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CAPITAL MARKET REVIEW

Market, Country and World Effects on Regional Equity Market Integration

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This study explores the fundamental driving forces of regional equity market integration in a trading bloc. The determinant factors are categorized into market attribute, economic fundamentals and world information. Our sample consists of 26 equity markets of five regional trading blocs, namely AFTA, CER, EFTA, EU and NAFTA over the period of January 1999 to August 2005. We measure market integration based on pricing errors as proposed by Korajczyk (1996) and Levine and Zervos (1998). Using panel regressions, our results show that equity integration in these trading blocs is driven internally, where only individual-market volatility and economic fundamentals play a significant role in the process. Intra-bloc trade is found to enhance regional equity market integration, supporting the notion that regional convergence extends beyond the trade sector that is promoted in the trade agreements. We also document regime shifting effects during stock market crises, where most of these markets became strongly integrated after a regional crisis, but integration was significantly weakened during a crisis that affected the world markets. Also, the level of equity market integration differs across trading blocs, where the blocs with a smaller number of country members are relatively more integrated.

Keywords: *fundamental factors, panel regression, stock market, trading bloc.*

Introduction

The last three decades witnessed a proliferation of regional trading agreements, which brought about a rise in economic regionalism. The number of regional trade agreements notified to WTO jumped from 27 in 1990 to 205 as of July 2007. This phenomenon raised the question of whether such progress might lead to "trade diversion" or whether it contributes to globalization and welfare benefits of the regional economic development (Bhagwati, 1993 and Frankel, 1995). While much of the empirical evaluation on the impact of economic regionalism focused on the terms of trade, recently the scope of research has moved beyond the real sector to financial sector, i.e. whether such development might also have led to more segmentation of international financial markets

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(Langhammer,1995 and Blomstrom and Kokko, 1997).

At the empirical front, Heaney et al. (2000) explored the similarities of 26 emerging equity markets through a cluster analysis. Based on their dendrogram analysis, i.e. the ranking of markets according to their strength of fusion, they concluded that most of the markets formed the closest amalgamation with their regional counterparts, especially those of the same trading bloc affiliation. Others could be grouped by the nature of their export industries or by the similarity in the stage of economic development and openness. The results of Heaney et al. (2000) are further supported by Heaney and Hooper (2001) who applied the same techniques on 34 markets, comprising of both developed and emerging markets. On the other hand, Hooper et al. (2000) reported increased interdependence among six Asian emerging markets as a result of stronger regionalism and increased liberalization, by analyzing rolling correlations in stock returns of these markets with the world and regional indices for the period 1985-1996. They concluded that the stronger interdependence promoted the contagion effect of the 1997 Asian financial crisis among these countries.

What might have caused such pattern of regionalism that also occurred in equity markets? According to Heaney et al. (2000), one of the possible reasons for regional equity integration is macroeconomic integration that is largely due to trading bloc formation. An example is the stronger linkages of the European Union (EU) markets after the removal of exchange rate controls and the establishment of common criteria that laid the path towards the formation of a common currency system. In another study focusing on asset pricing, Heaney and Hooper (1999) postulated that with increasing trade regionalism, future cash flows generated by the corporations within the trading bloc were expected to be correlated, thereby causing significant trading-bloc effects in the pricing of financial assets. Hooper et al. (2000) attributed the high correlation among regional markets to cross-border portfolio investment in the equity and property sector. Another contributing factor to equity market regionalism that is gathering momentum in Europe and Asia was the regulatory co-operative agreements initiated by stock exchanges within these regions (Hooper, 2002).

The nature of economic integration has been broadening with initiatives taken to deepen the integration of regional financial sector. The scope of the current study is to examine regionalism based on the formation of trading bloc, not based on geographical-based regional integration unrelated to trading blocs. Many studies have focused on the issue of equity market integration within a trading bloc, for example, the European Monetary Union (EMU) (Akdogan, 1992; Corhay et al., 1993; Johnson and Soenen, 1993; Johnson et al., 1994; Monadjemi and Perry, 1996; Choudhry, 1996; Kanas, 1998; Fratzscher, 2002), NAFTA (Adler, 1995; Ewing et al., 1999; Adler and Qi, 2003), Mercado Comun del Cono Sur or MERCOSUR (Soydemir, 2000; Seabra, 2001; Edwards and Susmel, 2001; Chen et al., 2002; Heaney et al., 2002; Johnson and Soenen, 2003) and AFTA (Ng, 2002; Click and Plummer, 2005). These studies examined the different channels of stock market interaction, including linkages in returns, spillover of volatility, portfolio diversification, and more recently, the contagion effects during financial crises. The results of these studies are discerning in showing regional interdependence, but they do not offer further insights into the causes of regionalism in equity market integration.

This paper aims to fill the void in the literature through exploration of the determinants of market integration in a trading bloc for understanding equity market regionalism. The existing empirical

literature on market integration and stock return pricing provide guidance on what the potential determinants are. Using panel regressions, we documented evidence that equity market integration in a trading bloc, or regional integration henceforth, is driven by forces representing market attributes and economic fundamentals, and the process is affected by financial crises.

The rest of this paper is divided into four sections. The following section provides a brief review of the literature on market linkages and integration. The section that follows this explains the methodology and data used in our analysis. Then, followed by result and discussion. The final section concludes the study and states the direction for future research.

Literature review

Much of the literature on market integration focuses on modeling and measuring the process of market linkages. Empirical research on integration of world equity market has not been conclusive. A common consensus reported in the stream of studies on equity return correlation is that intra-regional correlation tends to be higher than inter-regional correlation (Eun and Shim, 1989). This finding was basically consistent with the structure of time zone differences between the interrelated markets. Another finding was that the correlation pattern might reflect the degree of economic integration between countries (Rahman and Yung, 1994). In another vein, empirical works on time-varying correlation and covariance found that macroeconomic fundamentals contributed to explaining market linkages (Longin and Solnik, 1995; Ammer and Mei, 1996; Karolyi and Stulz, 1996; Dickinson,2000), but a recent view was that contagion effects might have played a role in the changes of market co-movement over time (Karolyi, 2003).

There were studies using other approaches to measure market linkages and co-movement. For example, Bracker et al. (1999) reported that macroeconomic variables had significant effects on bilateral lead-lag linkages that were constructed using the method of Geweke (1982). On the contrary, Cheung and Lai (1999) found only weak evidence of long-run relationships of stock returns that could be explained by macroeconomic fundamentals. In a recent study, Chinn and Forbes (2004) showed that direct trade with the large economies (top five global markets) appeared to be the only important factor for explaining cross-section market linkages with the large economies. Trade competition, bank lending and foreign investment had no significant effect.

These studies provided a general picture on the driving forces of market linkages. However, as market return correlations and linkages reflect only ex-post causality, these studies were limited to weak tests for market integration, but the process of market integration was not captured. Adler and Dumas (1983) pointed out that correlation between markets depended heavily on the specialization of international trade of the individual economy. As a result, market co-movement reflected only sectoral linkages, not market integration. A test for market integration needs to be built on asset pricing model, which offers an ex-ante framework (Bekaert and Harvey, 1995).

To the best of our knowledge, the work of Carrieri et al. (2007) remains the only study that has explored the determinants for market integration using asset pricing approach. Carrieri et al. (2007) analyzed eight emerging markets, and market integration was calculated from systematic risk and a pooled regression with only four explanatory variables. Their findings showed that financial development and market liberalization had a positive impact on market integration, but the effects of trade openness and world market volatility were

not significant. The present paper extends the study of Carrieri et al. (2007) to cover a larger number of equity markets. We used a different measure for market integration, and explored a wider coverage of the determinants, which can be categorized into three groups of fundamental forces – market attributes, macroeconomic fundamentals and world information. In addition, we also controlled several potential structural breaks and trading-bloc effects.

Methodology

Capital Asset Pricing Models

In this paper, the capital asset pricing model (CAPM) provides the theoretical underpinnings to the discussion of regional equity market integration. The standard CAPM postulates that returns to individual stocks in excess of some risk free returns are systematically related to the market returns. The relationship suggests that all the stocks are integrated within the market itself, and hence, different inward looking equity markets are fully segmented from each other. In a liberalized state of the current world financial architecture, this assumption is certainly not realistic. On the other hand, the international version of the CAPM suggests a systematic linear relationship between excess market returns and excess returns to a world market portfolio. In this case, all markets are assumed to be fully integrated in the world financial network. Many other models in between these two extremes have been proposed to take into consideration mildly segmented equity markets. The works of Akdogan (1992) and Adler and Qi (2003), for example, suggest a CAPM version that allows for market integration within regions. Following their idea, the pricing model that is used in this study can be stated as:

$$R_{i,t} - R_{F,t} = \alpha_i + \beta_i (R_{B,t} - R_{F,t}) + \varepsilon_{i,t}; \quad \forall t \quad (1)$$

where $R_{i,t}$ and $R_{TB,t}$ are returns to the portfolio of market-i and the trading-bloc portfolio, respectively, and $R_{F,t}$ is the international risk free rate. This model, based on for the pricing of trading bloc portfolios, is henceforth referred to as the Trading-Bloc CAPM (TBCAPM).

Market integration is commonly understood as the materialization of the law of one price, where companies that are exposed to similar risk in future cash flows should be priced the same regardless of their domicile (Adler, 1995; Bekaert Harvey, 1995; and Bekaert et al., 2002). The CAPM discussed above is often used to determine the pricing process. According to Korajczyk (1996), perfect market integration can be achieved when there is no pricing error in benchmarking market indices to common risk factors under an equilibrium capital asset pricing model. Therefore, pricing errors α_i from model (1) represent deviations from the state of perfect regional market integration attributed to a trading bloc.

To capture the time varying behavior of market integration, we constructed an integration index, RMI_{it} (regional market integration index) for every market i in this study. The weighted returns computed from the market indices of the other member countries within a same bloc were used as a proxy to the trading bloc portfolio for market i. In other words, the returns of market i were not included in the computation of its trading-bloc portfolio returns. Then, following the market integration measurement proposed by Korajczyk (1996) and Levine and Zervos (1998), we estimated the pricing errors from TBCAPM. To obtain a time-series estimates for the market integration index, we implemented a 5-year rolling regression. Equation (1) is estimated with a fixed window of 5 years of monthly observations and the collected time-varying pricing errors were adjusted to construct the regional market integration

index (*RMI*) as below:

$$RMI_{i,t} = -\left|\hat{\alpha}_{i,t}\right| \quad (2)$$

The *RMI* index can take any negative value with a zero upper bound. A zero value suggests integration with the world market, and the index is positively correlated with the degree of market integration.

Determinants of Regional Market Integration

We postulate that regional equity market integration is determined by three fundamental aspects, i.e., development of the individual market, macroeconomic performance of the country, and the global economic climate. In general, we can write the integration process as a function of:

$$\text{RI}=\text{f}(Z_{\text{Market}}, Z_{\text{Economy}}, Z_{\text{World}}) \quad (3)$$

where R denotes the level of regional equity market integration, while Z_{Market}, Z_{Economy}, and Z_{World} refer to the vectors of determinants at the market, economy and world level, respectively. The variables in each of these categories are summarized in Table 1.

A Panel Model for Regional Market Integration

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

$$RMI_{i,t}=\mu+Z'_{i.t}\delta+\varepsilon_{i,t},$$

$$i=1,...,M; \quad t=1,...,T \quad (4)$$

where μ is the intercept term, δ is a vector of kx1 coefficients and $Z_{i.t}$ is a vector of kx1 independent variables across market i and period t. The vector of the independent variables is as follows:

$Z_{i.t}$ = *(MD, DYD,VOL, EXVOL, CRC, IFL, INT, TOP, RTI, WLQ, WVOL, IPG6, OILPC)′*

There are a total of 13 variables in the above model (defined in Table 1) and the vector of coefficients is given by

$$\delta_{ji} = (\delta_{1i}, \delta_{2i}, \delta_{3i}, \ldots, \delta_{13i})'.$$

We considered a number of panel models in this paper. Under the error components, specification with fixed cross-section and period effects in the error process, (4) can be written as:

$$RMI_{i,t}=\mu+Z'_{i.t}\delta+\eta_i+\xi_t+v_{i,t} \quad (5)$$

where η_i represents the cross-section effects, ξ_t captures the period effects and $v_{i,t}$ is the remainder disturbance effects. This model is referred to as a Two-Way Fixed Effects model henceforth. We also considered the random effects model, where both η_i and ξ_t are random error terms assuming a zero mean value and their variances are given by σ^2_{η} and σ^2_{ξ}, respectively. They are not directly observable and thus are a form of latent variables. In order to decide whether fixed effects exist, we conducted a simple *F* test. If the null hypothesis is rejected in favor of choosing the fixed effects model, the next step is to verify whether a random effects model is more superior. The specification test proposed by Hausman (1978) is used to test for orthogonality between the random effects and the independent variables.

In constructing the stacked panel data, we repeated the same time series for each cross-section observation *i*. As a result, the full model that included the fixed period effects together with world information variables suffered from singularity problem in estimation. Thus, we had to restrict our investigation on various panel models

Table 1. List of Variables for Stock Market Integration Model

Category	Determinant	Measure	Source
Market Attributes	Market Development	*MD* = 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 (1993, 1994, 1998), Bekaert and Harvey (1995, 2000), Fama and French (1998)
	Individual-Market Volatility	*VOL*= conditional volatility generated from an AR(1) process with GARCH(1,1) errors on log (P_t/P_{t-1})	Pindyck (1984), King and Wahwani (1990), Bollerslev et al. (1992)
Economic Fundamentals	Exchange Rate Volatility	*EXVOL* = 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	*CRC* = changes of log (international currency reserve)	Mohanty and Turner (2006)
	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)	-
	Trade Openness	*TOP* = total trade with the world / Nominal GDP	Bekaert and Harvey (1997, 2000), Carrieri et al. (2007)
	Regional Trade Intensity	*RTI* = total trade with bloc members / Total trade with the world	-
World Information	World Liquidity	*WLQ* = log [Turnover by volume]. Turnover in billion USD	Ferson and Harvey (1993, 1994, 1998), Bekaert et al. (2002), Gérard et al. (2003), Carrieri et al. (2007)
	World Volatility	*WVOL* = 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	*IPG6*= equal weighted log of industrial production of G6 countries	-
	Oil Price Changes	*OILPC*= log ($P_{oil,t}$ - $P_{oil,t-1}$) (month end crude oil price)	Chen et al. (1986), Hamao (1988), Ferson and Harvey (1994)

without the world information variables to allow the testing for the fixed and random period effects. In our restricted version of Model (5), the vector of the independent variables is reduced to:

$$Zi,t = (MD, DYD, VOL, EXVOL, CRC, IFL, INT, TOP, RTI)'$$

with a total of nine coefficients to be estimated, $\delta_{ji} = (\delta_{1i}, \delta_{2i}, \delta_{3i}, \ldots, \delta_{9i})'$.

We then estimated the unrestricted model using specific panel specifications, where the individual cross-section and time-period terms in Model (5) were excluded, and they were replaced with predetermined dummy variables in order to examine two different natures of cross-section and period effects, i.e. trading blocs and stock market crises, respectively. [1] The trading blocs included in this study were 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) (see data description below). The model is given by:

$$\begin{aligned} RMI_{i,t} = {} & \mu t + \delta_1 MD_{i,t} + \delta_2 DYD_{i,t} + \delta_3 VOL_{i,t} + \\ & \delta_4 EXVOL_{i,t} + \delta_5 CRC_{i,t} + \delta_6 IFL_{i,t} + \\ & \delta_7 INT_{i,t} + \delta_8 TOP_{i,t} + \delta_9 RTI_{i,t} + \\ & \delta_{10} WLQ_t + \delta_{11} WVOL_t + \delta_{12} IPG6_t + \\ & \delta_{13} OILPC_t + \delta_{14} D97_t + \delta_{15} D00_t + \\ & \delta_{16} DEFTA_i + \delta_{17} DNAFTA_i + \\ & \delta_{18} DCER_i + \delta_{19} DAFTA_{i,t} + \\ & v_{i,t}; \ \forall i \ \forall t \end{aligned} \quad (6)$$

Four dummy variables were added to examine whether market integration was

[1] These dummy variables are not considered in the earlier panel specifications because according to Baltagi (2002, p. 310) and Hsiao (2003, p.51), inclusion of additional time-invariant variables into panel models are subject to perfect multicollinearity problem that will wipe out the deviation from mean transformation.

related to economic cooperation in trading blocs. The dummies are $DEFTA_i$, $DNAFTA_i$, $DCER_i$, and $DAFTA_i$ to represent EFTA, NAFTA, CER and AFTA affiliations. The dummy was equal to one for members of the respective bloc and zero otherwise. EU is the benchmark group in this analysis.

In order to control for possible structural shift over the sample period of this study (1991 to 2005, see discussion below), we included two dummy variables to account for the impact of stock market crashes. The first dummy variable, *D*97, was set as one for the period of July 1997 to December 1998, and zero otherwise. This dummy aimed to capture the effect of the 1997 East Asian financial crisis and the 1998 Russian financial crisis on the 26 sample stock markets.[2] The second dummy variable, *D*00, was set as one for the period March 2000 to March 2003, and zero otherwise. The aim was to encompass the dot-com bubble crash, the post September-11 crash and the stock market downturn of 2002. Basically, these events occurred during the early 2000 economic downturn that was felt in the Western developed countries.[3] If the world stock market had become more segmented during these market crashes, the dummy variables would have been expected to have negative coefficients. The simultaneous collapse of the markets during the 1997 East Asian financial crisis implied convergence of risk-reward ratios. This suggests that segmentation could disappear during a market crash, which could possibly be due to the contagion effect that affected a group of markets.

Data Description

A total of 26 member countries of five notable trading blocs, namely EU, EFTA, NAFTA, CER and AFTA were examined in this study (see Table 2).[4] These blocs covered different level of economic integration among member countries.[5] The sample length of this study was from January 1991 to August 2005 and monthly data were employed. All the stock market indices were collected from Morgan Stanley Capital International (MSCI). In the computation of excess returns, the US Treasury bill rate downloaded from the website of the EconStats (www.econstats.com) was used as the proxy for the world risk free rate. The MSCI All Country World Index was used as the proxy for the world

[2] A generally accepted starting date for the East Asian financial crisis is July 1997, when Thailand floated its currency on 2 July and Kia Motors of South Korea suffered serious corporate crisis. As there is no consensus on when the East Asian crisis ended, we set the ending period that should sufficiently capture the market crashes of the East Asian emerging markets.

[3] The burst of the dot-com speculative bubble in March 2000 marked the beginning of a relatively mild yet lengthy bearish performance of the developed markets. The downturn started in EU during 2000 and 2001, while the US mostly in 2002 and 2003. The NASDAQ suffered its worst one-day and one-week losses in the history as a result of the terrorist attack in the September-11 event. The market rebounded but it crashed again in the late 2002 and reached a final low in mid-March 2003. The real rebound only took place after the second quarter of 2003 (see http://en.wikipedia.org/wiki/List_of_stock_market_crashes).

[4] Markets such as Japan, South Korea and Hong Kong were excluded because they were not attached to any established trading blocs during the entire sample period.

[5] As a monetary union, members of EU are expected to have the highest degree of integration. Members of NAFTA are also expected to be more integrated as the trading agreement covers a wide range of economic as well as financial cooperation. Although AFTA in principle endorsed the concept of an investment area through the 1995 ASEAN Summit, the bloc is expected to share a lower degree of market integration because AFTA's main areas of cooperation are in the real sectors, and countries in AFTA have competitive trade policies that may be of conflicting aims to bloc cooperation. Also the stock markets of its member countries are emerging markets (except Singapore), and they are especially vulnerable to external shocks. The level of integration of EFTA is expected to be similar to that of CER, as they both involve a small number of stock markets. Their level of integration is expected to be higher than that for AFTA.

portfolio. The variables used for exploring the determinants of regional equity integration were obtained from various sources. The data on market value, nominal GDP, dividend yield, USD exchange rate, CPI, interest rate, market liquidity (volume) were all collected from the DataStream database downloaded at the *Thomas J. Watson Library of Business and Economics*, Columbia Business School, Columbia University. The data on international currency reserve, CPI for Australia and New Zealand, and industrial production were downloaded from the International Financial Statistic (IFS) database in the same library. The trade data were extracted from the IMF Direction of Trade Statistics (DOTS) provided by the *Electronic Data Service* in the *Lehman Social Sciences Library*, School of International and Public Affairs, Columbia University. Crude oil prices were downloaded from the WTRG Economics website (wtrg@wtrg.com).

Result and Discussion

This section reports the results of the analysis.[6] In Table 3, the results of five panel unit root tests are reported. All the tests have a null hypothesis of a unit root. For most part of the result, the results do not indicate presence of unit roots. The null

Table 2. Selected Trading Blocks for the Study

Trading Block	Country	Stock Exchange
EU	Austria	Vienna Stock Exchange
	Belgium	Belgian Stock Exchange
	Denmark	Copenhagen Stock Exchange
	Finland	Helsinki Stock Exchange
	France	Bourse de Paris
	Germany	Deutsche Borse
	Greece	Athens Stock Exchange
	Ireland	Irish Stock Exchange
	Italy	Italian Stock Exchange
	Netherlands	Amsterdam Stock Exchange
	Portugal	Lisbon Stock Exchange
	Spain	Madrid Stock Exchange
	Sweden	Stockholm Stock Exchange
	United Kingdom	London Stock Exchange
EFTA	Norway	Oslo Stock Exchange
	Switzerland	Swiss Stock Exchange
NAFTA	Canada	Toronto Stock Exchange
	Mexico	Mexican Stock Exchange
	US	American Stock Exchange, Chicago Stock Exchange, NASDAQ, New York Stock Exchange
CER	Australia	Australia Stock Exchange
	New Zealand	New Zealand Stock Exchange
AFTA	Indonesia	Jakarta Stock Exchange
	Malaysia	Bursa Malaysia
	Philippines	Philippine Stock Exchange
	Singapore	Singapore Stock Exchange
	Thailand	Stock Exchange of Thailand

[6] The correlation coefficients between the variables were computed (available on request). Of the 91 pairwise correlation coefficients, only ten of them are higher than 0.1 in absolute value. The strongest correlation is found between market volatility and exchange rate volatility (coefficient of 0.35). Given these results, the extent of multicollinearity may not be serious in the estimations of the panel models.

hypothesis was rejected in at least three out of five tests for each variable. In general, the evidence suggests that all the panel series are I(0).

The restricted version of the panel model (5) was estimated and a series of hypotheses were tested with the *F* and Hausman tests in order to select an appropriate specification. The results are given in Table 4. The null hypothesis of absence of fixed effects was rejected in favour of either one-way cross section, one-way period or two-way fixed effects. Further testing provided evidence in support of the two-way fixed effects model. The fixed effects specification was then tested against the random effects model, and the two-way fixed effects model was preferred.

Both the restricted and unrestricted two-way fixed effects models were estimated and the results are reported in Table 5. In the unrestricted model, the trading-bloc and stock market crisis dummy variables given in equation (6) were introduced to replace the cross-section and period fixed effects, respectively. The White robust standard errors were also given in the table. The results of the restricted model suggest that only one market attribute and two economic fundamentals were statistically significant. These variables are market volatility, trade openness and regional trade intensity. These variables were also statistically significant in the unrestricted model. In addition, exchange rate volatility and interest rates were found to have significant positive impact on regional market integration. The magnitude of the coefficients of all these variables was fairly close in both models, except for the exchange rate volatility. None of the world information variables was statistically significant.

The findings that the individual-market volatility but not the world market

Table 3. Panel Unit Root Tests

	Null: Unit Root (assumes common unit root process)		Null: Unit Root (assumes individual unit root process)		
	Levin, Lin & Chu t	Breitung t	Im, Pesaran and Shin W	ADF-Fisher Chi-square	PP-Fisher Chi-square
RMI	-0.7436	2.1350	-3.6218	90.9972	90.4669
	(0.2286)	(0.9836)	(0.0001)***	(0.0007)***	(0.0008)***
MD	-67.4575	-45.4436	-59.7375	2122.3500	2225.0200
	(0.0000)***	(0.0000)***	(0.0000)***	(0.0000)***	(0.0000)***
DYD	-2.9675	-1.9254	-4.9924	117.2670	115.8340
	(0.0015)***	(0.0271)**	(0.0000)***	(0.0000)***	(0.0000)***
VOL	-11.6287	-3.5014	-20.1081	522.6270	542.3830
	(0.0000)***	(0.0002)***	(0.0000)***	(0.0000)***	(0.0000)***
EXVOL	-711.9540	2.0598	-356.6000	722.3550	981.4400
	(0.0000)***	(0.9803)	(0.0000)***	(0.0000)***	(0.0000)***
CRC	-69.3339	-25.2236	-63.6100	2187.1300	2414.6300
	(0.0000)***	(0.0000)***	(0.0000)***	(0.0000)***	(0.0000)***
IFL	-31.5769	-15.2384	-32.6414	1104.6200	2093.7900
	(0.0000)***	(0.0000)***	(0.0000)***	(0.0000)***	(0.0000)***
INT	-0.3085	-2.7741	-2.0273	75.0142	67.1057
	(0.3788)	(0.0028)***	(0.0213)**	(0.0200)**	(0.0775)*
TOP	-3.2950	-2.0430	-4.4346	95.6874	254.0900
	(0.0005)***	(0.0205)**	(0.0000)***	(0.0002)***	(0.0000)***
TRI	-5.0778	-5.7316	-8.9207	246.4950	663.7790
	(0.0000)***	(0.0000)***	(0.0000)***	(0.0000)***	(0.0000)***
WLQ	-70.5754	-35.6429	-61.7441	2241.1200	2798.5400
	(0.0000)***	(0.0000)***	(0.0000)***	(0.0000)***	(0.0000)***
WVOL	-4.5774	-5.2929	-9.6692	193.2820	193.2820
	(0.0000)***	(0.0000)***	(0.0000)***	(0.0000)***	(0.0000)***
IPG6	908.9420	-5.2628	-1.6791	47.3452	478.9380
	(1.0000)	(0.0000)***	(0.0466)**	(0.6572)	(0.0000)***
OILPC	-73.4133	-53.0760	-65.0747	2336.8400	2334.1800
	(0.0000)***	(0.0000)***	(0.0000)***	(0.0000)***	(0.0000)***

Note: Figures in parentheses are p-values. *, ** and *** denote significance at the 0.10, 0.05 and 0.01 levels, respectively. RSS is residual sum of squares. Test failed as the test variance (either cross-sectional or period) is invalid.

Table 4. Specification Tests for the Restricted Panel Regression

Hypothesis	Adjusted R^2	RSS	Chi-Sq	*F*
Panel A: F-Test for Fixed Effects				
H_0: Without Fixed Effects	0.1022	393.0818	1364.4528	63.2646
H_1: One-Way Cross-section Fixed Effects	0.3334	290.2292	(0.0000)***	(0.0000)***
H_0: Without Fixed Effects	0.1022	393.0818	322.7905	1.8669
H_1: One-Way Period Fixed Effects	0.1311	365.8614	(0.0000)***	(0.0000)***
H_0: Without Fixed Effects	0.1022	393.0818	1894.9952	11.4123
H_1: Two-Way Fixed Effects	0.3838	257.9383	(0.0000)***	(0.0000)***
H_0: One-Way Cross-section Fixed Effects	0.3334	290.2292	1572.2047	71.8153
H_1: Two-Way Fixed Effects	0.3838	257.9383	(0.0000)***	(0.0000)***
H_0: One-Way Period Fixed Effects	0.1311	365.8614	530.5424	3.1232
H_1: Two-Way Fixed Effects	0.3838	257.9383	(0.0000)***	(0.0000)***
Panel B: Hausman Test for Random Effects				
H_0: One-Way Cross-section Random Effects	0.0704	292.1379		13.3508
H_1: One-Way Cross-section Fixed Effects	0.3334	290.2292		(0.1474)
H_0: One-Way Period Random Effects	0.0929	384.9999		62.7735
H_1: One-Way Period Fixed Effects	0.1311	365.8614		(0.0000)***
H_0: Two-Way Random Effects	0.0503	277.0235		Failed[a]
H_1: Two-Way Cross-section Random Period Fixed Effects	0.1376	260.5001		
H_0: Two-Way Random Effects	0.0503	277.0235		Failed[a]
H_1: Two-Way Cross-section Fixed Period Random Effects	0.3342	275.0362		
H_0: Two-Way Random Effects	0.0503	277.0235		Failed[a]
H_1: Two-Way Fixed Effects	0.3838	257.9383		
H_0: Two-Way Cross-section Random Period Fixed Effects	0.1376	260.5001		26.6172
H_1: Two-Way Fixed Effects	0.3838	257.9383		(0.0016)***
H_0: Two-Way Cross-section Fixed Period Random Effects	0.3342	275.0362		121.4374
H_1: Two-Way Fixed Effects	0.3838	257.9383		(0.0000)***

Note: Figures in parentheses are standard errors. *, ** and *** denote significance at the 0.10, 0.05 and 0.01 levels, respectively. RSS is residual sum of squares.

volatility is significant are similar to those of Carrieri et al (2007). The integration of equity markets is exposed to individual market stability not to the world market volatility, suggesting the importance of market stability for convergence of regional risk pricing. While Carrieri et al. (2007) reported that market development has a positive impact on world market integration of eight emerging markets, we did not find similar evidence for regional equity market integration. Dividend yield differential was not significant either in determining regional equity market integration. Stability seemed to be the only significant factor in terms of market attributes.

Estimates from both the restricted and unrestricted models show that trade openness had a significant negative impact on regional equity market integration. This indicates openness to the rest of the world reduced synchronization of risk pricing with stock markets of trading bloc members. The integration of regional equity market into the world market was therefore expected to increase when the

Table 5. Pooled Regression Models

$$RMI_{i,t} = \mu t+\delta_1 MD_{i,t}+\delta_2 DYD_{i,t}+\delta_3 VOL_{i,t}+\delta_4 EXVOL_{i,t}+\delta_5 CRC_{i,t}+\delta_6 IFL_{i,t}+\delta_7 INT_{i,t}+\delta_8 TOP_{i,t}+\delta_9 RTI_{i,t}+\delta_{10} WLQ_t+\delta_{11} WVOL_t+\delta_{12} IPG6_t+\delta_{13} OILPC_t+\delta_{14} D97_t+\delta_{15} D00_t+\delta_{16} DEFTA_i+\delta_{17} DNAFTA_i+\delta_{18} DCER_i+\delta_{19} DAFTA_{i,t}+v_{i,t};\ \forall i\ \forall t$$

	Restricted		Unrestricted	
	-0.4767	(0.0758)***	-0.5015	(0.0371)***
δ_1 (MD)	0.0008	(0.0140)	0.0024	(0.0143)
δ_2 (DYD)	0.4969	(0.6006)	-0.2222	(0.5595)
δ_3 (VOL)	-0.0053	(0.0005)***	-0.0099	(0.0005)***
δ_4 (EXVOL)	-0.0042	(0.1291)	0.4789	(0.1488)***
δ_5 (CRC)	-0.0687	(0.0474)	-0.0519	(0.0548)
δ_6 (IFL)	0.0050	(0.0275)	-0.0114	(0.0301)
δ_7 (INT)	0.0159	(0.0113)	0.0693	(0.0069)***
δ_8 (TOP)	-0.2493	(0.0378)***	-0.0358	(0.0108)***
δ_9 (RTI)	0.4648	(0.1284)***	0.6359	(0.0436)***
δ_{10} (WLQ)			-0.0387	(0.0379)
δ_{11} (WVOL)			-0.0044	(0.0048)
δ_{12} (IPG6)			-0.0176	(0.0500)
δ_{13} (OILPC)			-0.0414	(0.0515)
δ_{14} (D97)			0.0506	(0.0126)***
δ_{15} (D00)			-0.0540	(0.0136)***
δ_{16} (DEFTA)			0.3662	(0.0245)***
δ_{17} (DNAFTA)			0.3603	(0.0300)**
δ_{18} (DCER)			0.3523	(0.0313)***
δ_{19} (DAFTA)			-0.0313	(0.0142)**
Adjusted R2	0.3838		0.1575	
RSS	257.9383		368.0419	

Note: Figures in parentheses are p-values. *, ** and *** denote significance at the 0.10, 0.05 and 0.01 levels, respectively. RSS is residual sum of squares. Test failed as the test variance (either cross-sectional or period) is invalid.

trade sector was more open. The estimate for the coefficient of trade openness was -0.25 from the restricted model while in the unrestricted model it dropped to -0.04. When more variables came into play, the impact of trade openness might have been diverted away.

The estimated coefficient for regional trade intensity was significantly positive with a fairly large magnitude compared to that of trade openness. As expected, its sign was opposite to that of trade openness. While trade openness reduced regional integration, the results show that regional equity markets were increasingly integrated with higher trade flows among the trading bloc members. This implies that the real sector linkages among trading bloc members led to higher integration in the equity markets. While it is common for countries to enter into trade agreements with the purpose of promoting trade among member countries, the impact on regional convergence could extend beyond the real sector.

Exchange rate volatility was significantly positive in the unrestricted model, while it was insignificant in the restricted model. The number of studies on the impact of exchange rate volatility on market integration was insufficient for us to make a comparison of the results. One possible explanation for the positive impact is that higher exchange rate volatility could have induced short-term capital flows into the stock market to take advantage of exchange rate changes, thereby promoting the flow of cross-border funds within the trading bloc and reduces the degree of regional equity market segmentation. In this case, higher exchange rate volatility might also imply accessibility to the regional markets.

The coefficient for interest rate is significantly positive in the unrestricted model. An interpretation is that higher domestic bond returns might attract capital inflows among regional investors. The increasing ease of market access as a result of trading bloc expansion indirectly promotes higher regional equity investment and integration. The other variables of macroeconomic fundamentals (currency reserve and inflation) did not seem to have any significant impact on regional equity market integration. None of the variables on world market information was significant. The insignificance of world market volatility was consistent with the results of Carrieri et al. (2007).

The dummy variables representing stock market crisis and trading-bloc affiliations introduced in the unrestricted model were all statistically significant. This provides further evidence in support of the two-way fixed effects. The East Asian financial crisis had a positive impact on the integration of the regional stock markets while the series of developed market crashes had a negative impact on the integration process. The positive impact of the East Asian financial crisis could be attributed to contagion effects that affected the region, particularly the markets of AFTA members. The crashes in developed markets might have led to integration of the world stock market, hence, reducing the integration of the regional equity markets.

The process of regional market integration is associated with the trading-bloc affiliations. The EU is the trading bloc of reference in the analysis. The magnitude of the coefficients suggests that the level of regional stock market integration of the EFTA, NAFTA and CER markets are higher than that of EU. The level of integration is the lowest among the AFTA markets. The level of market integration across trading blocs in descending order is as follows: EFTA, NAFTA, CER, EU and AFTA. The lower level of integration among stock markets in EU might be the large number of markets involved in the bloc. The convergence process may be relatively difficult to achieve in this case.

Conclusion

This study sheds light for understanding the fundamental driving forces behind equity market integration for the markets of five trading blocs. A regional market framework which includes information at the market, country and world level is explored to examine the contributing factors for regional equity market integration. This is an issue that is relatively unexplored in the literature on equity market integration, which has important implications for management of risks and stock market development.

The level of integration has direct bearing on the risk class of equity assets from different markets. If stock markets of member countries are not integrated within a trading bloc, this implies that risk premiums for assets of similar risk class may not be identical. For markets that are not integrated, international investors and country funds have the alternative to commit their investment in different markets within a bloc for diversification purposes. Further, a segmented stock market provides opportunities for acquiring equities with lower costs. In a broader perspective, the lack of full regional equity market integration within a trading bloc suggests rooms for improvement for the allocation efficiency of consumption and production among the member countries, and also the need for catching up in developing stock exchanges that are less efficient.

Our panel regression results show that market volatility, and variables on economic fundamentals have played a significant role in explaining the process of regional equity market integration.

While openness to world trade reduces integration, regional trade intensity has the opposite effects. The results suggest that trade cooperation as provided by trading-bloc agreements has a positive impact on regional convergence that extends beyond the real sector. The world level information, however, is of lesser concern. In short, we can conclude that the regional integration is driven by internal factors. The policy lesson is that market stability is important for the development of a stock market, as well as for integrating the market into the larger financial network within the region. Another policy implication is that the development of equity market cannot be seen in isolation of the development in the real sectors of an economy.

The integration process is found to experience significant shifts during stock market crises. Integration was significantly stronger during the 1997 Asian financial crisis, but weakened during the world recession in the early 2000s. The evidence indicates that a regional crisis would enhance integration, presumably due to the contagion effects. On the other hand, a crisis at the world market level reduces regional market integration. The regional focus could have been diverted to the world market in times of such crises. The results also highlight the differences in the level of regional equity market integration. Weaker convergence was found among the markets belonging to blocs with a higher number of member countries. This is a useful information for timing the market and for selecting equity markets for portfolio investments.

A few caveats remain in this study. First, the study is limited to five trading blocs covering 26 markets. A few potential trading blocs were excluded due to unavailability of a complete set of determinant variables (for example MERCOSUR and ANCOM). Some big markets, including those of Hong Kong, Japan, and Korea, were excluded because they were not notably part of any trade agreements during the sample period. Future studies could explore the link of integration within a trading bloc to these markets and the likes that often have significant influence on regional stock market movements. Second, the construction of the regional market integration index was based on the assumption that the international CAPM was the correct underlying pricing model. Other alternative measures for market integration could be considered. For example, Akdogan (1996) proposed to use the world beta, by taking the world systematic risks as the integration index. This was applied by Barari (2004). Another alternative measure for market integration is the stochastic discount factor proposed by Chen and Knez (1995), which was applied by Ayuso and Blanco (2001). Lastly, one might want to consider controlling for other factors such as market liberalization, capital flows and investment constraints (see Edison et al., 2002).

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