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Stock Market Integration across National Boundaries: Causes and Impediments[#]

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Abstract: This study examines the factors that lead to integration of stock markets into the world network and those that impede this process using data on 26 markets of member countries of five trading blocs around the world. Using panel data models, higher trade openness, world dividend yield changes and world term premium are found to promote integration of stock markets. On the other hand, higher dividend yield differential, individual market volatility, interest rate, regional trade intensity, world market premium, credit premium and market volatility are impediments to integration. Also, world events such as the Asian financial crisis in 1997 and the recession at the beginning of the new millennium have a negative impact on stock market integration. Surprisingly, trading block affiliation is a significant determinant of market integration. The level of integration is highest among stock markets in the European Union (EU), while the markets in the Association of South-East Asia Nations Free Trade Area(AFTA) are most segmented from the world market.

Keywords: International CAPM, market integration, panel models, trading bloc

1. Introduction

As to whether stock markets are integrated across national borders is important for several reasons. For global investors and country funds, a highly integrated world stock market indicates that the returns from securities are similarly priced internationally. As a result, there is little differential in risk premiums and the benefit 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. The issue of market integration

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has increasingly received attention from international and development economists. The concern of international economists is related to the potential gains of public welfare stemming from market integration (see 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; Henry 2000). Market integration is also an important aspect for understanding the international financial architecture.

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 risks in future cash flows should be similarly priced regardless of where they are listed (Adler 1995; Bekaert and Harvey 1995; Bekaert *et al.* 2002). Stock market linkages therefore do not constitute a sufficient condition for validating the law of one price.[1] Tests for market integration should be built on asset pricing models which offer a fundamental *ex-ante* framework. To our knowledge, the study of Carrieri *et al.* (2007) remains the only one that explores 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 from another in achieving pricing efficiency, this paper looks at an information set that matters to the asset pricing process.

The objectives of this study are to examine the major driving forces and impediments 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. Panel regression techniques are adopted for analysis. 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.

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 at different levels of development are considered. The trading blocs covered in the study include European Union (EU), European Free Trade Agreement (EFTA), North American Free Trade Agreement (NAFTA), Australia-New Zealand Closer Economic Relations(CER), and Association of South-East Asia Nations (ASEAN) Free Trade Area (AFTA). Table 1 provides a summary of some information on the trading blocs and their member countries. The setup of the trading blocs is different – 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 than suggested by their setup. For example, member countries of EFTA and NAFTA

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

have services agreement under GATS Article V, and this represents a higher degree of inter-bloc cooperation than suggested by that of a conventional free trade area.

3. The Empirical Model

3.1 Determinants of Market Integration

The choice of variables that enter our empirical model is determined through a literature search of factors that affect stock returns and market integration. We examine three categories of potential factors, and postulate that the market integration process is driven by the development of the market itself, the economic fundamentals of individual countries, as well as the global economic climate. Table 2 lists the variables to be considered as determinants of the stock market integration process and the notations used for each of these variables. The sources given in the table show the studies on capital markets that have considered these variables.

3.2 The Time-Varying Market Integration Index

To understand the behaviour 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

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,	1 Jan 58	10 Nov 95	GATS Art. V	Services agreement
Denmark, Finland, France, Germany, Greece, Italy, Ireland, Netherlands, Portugal, Spain, Sweden and UK)	1 Jan 58	24 Apr 57	GATT Art. XXIV	Customs union
EFTA (Norway	1 June 02	3 Dec 02	GATS Art. V	Services agreement
and Switzerland)	3 May 60	14 Nov 59	GATT Art. XXIV	Free trade agreement
NAFTA (Canada,	1 Apr 94	1 Mar 95	GATS Art. V	Services agreement
Mexico, and the US)	1 Jan 94	1 Feb 93	GATT Art. XXIV	Free trade agreement
CER (Australia and	1 Jan 89	22 Nov 95	GATS Art. V	Services agreement
New Zealand)	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/*

Table 2. Summary list of determinant variables

Category	Variable	Definition & explanation	Source
Market attributes	Financial development	FD = changes of (Market value / Nominal GDP)	Levine and Zervos (1996), Bekaert *et al.* (2002), Carrieri *et al.* (2007).
	Dividend yield Differential	$DYD = DY$ country i - DY world; DY = dividend/price	Ferson and Harvey (1994), Bekaert and Harvey (1995), Fama and French (1998).
	Market volatility	σ = conditional volatility generated from an AR(1) process with GARCH(1,1) errors on log (P_t/P_{t-1})	King and Wadhwani (1990), Glosten *et al.* (1993).
Economic fundamentals	Exchange rate volatility	σ_{EX} = conditional volatility generated from an AR(1) process with GARCH(1,1) errors on $\log(Ex_t)$. Exchange rate is expressed in terms of domestic currency per unit of USD	Jorion (1991), De Santis and Gerard (1998), Ng (2004).
	Currency reserve changes	ΔCR = changes of log (international currency reserve)	
	Inflation rate	$IFL = (CPI_t - CPI_{t-1})/CPI_{t-1}$	Boyd *et al.* (2001).
	Interest rate	INT = log (Short term interest rate, TB rate or interbank rate)	Giovannini and Jorion (1987)
	Trade openness	TOP = total trade with the world / Nominal GDP	Bekaert and Harvey (1997), Carrieri *et al.* (2007)
	Regional trade intensity	RTI = total trade with bloc members / Total trade with the world	Hooy (2008)
World information	World liquidity	WLQ = log (Turnover by volume). Turnover in billion USD.	Ferson and Harvey (1994), Bekaert *et al.* (2002),
	World dividend Yield changes	ΔWDY = changes of world dividend yield	Gérard *et al.* (2003), Carrieri *et al.* (2007)
	World volatility	σ_W = conditional volatility generated from an AR(1) process with GARCH(1,1) errors on log $(P_{W,t}/P_{W,t-1})$	
	G6 industrial production[1]	IP_{G6} = equal weighted log of industrial production of G6 countries	Chen *et al.* (1986), Hamao (1988), Ferson and Harvey (1994).
	Oil price changes	ΔP_{oil} = log $(P_{oil,t} - P_{oil,t-1})$ (month-end crude oil price)	
	Market premium	$MarketP$ = MSCI World – US 3-month TB rate	Errunza and Miller (2000), Henry (2000).
	Term premium	$TermP$ = US 10-year bond rate – US 3-month TB rate	Fama and French (1986), Cuaresma *et al.* (2005).
	Default premium	$DefaultP$ = BAA bond rate – AAA bond rate	Fama and French (1986).
	Credit premium	$CreditP$ = Eurodollar 3-month interest rate - US 3-month TB rate	Aquino (2004).

Note: [1]G6 refers to the all the G7 countries except Canada for which data are not available.

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), given by the following specifications:

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

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. A series of α_{it} 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 determinants of stock market integration. A panel regression has several advantages in that it offers flexibility in modeling the heterogeneity bounded in the market integration process across individual markets. Pooling both time-series and cross-section data reduces colinearity, provides 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 2002:307). The basic panel framework for the market integration model is a regression of the form:

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

where δ 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. As the world information is a set of common time-series regressors that are identical for every market, the same time series are repeated for each cross-section units. Singularity problem may arise from this panel structure. Thus a restricted model without the world information variables is firstly considered. The restricted model is given by

$$\begin{aligned} MII_{it} = {} & \mu + \delta_1 FD_{it} + \delta_2 DYD_{it} + \delta_3 \sigma_{it} + \delta_4 \sigma_{EX,it} + \delta_5 \Delta CR_{it} + \delta_6 IFL_{it} \\ & + \delta_7 INT_{it} + \delta_8 TOP_{it} + \delta_9 RTI_{it} + \eta_i + \xi_t + v_{it} \end{aligned} \tag{2}$$

where η_i is the cross-section component of the disturbance terms, ζ_t captures the period effects across observations and v_{it} is the remainder disturbance effects. In the pooled regression, both η_i and ζ_t collapse to zero. If the cross-section and period components are fixed over time, the above model is referred to as a two-way fixed effects model. For estimation purposes, a least squares dummy variable (LSDV) or the generalised least squares (GLS) method can be used. However, both η_i and ζ_t could be randomly distributed with the following properties:

$$E\eta_i = E\xi_t = Ev_{it} = 0, \qquad E\eta_i\xi_t = E\eta_i v_{it} = E\xi_t v_{it} = 0,$$

$$E\eta_i\eta_j = \begin{cases} \sigma_\eta^2 & \text{if } i = j, \\ 0 & \text{if } i \neq j, \end{cases} \qquad E\xi_t\xi_s = \begin{cases} \sigma_\xi^2 & \text{if } t = s, \\ 0 & \text{if } t \neq s, \end{cases}$$

$$Ev_{it}v_{it} = \begin{cases} \sigma_v^2 & \text{if } i = j,\ t = s, \\ 0 & \text{otherwise}, \end{cases} \qquad E\eta_i z'_{it} = E\xi_t z'_{it} = Ev_{it}z'_{it} = 0'$$

In this case, they are not directly observable and thus represent a form of latent variables (Hsiao 2003). In the above specification, the disturbance term ε_{it} is correlated, where the correlation is given by $corr\,(\varepsilon_{it}, \varepsilon_{iS'}) = \sigma_\eta^2 / (\sigma_\eta^2 + \sigma_v^2)$. If this is the case, the OLS estimator becomes inefficient. To overcome the correlation problem, Baltagi (2002) and Hsiao (2003) suggested the use of the GLS estimation.

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 the unrestricted specification that includes the world information variables. In addition, three period dummy variables and four trading bloc dummy variables are included as follows:

$$\begin{aligned} MII_{it} = {} & \mu + \delta_1 FD_{it} + \delta_2 DYD_{it} + \delta_3 \sigma_{it} + \delta_4 \sigma_{EX,it} + \delta_5 \Delta CR_{it} + \delta_6 IFL_{it} + \delta_7 INT_{it} + \delta_8 TOP_{it} \\ & + \delta_9 RTI_{it} + \delta_{10} WLQ_{it} + \delta_{11} \Delta WDY_{it} + \delta_{12} \sigma_{W,it} + \delta_{13} IP_{G6,it} + \delta_{14} \Delta P_{oil,it} + \delta_{15} MarketP_{it} \\ & + \delta_{16} TermP_{it} + \delta_{17} DefaultP_{it} + \delta_{18} CreditP_{it} + \delta_{19} D_{97-99,it} + \delta_{20} D_{01-03,it} + \delta_{21} D_{04-05,it} \\ & + \delta_{22} D_{EU,it} + \delta_{23} D_{EFTA,it} + \delta_{24} D_{NAFTA,it} + \delta_{25} D_{AFTA,it} + v_{it} \end{aligned} \tag{3}$$

where the period and the trading bloc dummy variables are:

$D_{97\text{-}99} = 1$ for the period January 1997 – December 1999, and 0 otherwise

D_{01-03} = 1 for the period January 2001– 2003 December, and 0 otherwise
D_{04-05} = 1 for the period January 2004 – August 2005, and 0 otherwise
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 to test if the markets of the same trading bloc share similar behaviour. The CER remains as the reference trading bloc. Note that the period and trading bloc dummy variables are included for us to examine specific 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 capitalisation weighted average of all the indices of the markets in the bloc, excluding that of the market of interest 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 proxied 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 reserves, CPI (Australia and New Zealand) and industrial production are downloaded from the International Financial Statistics (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

A series of tests were conducted to decide on the appropriate specification of the market integration model. Based on the *F*-test and Hausman tests on the restricted model, the two-way fixed effects specification is preferred against the pooled and random effect models. [2] The fixed effects model also has the highest adjusted R^2. The estimated model is reported

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[2] We conducted five panel unit root tests for each series. Overall, the data set indicates no unit root process. The null hypothesis of presence of unit root is rejected by at least three out of five tests. To conserve space, the results of unit root tests, *F*-test, and Hausman tests are not reported here. They are available upon request.

Table 3. 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 I	White II	GLS I		GLS II	
μ_M	-0.0495	(0.1291)	(0.1477)	(0.5146)	-0.5835	(0.0741)***	-0.3551	(0.1087)***
δ_1	-0.0684	(0.0234)***	(0.0208)***	(0.0258)**	-0.0447	(0.0131)***	-0.0564	(0.0219)**
δ_2	-4.2893	(1.0163)***	(1.1746)***	(6.0824)	-3.8931	(0.6184)***	-3.0563	(0.8385)**
δ_3	-0.0064	(0.0008)***	(0.0026)**	(0.0047)	-0.0060	(0.0008)***	-0.0080	(0.0007)***
δ_4	0.8613	(1.3015)*	(1.2435)	(1.1905)	3.0488	(1.9324)	-0.3693	(0.9733)
δ_5	-0.0375	(0.0859)	(0.0720)	(0.0501)	-0.0182	(0.0484)	-0.0392	(0.0661)
δ_6	0.0115	(0.0510)	(0.0289)	(0.0203)	0.0027	(0.0146)	0.0019	(0.0380)
δ_7	-0.0702	(0.0189)***	(0.0289)**	(0.0578)	-0.0391	(0.0107)**	-0.1029	(0.0159)***
δ_8	0.1949	(0.0672)***	(0.0416)***	(0.3758)	0.3777	(0.0434)***	0.1910	(0.0596)***
δ_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 10, 5 and 1 per cent levels, respectively. RSS refers to the residual sum of squares.

in Table 3. 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 system of multivariate regressions (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.

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. The market development measure has a negative sign, suggesting that higher market development reduces market integration. At the same time, 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.

The unrestricted model given by Equation 3 is estimated as a pooled regression to further understand the fixed effects model reported above. The results are given in Table 4. 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 as before. Two of the estimates of exchange rate volatility coefficient are significantly positive, which is not expected because high exchange rate volatility destabilises the market and hence is expected to have a negative impact on the level of market integration. Higher dividend yield differential, market volatility, interest rate, and regional trade intensity increase market segmentation, while trade openness promotes integration. 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 destabilises 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

Table 4. 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 I	White II	GLS I		GLSO II	
μ	-0.1841	(0.0586)***	(0.0793)**	(0.2097)	-0.2960	(0.0290)***	-0.2293	(0.0520)***
δ_1	-0.0651	(0.0240)***	(0.0245)***	(0.0266)	-0.0301	(0.0123)**	-0.0535	(0.0218)**
δ_2	-3.5914	(0.8879)***	(0.7609)***	(3.7928)	-0.7474	(0.4449)*	-1.9129	(0.6813)***
δ_3	-0.0111	(0.0008)***	(0.0024)***	(0.0049)**	-0.0102	(0.0007)***	-0.0125	(0.0007)***
δ_4	3.1363	(1.3402)**	(2.0061)	(2.5169)	-2.6468	(2.0325)	3.9200	(1.2442)***
δ_5	-0.0356	(0.0894)	(0.0719)	(0.0478)	-0.0138	(0.0437)	-0.0600	(0.0638)
δ_6	-0.0115	(0.0539)	(0.0191)	(0.0221)	-0.0178	(0.0190)	-0.0049	(0.0419)
δ_7	-0.0787	(0.0124)***	(0.0189)***	(0.0410)*	-0.0539	(0.0069)***	-0.0824	(0.0105)***
δ_8	0.1514	(0.0178)***	(0.0164)***	(0.1124)	0.0732	(0.0116)***	0.0860	(0.0145)***
δ_9	-0.1486	(0.0686)**	(0.0326)***	(0.2049)	-0.0371	(0.0299)	-0.1854	(0.0577)***
δ_{10}	-0.0635	(0.0528)	(0.0692)	(0.0281)**	-0.0173	(0.0250)	-0.0649	(0.0485)
δ_{11}	48.0483	(22.6692)**	(40.0232)	(23.2891)**	8.4467	(10.7167)	31.6273	(17.4417)*
δ_{12}	-0.0338	(0.0097)***	(0.0162)**	(0.0206)*	-0.0094	(0.0046)**	-0.0196	(0.0089)**
δ_{13}	0.0186	(0.0772)	(0.1109)	(0.0168)	0.0015	(0.0365)	0.0292	(0.0617)
δ_{14}	-0.1282	(0.0800)	(0.1249)	(0.0762)*	-0.0096	(0.0379)	-0.0792	(0.0681)
δ_{15}	0.0352	(0.0102)***	(0.0205)	(0.0149)**	0.0113	(0.0048)**	0.0245	(0.0083)***
δ_{16}	3.1241	(0.8001)***	(1.6025)*	(1.2899)**	2.1234	(0.3793)***	0.7166	(0.6874)

δ_{17}	7.1622	(5.9185)	(9.1903)	(6.1143)	1.1234	(2.7997)	1.1157	(5.6065)
δ_{18}	-30.8816	(5.4024)**	(9.7971)***	(9.7419)***	-12.2407	(2.5565)***	-18.4872	(4.7820)***
δ_{19}	0.0332	(0.0249)	(0.0479)	(0.0459)	-0.0283	(0.0117)**	-0.0701	(0.0248)***
δ_{20}	-0.3743	(0.0281)***	(0.0425)***	(0.0986)***	-0.1840	(0.0136)***	-0.4244	(0.0268)***
δ_{21}	-0.2960	(0.0259)***	(0.0507)***	(0.0873)***	-0.1390	(0.0126)***	-0.3008	(0.0230)***
δ_{22}	0.1305	(0.0470)***	(0.0215)***	(0.1473)	0.0719	(0.0209)***	0.1413	(0.0386)***
δ_{23}	-0.1090	(0.0388)***	(0.0244)***	(0.1346)	-0.0670	(0.0167)***	-0.1435	(0.0318)***
δ_{24}	0.0340	(0.0513)	(0.0258)	(0.1321)	0.0056	(0.0197)	0.0196	(0.0411)
δ_{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 10, 5 and 1 per cent levels, respectively. RSS refers to the residual sum of squares.

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 on stock market integration is the least of the three. 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 per cent 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.

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 increase 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 a trading bloc explain the different levels 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 market segmentation.

The lack of perfect world stock market integration reported in this study has implications for international portfolio diversification.[3] By taking advantage of the heterogeneity in market behaviour due to segmentation, risks in equity investment can be diversified, particularly across markets in different trading blocs. Given the different degree of market segmentation, opportunities also exist for investors to choose an international portfolio that best suit their purpose of investment according to the extent of market risk heterogeneity.

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[3] We are grateful to an anonymous referee for suggesting this point.

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