Market, Country and World Effects on Regional Equity Market Integration

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Abstract

This study explores the fundamental driving forces of regional equity market integration. The determinant factors are being 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 regional equity integration 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 regional markets became strongly integrated after a regional crisis, but integration is significantly weakened during a crisis that affected the world markets. Also, the level of regional 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*

JEL classification: F36, G15

1. 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 has 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 does it contribute to globalization and welfare benefits of the regional economic development (see for example, Bhagwati 1993 and Frankel et al. 1995). While much of the empirical evaluation on the impact

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of economic regionalism has focused on the terms of trade, recently the scope of research has moved beyond the real sector to financial sector. For example, Langhammer (1995) investigated the flows of portfolio capital in the presence of regionalism while Blomström and Kokko (1997) studied the impact of regionalism on foreign direct investment flow. Despite the move of research focus to the financial sector, only a few studies have directly examined the impact of economic and trade regionalism on the equity market integration.

At the empirical front, Heaney et al. (2000) explored the similarities of 26 emerging equity markets through a cluster analysis. Based on their dendogram analysis, i.e. the ranking of markets according to their strength of fusion, they concluded that most of the markets form 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. Their results are further supported by Heaney and Hooper (2001) who applied the same techniques on 34 markets, comprising 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. Greater policy coordination and market liberalization in the Association of Southeast Asian Nations (ASEAN) has led to convergence in the regional rates of return. 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 are 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 is the regulatory co-operative agreements initiated by stock exchanges within these regions (see for example Hooper, 2002).

At the same time, the nature of economic integration has been broadening. There are initiatives taken to deepen the integration of regional financial sector. For example, the North American Free Trade Agreement (NAFTA) has called for free and quick transfer of all payments relating to equity transactions including dividends, interest and capital gains among members (article 1109), while the 1995 ASEAN Summit has endorsed in principle the concept of an investment area to lower and remove barriers to intra-regional investment among members of the ASEAN Free Trade Area, or AFTA (see http://www.aseansec.org/home.htm).

Many studies have focused on the issue of equity market integration within a trading bloc. Among others, the blocs that have been examined are 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 effect 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 regional market integration for understanding equity market regionalism. Given the exploratory nature of this study, we try to encompass as many determinant variables as possible. The existing empirical literature on market integration and stock return pricing provides guidance on what the potential determinants are. Using panel regressions, we document evidence that regional equity market integration is driven by forces representing market attributes and economic fundamentals, and the process has been affected by financial crises. The integration behaviour differs across trading blocs.

The rest of this paper is divided into the following sections. Section 2 provides a brief review of the literature on market linkages and integration. Section 3 explains the methodology and data used in our analysis. Empirical results are reported in Section 4. The final section concludes the study and states the direction for future research.

2. MARKET LINKAGES AND INTEGRATION

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 (see for example, Eun and Shim 1989). This finding is basically consistent with the structure of time zone differences between the interrelated markets. Another finding is that the correlation pattern may reflect the degree of economic integration between countries (see for example, Rahman and Yung 1994). In another vein, empirical works on time-varying correlation and covariance find that macroeconomic fundamentals contribute to explaining market linkages (Campbell and Mei 1993, Longin and Solnik 1995, Ammer and Mei 1996, Karolyi and Stulz 1996, Dickinson 2000), but a recent view is that contagion effects might have played a role in the changes of market co-movement over time (Karolyi 2003).

Besides correlation, there are studies using other approaches to measure market linkages and co-movement. For example, Bracker et al. (1999) reported that macroeconomic variables have 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 can 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) appears to be the only important factor for explaining cross-section market linkages with the large economies. Trade competition, bank lending and foreign investment have no significant effect.

These studies provide a general picture on the driving forces of market linkages. However, as market return correlations and linkages reflect only ex-post causality, these studies are limited to weak tests for market integration, but the process of market integration is not captured. Adler and Dumas (1983, p.964) pointed out that correlation between markets depends heavily on the specialization of international trade of the individual economy. As a result, market co-movement reflects only sectoral linkages instead of market integration. This argument implies that the study on stock market integration cannot be based on co-movement of stock returns alone. A test for market integration needs to be built on asset pricing model, which offers an ex-ante framework (see also Bekaert and Harvey 1995, p.403).

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) employed monthly data from January 1977 to December 2000 for eight emerging markets, namely Argentina, Brazil, Chile, India, Korea, Mexico, Taiwan and Thailand. In their paper, market integration is calculated from systematic risk and a pooled regression with only four explanatory variables was applied. Their findings show that financial development and market liberalization have a positive impact on market integration, but the effects of trade openness and world market volatility are not significant.

The present paper extends the study of Carrieri et al. (2007) to search for the causes of equity market integration in the realm of regionalism. We cover a large number of equity markets, use a different measure for market integration, and explore a wider coverage of explanatory factors to enrich the framework for understanding determinants of market integration. Besides economic fundamentals like financial development and trade openness, we also look into market-specific factors, as well as world level information to extend the scope of study. Drawing insight from the literature on market linkages and pricing of stock return, we construct a list of 18 explanatory variables, which can be categorized into three groups of fundamental forces – market attributes, macroeconomic fundamentals and world information. In addition, we also control for several potential structural breaks and trading-bloc effects. Further details are discussed in the following section.

3. METHODOLOGY AND DATA

3.1 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:

$$RI = f\left(Z_{Market}, Z_{Economy}, Z_{World} \right) \tag{1}$$

where RI 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 information set at each level captures the influence of each unique environment in driving the aggregate behavior of firms listed in the stock market, which in turn determines the degree of integration with the world market over time. The distinct roles of market, economic and world fundamentals in the integration process can then be assessed. Drawing from empirical evidence in the recent literature, thirteen variables are selected as possible determinants within the three categories mentioned above. These variables are summarized in Table 1.

Insert Table 1 about here

Market Attributes

Three market attribute variables are included, namely market development, market performance and market volatility. Market development is one of the most popular information variables applied in the test for market integration within the framework of conditional asset pricing (see Bekaert et al. 2002 and Carrieri et al., 2007). Better developed markets logically attract higher international portfolio investment capital inflows. Moreover, it is found that stock market development is positively correlated with capital mobility and risk diversification (Levine and Zervos, 1996).

We employ dividend yield differential (local market relative to the world dividend yield) to gauge how the relative performance of an individual market relative to the world affects regional equity market integration. Dividend yield has been an important factor in the pricing of the international equity risk premium (see Fama and French, 1998), and a popular instrument in international conditional asset pricing models (see Ferson and Harvey, 1993, 1994, 1998; and Bekaert and Harvey, 1995). Bekaert and Harvey (2000) showed that dividend yield is a predictor for integration of emerging equity markets. If the dividend yield differential is significant, we can expect more segmentation among the equity markets.

In modern finance, the “volatility feedback” effect has been very popular in explaining movements in stock returns (see Bollerslev et al., 1992). Many argued that market volatility is responsible for price declines in bearish markets. The oil crises in the 1970s (Pindyck, 1984) and the 1987 US stock market crash (King and Wahwani, 1990) are two episodes where the negative impact of high volatility on the global stock market is witnessed. Thus we expect market volatility to be an important determinant of market integration, especially over time.

Economic Fundamentals

An immense amount of evidence shows that stock prices are affected by economic fundamentals (see for example, Chen et al., 1986). Thus, we consider two stability indicators, two price indicators and two international trade variables as measures of economic fundamentals. Equity securities are backed by the production of the economy. Sound economic performance and stability in economic fundamentals bodes better prospect for listed firms to expand their business, generates positive market sentiments and promotes investors’ confidence. A commonly accepted indicator for economic instability is exchange rate volatility. The exchange rate dynamics affect a firm’s net balance sheet position and indirectly affect the aggregate demand through the cost of traded inputs, or the price of competing imported goods (see Jorion, 1991). Exchange rate volatility is also important in tests of asset pricing models for market integration (see De Santis and Gerard, 1998; and Ng, 2004). Another indicator for economic stability is changes in international currency reserves. This variable has often been referred to as an indicator of the economy's ability to finance international trade. A large currency reserve accumulation is often associated with strong financing conditions and rapid growth in equity prices (Mohanty and Turner, 2006).

Inflation and interest rates have direct effects on the level of consumption and investment costs, hence the expected cash flow of the listed firms. Boyd et al. (2001) argued that high inflation rates exacerbate financial market frictions, interfere with the efficiency of the financial system and thus inhibit long-run growth. On the other hand, interest rates represent the return on alternative assets to equities and they are the discount rates used in the valuation of stock returns. Thus, higher interest rates may work against stock market integration as they distract capital from equity to bond market.

Bekaert and Harvey (1997, p.38) pointed out that trade openness induces correlation between consumption and business cycle, leading to pricing of assets that reflects high risks. Bekaert and Harvey (2000) found trade openness to have a negative impact on dividend yield but a positive effect on GDP growth. They argued that trade openness contributes positively to market integration. Carrieri et al. (2007) reported a negative but insignificant effect of trade openness on market integration. The integration of the real sector due to trading bloc agreements might also lead to a higher level of regional equity market integration. WTO and APEC are of the opinion that regionalism will ultimately lead to globalization.[1] Thus, the impact of regionalism (increase in intra-region trade) on equity market integration will depend on the level and scale of the economic integration involved within a trading bloc. The regional trade intensity would therefore have to be considered.

World Market Information

The variables reflecting world market information include world market liquidity, world price volatility, industrial production and oil price changes. The first two variables are commonly applied in the literature on conditional asset pricing (see Ferson and Harvey, 1993, 1994, 1998; Bekaert et al., 2002; and Gérard et al., 2003). Higher world market liquidity means better market performance and international investment flow. World market volatility is a proxy for the degree of global market uncertainty, although Carrieri et al. (2007) found that it has an insignificant impact on market integration in emerging markets. No countries can be exempted from the effects of world business cycle. The proxy for business cycle used in this study is the industrial production (of industrialized countries) and changes in crude oil price. The industrial production of G6 is used instead of G7 due to incomplete data series for Canada. Chen et al. (1986) used oil price change as a measure of economic risk for the US market. The variable is also applied by Hamao (1988) and Ferson and Harvey (1994). To a large extent, this variable serves to indicate global inflation pressure.

[1] Bhagwati (1993) and Frankel et al. (1995) argued that the recent trade regionalism is more likely to work against globalization. However, WTO and APEC believe that regionalism provides a complementary process to the multilateral trade system as long as open regionalism is promoted, i.e. barriers on trades with non-bloc members are not increased (see GATT Article XXIV).

3.2 Measuring Regional Market Integration

From the asset pricing point of view, a test on market integration is commonly referred to as a the test 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 and Harvey, 1995; and Bekaert et al., 2002). According to Korajczyk (1996), perfect market integration can be achieved when there is no pricing error in benchmarking market indices to the world portfolio, or to a list of common risk factors under an equilibrium capital asset pricing model. From the view of market efficiency, the process of world market integration is a reflection of improvement in the information efficiency process that reduces pricing errors across borders. The pricing errors that segment the markets could be due to investment barriers, home preference biases for choice of investment, limitation in cross-border arbitrage, or even institutional inefficiency. Thus, in searching for possible determinants on how a market could differ with another in achieving pricing efficiency, it is the information set to the asset pricing process that matters.

To capture the time varying behavior of regional market integration, an integration index, RMI_{it} (regional market integration index) is constructed for every market *i*. Following the spirit of the market integration measure proposed by Korajczyk (1996) and Levine and Zervos (1998), we estimate the pricing error from a Trading-Bloc CAPM (TBCAPM henceforth), which is based on the work of Akdogan (1992) and Adler and Qi (2003) for the pricing of trading bloc portfolios. TBCAPM can be written in the following specification:

$$R_{i,t} - R_{F,t} = \alpha_i + \beta_i (R_{TB,t} - R_{F,t}) + \varepsilon_{i,t}; \quad \forall t \qquad (2)$$

where $R_{i,t}$ and $R_{TB,t}$ are returns for the market portfolio and the trading-bloc portfolio, respectively, and $R_{F,t}$ is the international risk free rate. The trading bloc portfolio for market *i* is a weighted portfolio of equity returns computed from the market capitalization of stock markets of the other member countries. In other words, the returns of market *i* are not included in the computation of its trading-bloc portfolio returns.

The pricing error α_i shows deviation from the state of perfect regional market integration. To obtain a time-series estimates for the market integration index, a 5-year rolling regression is implemented. Equation (2) is estimated with a fixed window of 5 years of monthly observations and the collected time-varying pricing errors are adjusted to construct the regional market integration index (*RMI*) following the suggestion of Levine and Zervos (1998), as below:

$$RMI_{i,t} = -\left|\hat{\alpha}_{i,t}\right| \qquad (3)$$

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.

3.3 A Panel Model for Regional Market Integration

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

$$RMI_{i,t} = \mu + Z'_{i,t}\delta + \varepsilon_{i,t}, \qquad i = 1,...,M; \qquad t = 1,...,T \qquad (4)$$

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:

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

We consider 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:

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

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 consider 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_η^2 and σ_ξ^2, respectively. They are not directly observable and thus are a form of latent variables. In order to decide whether fixed effects exist, a simple F test is conducted. 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, the same time series are repeated for each cross-section observation i. As a result, the full model that includes the fixed period effects together with world information variables suffer from singularity problem in estimation. Thus, we have to restrict our investigation on various panel models 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:

$$Z_{i,t} = (MD, DYD, VOL, EXVOL, CRC, IFL, INT, TOP, RTI)'$$

with a total of nine coefficients to be estimated:

$$\delta_{ji} = \left(\delta_{1i}, \delta_{2i}, \delta_{3i} ..., \delta_{9i}\right)'$$

We then estimate the unrestricted model using specific panel specifications, where the individual cross-section and time-period terms in Model (5) are excluded, and they are 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. [2] The trading blocs included in this study are EU (European Union), EFTA (European Free Trade Agreement), NAFTA (North American Free Trade Agreement), CER (Australia-New Zealand

[2] 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.

Closer Economic Relations), and AFTA (Association of South-East Asia Nations (ASEAN) Free Trade Areas) (see data description below). The model is given by:

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

Four dummy variables are added to examine whether market integration is related to economic cooperation in trading blocs. The dummies are $DEFTA_t$, $DNAFTA_i$, $DCER_i$ and $DAFTA_i$, to represent EFTA, NAFTA, CER and AFTA affiliations. The dummy is 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), two dummy variables are included to account for the impact of stock market crashes. The first dummy variable, $D97$, is set as one for the period of July 1997 to December 1998, and zero otherwise. This dummy aims to capture the effect of the 1997 East Asian financial crisis and the 1998 Russian financial crisis on the 26 sample stock markets.[3] The second dummy variable, $D00$, is set as one for the period March 2000 to March 2003, and zero otherwise. The aim is 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.[4] If the world stock market becomes more segmented during these market crashes, the dummy variables are expected to have negative coefficients. The simultaneous collapse of the markets during the 1997 East Asian financial crisis implies convergence of risk-reward ratios. This suggests that segmentation can disappear during a market crash, which could possibly due to the contagion effect that affects a group of markets.

3.4 Data Description

A total of 26 stock markets of the member countries of five notable trading blocs, namely EU, EFTA, NAFTA, CER and AFTA are examined in this study.[5] They cover different levels of bloc integration among member countries. As a monetary union, members of EU are expected

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[3] 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.

[4] 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).

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

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 has endorsed in principle the concept of an investment area through the 1995 ASEAN Summit, the bloc is expected to share a lower degree of market integration due to two reasons. First, AFTA's main areas of cooperation are in the real sectors. In addition, countries in AFTA have competitive trade policies that may be of conflicting aims to bloc cooperation. Second, 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 in our case, they both involved only two stock markets. The level of integration within these blocs is expected to be higher than that for AFTA. However, it is unclear relative to EU and NAFTA, as their level of integration may be higher given the smaller size of the bloc, or lower due to the difference in pricing efficiency.

The sample length of this study is from January 1991 to August 2005 and monthly data are employed. All the stock market indices are 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) is used as the proxy for the world risk free rate. The MSCI All Country World Index is used as the proxy for the world portfolio.

The variables used for exploring the determinants of regional equity integration are obtained from various sources. The data on market value, nominal GDP, dividend yield, USD exchange rate, CPI, interest rate, market liquidity (volume) are 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 are downloaded from the International Financial Statistic (IFS) database in the same library. The trade data are 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 are downloaded from the WTRG Economics website (wtrg@wtrg.com).

4. RESULTS AND DISCUSSION

This section reports the results of the preliminary analysis and panel models. Some discussions are also provided.

4.1 Preliminary Analysis and Tests

The summary statistics for all the panel variables are reported in Table 2. The mean value for the market integration index is -0.4307 with a standard deviation of 0.3125, indicating a big variation in the level of integration across the individual markets. All the three volatility series (market volatility, exchange rate volatility and world market volatility) are conditional volatilities generated through modeling the GARCH process inherent in these series. It is worth noting that the volatility of the returns of individual markets are higher than those for the world market. The average regional trade intensity suggests that intra-bloc trade constitutes about half of the total trade. A mild increase in the crude oil price is experienced during the period of analysis.

Insert Table 2 about here

Table 3 reports the correlation matrix of the panel variables. The coefficients suggest low correlation among the panel series. Of the 91 pairwise correlation coefficients, only ten of them are higher than 0.1. The strongest correlation is found between market volatility and exchange rate volatility. Given these results, the extent of multicollinearity may not be serious in the estimations of the panel models.

Insert Table 3 about here

In Table 4, 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 hypothesis is 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).

Insert Table 4 about here

4.2 Estimated Results for the Panel Models

The restricted version of the panel model (5) is estimated and a series of hypotheses are tested with the *F* and Hausman tests in order to select an appropriate specification. The null and alternative hypotheses are stated in Panel A of Table 5. The null hypothesis of absence of fixed effects is rejected in favour of either one-way cross section, one-way period or two-way fixed effects. Further testing provides evidence in support of the two-way fixed effects model. The fixed effects specification is then tested against the random effects model. The results are in panel B of Table 5. We see that the two-way fixed effects setting is preferred to the random effect model. The random effects models perform poorly in terms of fit. The two-way fixed effect model has the highest adjusted R^2. Both the restricted and unrestricted two-way fixed effects models are estimated and the results are reported in Table 6. In the unrestricted model, the trading-bloc and stock market crisis dummy variables given in equation (6) are introduced to replace the cross-section and period fixed effects, respectively. The White robust standard errors are also given in the table.

Insert Table 5 about here

Insert Table 6 about here

The results of the restricted model suggest that only one market attribute and two economic fundamentals are statistically significant. These variables are market volatility, trade openness and regional trade intensity. These variables are also statistically significant in the unrestricted model. In addition, exchange rate volatility and interest rates are found to have significant positive impact on regional market integration. The magnitude of the coefficients of all these variables is fairly close in both models, except for the exchange rate volatility. None of the world information variables is statistically significant.

The findings that the individual-market volatility is significant but not the world market volatility are similar to those of Carrieri et al (2007). The integration of equity markets is exposed to individual market stability instead of 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 do not find similar evidence for regional equity market integration. Dividend yield differential is also not significant in determining regional equity market integration. Stability seems to be the only significant factor in terms of market attributes.

Estimates from both the restricted and unrestricted models show that trade openness has a significant negative impact on regional equity market integration. This indicates openness to the rest of the world reduces synchronization of risk pricing with stock markets of trading bloc members. The integration of regional equity market into the world market is therefore expected to increase when the trade sector is more open. The estimate for the coefficient of trade openness is -0.25 from the restricted model while in the unrestricted model it drops to -0.04. When more variables come into play, the impact of trade openness might have been diverted away.

The estimated coefficient for regional trade intensity is significantly positive with a fairly large magnitude compared to that of trade openness. As expected, its sign is opposite to that of trade openness. While trade openness reduces regional integration, the results show that regional equity markets are increasingly integrated with higher trade flows among the trading bloc members. This implies that the real sector linkages among trading bloc members lead 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 is significantly positive in the unrestricted model, while insignificant in the restricted model. There is a lack of study on the impact of exchange rate volatility on market integration 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 may attract capital inflows among regional investors. With the increasing ease of market access as a result of trading bloc expansion, this indirectly promotes higher regional equity investment and integration. The other variables of macroeconomic fundamentals (currency reserve and inflation) do not seem to have any significant impact on regional equity market integration.

None of the variables on world market information is significant. The insignificance of world market volatility is 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 are all statistically significant. This provides further evidence in support of the two-way fixed effects. The East Asian financial crisis has a positive impact on the integration of the regional stock markets while the series of developed market crashes have 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, in particularly the markets of AFTA members. The crashes in developed markets might have led to integration of the world stock market, and hence reducing 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.

5. CONCLUSION

This study sheds light for understanding the fundamental driving forces behind regional equity market integration for markets of five trading blocs. 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. A regional market framework which includes information at the market, country and world level is explored for examining the contributing factors for regional equity market integration.

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 for 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. In addition, the integration process is found to experience significant shifts during stock market crises. Integration is 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 that the difference in the level of regional equity market integration, with weaker convergence among the markets of the blocs with a higher number of member countries.

A few caveats remain in this study. First, the study is limited to five trading blocs covering 26 markets. A few potential trading blocs are 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, are excluded because they were not notably part of any trade agreements during the sample period. Second, the construction of the regional market integration index is based on the assumption that the international CAPM is the correct underlying pricing model. Other alternative measures for market integration can be considered. For example, Akdogan (1996) proposed to use the world beta, by taking the world systematic risks as the integration index. This has been applied by Barari (2004). Another alternative measure for market integration is the stochastic discount factor proposed by Chen and Knez (1995), which is 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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Table1 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	$IFL = (CPI_t\text{-}CPI_{t-1})/CPI_{t-1}$	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)

Table 2 Summary Statistics for All Panel Series

Variables	Mean	Standard Deviation	Maximum	Minimum	Skewness	Kurtosis	Jarque-Bera Normality Test
RMI	-0.4307	0.3125	-0.0003	-2.2792	-1.6070	7.4040	5603.0740***
MD	0.0134	0.2993	4.1126	-3.1459	-0.3408	27.1705	109578.2000***
DYD	0.0045	0.0094	0.0474	-0.0218	0.7394	4.1026	637.6730***
VOL	10.3581	11.9855	162.7204	0.9547	4.8154	36.9180	232993.3000***
EXVOL	0.0018	0.0245	1.4461	0.0000	48.5344	2745.1190	1.41×10^{9}***
CRC	0.0013	0.0753	0.7892	-0.7876	-1.0677	25.6977	97409.2700***
IFL	0.0025	0.1239	3.3214	-4.9412	-7.6977	805.7831	1.21×10^{8}***
INT	-2.9967	0.7630	-0.1076	-6.9078	-0.3725	4.8837	769.0598***
TOP	0.2626	0.4296	2.4166	0.0000	2.6720	9.8658	14186.9900***
RTI	0.4551	0.2583	0.8374	0.0000	-0.4366	1.7004	459.4623***
WLQ	0.0057	0.1350	0.3807	-1.0301	-2.5548	22.1772	73818.4500***
WVOL	3.0612	1.1210	6.3135	1.5295	0.9004	3.1047	609.8686***
IPG6	-0.0004	0.0890	0.2385	-0.2175	0.3185	4.7871	674.5993***
OILPC	0.0066	0.0857	0.2591	-0.2005	-0.0529	2.8195	8.2022**

Note: ** and *** denote significance at the 0.05 and 0.01 levels, respectively.

Table 3 Correlation Matrix for All Panel Series

	RMI	MD	DYD	VOL	VEX	CRC	IFL	INT	TO	TR	WLQ	WVOL	IPG6
RMI	1.0000												
MD	0.0006	1.0000											
DYD	0.0500	-0.0253	1.0000										
VOL	-0.2435	-0.0273	-0.0424	1.0000									
VEX	-0.0571	-0.0011	0.0018	0.3489	1.0000								
CRC	-0.0052	0.0682	-0.0261	0.0312	-0.0130	1.0000							
IFL	-0.0100	-0.0006	-0.0036	0.0224	0.0199	-0.0138	1.0000						
INT	0.1064	-0.0409	0.0401	0.3442	0.1151	0.0605	0.0176	1.0000					
TO	0.0029	0.0480	-0.0129	-0.1290	-0.0253	0.0051	-0.0053	-0.3022	1.0000				
TR	0.1012	-0.0142	0.0096	-0.1931	-0.0480	-0.0416	0.0068	0.0371	-0.0489	1.0000			
WLQ	-0.0224	0.0883	0.0061	0.0235	0.0099	0.0043	0.0066	0.0325	0.0001	0.0006	1.0000		
WVOL	-0.1395	0.0090	0.0612	0.2219	0.0227	-0.0441	-0.0041	-0.0945	-0.0642	0.0048	0.0663	1.0000	
IPG6	-0.0097	-0.0141	0.0027	0.0183	0.0014	0.0124	0.0124	0.0017	0.0141	0.0143	0.1730	0.0265	1.0000
OILPC	-0.0201	-0.0123	-0.0104	-0.0212	-0.0261	-0.0032	0.0225	-0.0745	0.0009	0.0078	-0.0474	0.0192	0.0461

Table 4 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 the 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 testing equations with intercept, except for the interest rate equation that includes individual trend and intercept.

Table 5 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 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 6 Pooled Regression Models

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

	Restricted		Unrestricted	
μ	-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 standard errors. *, ** and *** denote significance at the 0.10, 0.05 and 0.01 levels, respectively. RSS is residual sum of squares.