.0167)*** | -0.1435 | (0.0318)*** |
| $\delta_{24}$ | 0.0340 | (0.0513) | (0.0258) | (0.1321) | 0.0056 | (0.0197) | 0.0196 | (0.0411) |
| $\delta_{25}$ | -0.7850 | (0.0376)*** | (0.0616)*** | (0.1388)*** | -0.6550 | (0.0265)*** | -0.5757 | (0.0302)*** |
| $R^2$ | 0.5013 | | | | 0.1484 | | 0.4663 | |
| Adj $R^2$ | 0.4986 | | | | 0.1437 | | 0.4633 | |
| RSS | 893.9587 | | | | 699.4275 | | 848.0062 | |

Note: Figures in parentheses are standard errors. *, ** and *** denote significance at the 0.10, 0.05 and 0.01 levels, respectively.

## 5. CONCLUSION

This study reports statistical evidence that market attributes, economic fundamentals and world information have played a significant role in explaining the process of stock market integration. For market attributes, higher dividend yield differential and market volatility increases market segmentation. Variables reflecting the economic fundamentals including interest rate and regional trade intensity increases market segmentation, while trade openness promotes integration. Of the world information variables, the world dividend yield changes and term premium have positive impact on market integration. Market premium, credit premium and market volatility are found to reduce the level of market integration.

The process of market integration has been adversely affected by three major events, the Asian financial crisis in 1997, the world recession in 2001, and the oil price hike in 2004. The negative impact of the financial crisis is the least, while the impact of the world recession is most serious.

The study also found that affiliations to trading bloc explain the different level of market integration. The stock markets of member countries of EU tend to exhibit a higher level of integration, while those of the AFTA have the lowest level of market integration. This finding and the significance of the intra-bloc trade intensity suggest that trade regionalism has a role to play in driving market integration.

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