Commonalities between financial and market integration and equity return co-movements in emerging and frontier markets

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Abstract

International investors rely mainly on the interrelationship among stock returns for effective portfolio diversification. However, correlation values between equity return is only an indication of such underlying interconnectedness. Therefore, this study aims to measure the extent of variation that different factors i.e. market integration, financial integration, inflation and GDP growth trade differential between two countries produces in their securities returns' co-movement. Our results highlight the presence of short as well as long run relationship of financial integration and inflation rate differential with stock returns co-movement between Pakistan and other sampled Asian emerging and frontier countries. Our results have implications for individual and institutional investors for formulating portfolio based on these determinants rather than relying solely on correlation values.

Keywords:

Return co-movements, Stock market fundamentals, Emerging and frontier markets.

JEL classification:

G10, G11, F65.

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Comunalidades entre la integración financiera y de mercado y el comovimiento de los rendimientos financieros en los **mercados fronterizos y emergentes**

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Resumen

Los inversores internacionales confían fundamentalmente en la interrelación entre los rendimientos bursátiles a la hora de configurar carteras con una diversificación efectiva. Sin embargo, la correlación entre dichos rendimientos es solo una indicación de la interconexión subyacente. Este artículo tiene como objetivo medir el nivel de variabilidad que diferentes factores, por ejemplo, la integración del mercado, la integración financiera, los diferenciales de inflación y crecimiento del PIB entre dos provocan en el comovimiento de sus rendimientos bursátiles. Nuestros resultados ponen de manifiesto una relación, tanto a corto como a largo plazo, de la integración financiera a corto y largo plazo y del diferencial de tasas de inflación con el movimiento conjunto de los rendimientos bursátiles en Pakistán y otros países asiáticos emergentes y fronterizos asiáticos considerados en el estudio. Estos resultados tienen implicaciones tanto para los inversores, tanto individuales como institucionales, a la hora de construir carteras basadas en estos determinantes en lugar de confiar únicamente en los valores de correlación.

Palabras clave:

Comovimiento en rendimientos, fundamentales del Mercado de Valores, mercados emergentes y fronterizos.

■ 1. Introduction

Interconnectedness among international equity market returns is important because of its implications for asset allocation and risk mitigation. An earlier proposal by Markowitz (1952) followed by the contribution of Grubel (1968) gained much importance in international equity portfolio diversification. This international equity market connectedness in the form of returns co-movement is reported increasing in general and in developed stock markets in particular since mid-1990s.

Interrelationship between international stock markets has gained special attention by researchers, theorists, and finance practitioners in general and particularly after the advent of financial crisis in 2008-09. According to Wang (2014), financial crisis of 2008-09 had adverse effect (since 1930's great depression) which was further triggered by the fall of Lehman Brothers. This crisis had effects on the market efficiency types i.e. developed, emerging and frontier markets.

The resulting financial uncertainty and instability also led subsequent crises and turmoil mainly including the London movement, the Eurozone crisis and public reactions in Turkey, Greece, Egypt and Italy. Events of such nature and magnitude questioned the way through which fundamental of equity market co-movements needs to be analyzed. All these events followed by financial uncertainty and disturbances raised many concerns in terms of the determinants of international equity market co-movements, particularly in terms of the stability and underlying commonality. Moreover, it became apparent that co-movements of asset price fundamentals can only provide important information on simultaneous deterioration of wealth in larger group of countries (Uygur and Tas, 2014).

With a significant increase in levels of market and financial integration among frontier, emerging, developed markets, diversification benefits become difficult in any for mof market i.e. only developed, emerging and/or frontier. According to many past researchers (i.e. Bekaert *et al.*, 2014; Carrieri *et al.*, 2007 and Christoffersen *et al.*, 2012) emerging equity markets are arranged as segments compared to their developed financial market counterpart due to similarity in their size, location and institutional structure.

Existing literature focuses on exploring the relationship mainly among developed stock markets however, finding factors responsible for such co-movements between international stock markets and then predicting the future returns based on such correlations has been rarely worked on. Therefore, we aim to find the effect of variables like financial integration, market integration, inflation rate differential and GDP growth rate differential on bilateral equity market co-movements.

Our study is significant in providing basis of formulating a diversified portfolio by considering the role of market and macro-economic variables as determinants of international equity returns co-movement. The construction of an optimal portfolio depends not only on the bilateral stock return co-movement but also on some underlying processes. These interlinked processes affect not only bilateral equity co-movements but are also sensitive to them and therefore transmit and trigger stock return turbulence. Walti (2011) also propose macro-economic and financial integration variables that determine stock market co-movements along with determinants of time varying correlation among participating countries equity returns.

Our focus is to determine important factors having influence on bilateral equity market co-movement in emerging and frontier Asian equity markets which are at different levels of market efficiency. Although there are other emerging and frontier markets beside Asian region, we have selected Asian emerging and frontier markets for our study as very few studies have segregated Asian equity markets between emerging and frontier levels. Therefore, by selecting these Asian markets, we aim to contribute towards filling the gap in current literature.

Therefore, this paper investigates commonality and stability of underlying determinants among emerging and frontier equity markets. Another contribution of our study is the examination of associated reasons of stock return co-movement between frontier and emerging stock markets that has rarely been done in the past.

Therefore, our first contribution in this paper is to estimate bilateral international equity market co-movement based on time varying parameter model and differentiating time varying co-movement from traditional unconditional correlation. Second, we identify different bilateral macro-economic, market and financial variables and then determine their impact on bilateral equity return co-movement. Third, our paper contributes by including emerging and frontier sample markets from Asia as per Morgan Stanley Capital International (MSCI) that has been rarely done for determining factors for bilateral return co-movement. Results of our study present significant role of inflation rates differential and financial integration on bilateral stock market co-movement. Furthermore, financial integration and GDP growth rate induce variations in bilateral stock market co-movement not only in long but also in short run.

The structure of this paper is as follows. Section 2 entails review of relevant literature. Section 3 introduces estimation techniques. Section 4 presents data, operationalization of variables and data analysis. Section 5 concludes the study with implications for researchers and practitioners.

■ 2. Review of literature

International equity return correlation is like an interconnected time varying process with synchronization between them. Developed equity markets show greater integration than the emerging equity markets; however we witness synchronization among all the markets after experiencing fluctuations. According to Liu and Tse (2012), this behavior is more obvious in frontier markets. At one end, correlation among stock returns behaves as a proxy for shocks to aggregate stocks. This is because of the reason that the risk cost of correlation signifies investor concerns about the economic and financial uncertainties. Other than that, the same correlation risk portrays implications of portfolio diversification by implying that investors are concerned about these return co-movements. By analyzing correlation risk and the resultant price implications, investors can distinguish between the pure portfolio based and economic based factors. Higher return correlation values between assets have two dimensions. One is the presence of large exposure of risk to investors portfolio (that is implying low diversification benefits), other is demand for risk premium by investors (i.e. for more risk) thus resulting in negative correlation for risk price (Zheng and Yiwei, 2012).

Current literature on international equity market cointegration suggests that there can be many variables having important role in explaining such co-integration. Jeon and Chiang (1991) highlight strong economic ties, market deregulation and liberalization, policy coordination, contagion effects and financial crises as strong determinants of equity market integration and interconnectedness. Co-movements between two specific stock markets may have some strong momentary reasons. Moreover, simply noting the presence of co-movements does not guarantee long term dependence and therefore identifying plausible reasons for such co-movements becomes useful in understanding equity market dynamics. Chi (2006) reported positive correlation of Taiwan equity returns with the developed markets of US, Japan and Hong Kong. Further investigation in Taiwanese equity returns indicates short term relationship with US and diminishing effect with the Hong Kong equity returns.

Existing literature identifies some plausible factors behind international equity returns co-movement. Among others, these factors include trade intensity (Forbes and Chinn, 2004), synchronization of business cycles (Walti, 2005), financial development (Dellas and Hess, 2005) and geographical factors (Flavin and Yamashita, 2002). According to Erbaykal and Karaca (2008), capital flows and removal of legal barriers in developing countries can increase financial integration and equity market efficiency. Beine and Candelon (2007) proposed that international equity market co-movement is sensitive to trade liberalization among countries. According to Kallberg and Pasquariello (2008), excess stock returns co-movements exist mainly due

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to co-variation rather than the fundamental factors. Arouri *et al.* (2012) attribute co-movements to various regime shifts, economic events and financial crises. He proposed that excess stocks return co-movements can be an outcome of pure transmission of information (King and Wadhwani, 1994), financial constraint (Calvo, 2004), fragility of financial markets (Allen and Gale, 2000), wealth effects (Kyle and Xiong, 2001) or investor's trading behavior (Barberis *et al.*, 2005).

Beine and Candelon (2007) supported the findings by Canove and Nicolo (2000) that inflation rate differences between countries have weak relationship with their bilateral equity market returns co-movement. Similarly, Baele and Inghelbrecht (2009) argue that compared to liquidity proxy variables, macroeconomic variables have little contribution in explaining stocks and bond relationship. However, according to Pretorius (2002) macroeconomic variables (i.e. inflation rate differential and GDP growth rate differential) exhibit significant negative relationship with bilateral equity returns' co-movement. According to Mobarek and Mollah (2002), low differences in growth rate between countries tends to increase bilateral stock return co-movement. However, these findings are more significant for the mixed country sample and developed economies whereas less significant for emerging markets. According to Pretorius (2002), uniformity in economic structure leads towards the synchronicity in international equity co-movement and business cycle. He also suggested that stronger trade agreements among countries leads towards greater equity returns connectedness. Mobarek and Mollah (2002) reported high value of inflation rate differential among participating countries and suggest that this higher value results in lower stock return co-movement. Coeurdacier and Guibaud (2011) measured cross border equity holding and concluded that low value of equity holding results in higher value of bilateral equity return co-movement. Lane and Ferretti (2001) also used foreign portfolio equity holding to measure its impact on international stock returns co-movement. He proposed an allocation model as a benchmark where heterogeneity in consumption preferences and cost for trading in different goods and services is reflected by the positions in foreign portfolio.

■ 3. Empirical framework

3.1. Data description

We use monthly data from January 2000 to December 2014 for our included variables. Sampled equity markets consist of a set of frontier and emerging Asian markets according to Morgan Stanley Capital International (MSCI) classification. We have selected a sample of ten equity markets out of which three markets i.e.

Bangladesh, Pakistan and Sri Lanka are classified as frontier whereas rest of the markets including China, India, Indonesia, Malaysia, Philippine, Singapore and Thailand are categorized as emerging markets. For measuring bilateral stock market co-movement, we use monthly equity index pricing for sampled countries. Returns for each country are then calculated by taking natural log of the difference between current and lagged equity prices.

As the aim of this study is to explore the determinants of bilateral equity market co-movement, raw data on our variables cannot be used. To construct variables for analysis, we start with our dependent variable i.e. bilateral stock market co-movement. This co-movement represent correlation of Pakistani equity market with other sampled equity markets and is constructed by using the TVP (Time Varying Parameter) model expression of which is presented below.

$$SMC_{ij,t} = \beta_0 + \beta_1 R_{i,t-1} + \beta_2 R_{j,t} + e_{ij,t}$$
(1)

Where $SMC_{ij,t}$ represents bilateral stock market co-movement[1] between home (Pakistan) and host (other sampled Asian) equity markets.

■ **Figure 1. Bilateral return co-movement**

Pak-India

Pak-Bangladesh

Pak-China

Pak-Sri Lanka

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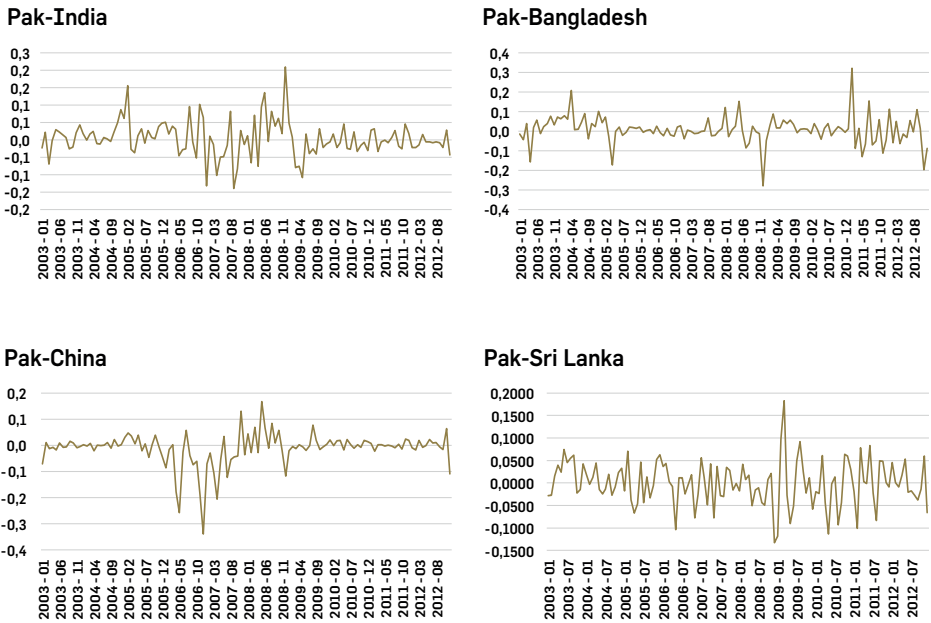
[1] It is measured by taking daily return correlation values from 2000 to 2003 through rolling betas estimation procedure using multivariate regression. These rolling betas are then used to calculate bilateral monthly correlation values from 2003 to 2012. presents regression intercept, is the lagged value of equity returns in home country i.e. Pakistan and are host country equity returns. and represent coefficient of Pakistan lagged equity and host country equity returns respectively. In this way, we analyze panel of nine equity markets with Pakistani equity markets (as a home country).

Pak-Indonesia
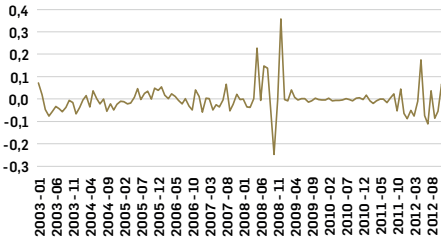
Pak-Korea
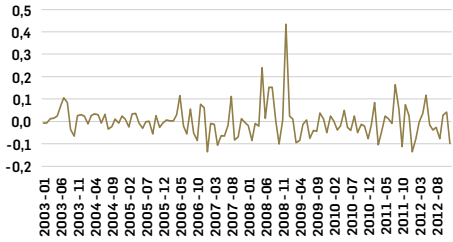
Pak-Malaysia

Pak-Philippine
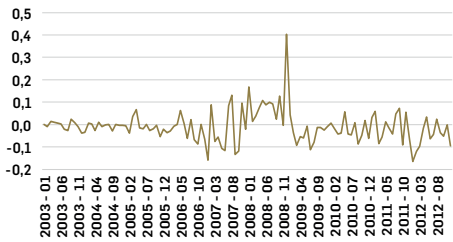
Pak-Thailand

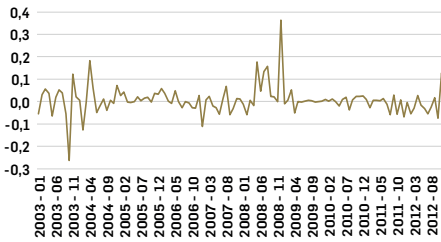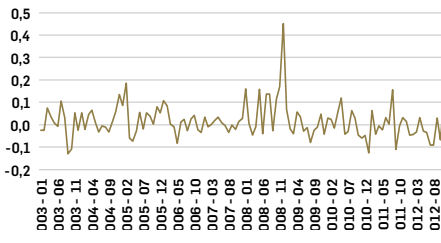Figure 1 presents bilateral co-movement of Pakistani equity market with the other sampled nine frontier and emerging Asian equity markets. Among our independent variables, financial integration indicates that how easy or costly it is for an investor of a home country to hold and trade securities in another country.

We measure financial integration by taking absolute value of the difference in net investment inflows to Gross Domestic Product between host (sampled Asian countries other than Pakistan) and the home (i.e. Pakistan) country. Market integration index is capable of capturing the differences in international asset pricing because of the systematic risks present in each country.

According to Korajczyk (1999), the intercept term representing the pricing errors represented in ICAPM i.e. International Capital Asset Pricing Model has the ability to capture market segmentation. He argued that if the similar systematic risk is

used to price all assets, then the international equity markets will experience perfect integration. For similar reasons, value of the intercept term needs to be equal to zero. He proposed that the asset pricing errors increases as the transaction costs, official and legal barriers, and taxes to international trading of assets increases. The market integration index that we constructed is given as

$$R_{i,t} - RF_{i,t} = \alpha_{i,t} + \beta_{i,t} \left(RW_{i,t} - RF_{i,t} \right) + \varepsilon_{i,t} \qquad (2)$$

$$R_{i,t} = \alpha_{i,t} + \beta_{i,t} RW_{i,t} + \varepsilon_{i,t} \qquad (3)$$

Where $R_{i,t}$ is the return on the home country, $RF_{i,t}$ is the risk free rate of return in the home country, β is estimated by the covariance and variance of the host country equity returns with respect to which co-movement of the home country will be measured. α represents the equity pricing differences between the participating countries. A value of zero means that there is no mispricing of assets. We take the absolute value of a as our market integration proxy. We measure financial integration among the countries as absolute value of the difference of net inflows to GDP between home and host country. Mougani (2012) measured the financial integration for his sampled countries using the same measure. To measure the role of macro-economic variables on bilateral equity market co-movement, we constructed inflation and GDP differential variables among home and host countries by taking the difference of their monthly log values.

Data for equity pricing is extracted from Thomson Reuters Financials Database. Inflation rate and GDP growth rate data is obtained from EconStat database whereas data for net investment inflows used in measuring financial integration is extracted from World Bank Development Indicators (WDI).

3.2. Data analysis and discussion

We start our analysis by presenting the descriptive statistics for selected equity markets returns. Results highlight that maximum monthly returns are recorded by Indian equity market i.e. 24.7 percent whereas Pakistani market exhibit minimum equity return values (-44.9 percent). Chinese equity market exhibits maximum variance in monthly returns' highlighting the associated risk.

Table 1 also provides information on the normality of data by skewness and kurtosis values. Except Thailand stock market, all equity indices are negatively skewed indicating the non-normality of monthly returns. Kurtosis values for Pakistan, Philippine, Indonesia and Thailand are very high also rejecting the hypothesis of normal distribution.

Statistic	Pakistan	India	Bangladesh	China	Sri Lanka	Indonesia	Korea	Malaysia	Philippines	Thailand
Panel A: Stock market returns										
Minimum	-0.449	-0.307	-0.048	-0.283	-0.176	-0.377	-0.263	-0.165	-0.275	-0.024
Maximum	0.202	0.247	0.054	0.243	0.212	0.183	0.127	0.127	0.139	0.178
Median	0.018	0.016	0.003	0.008	0.012	0.028	0.015	0.012	0.024	0.004
Mean	0.013	0.014	0.003	0.004	0.016	0.019	0.010	0.008	0.015	0.010
Variance	0.006	0.006	0.000	0.008	0.006	0.005	0.004	0.002	0.003	0.001
Std. dev.	0.080	0.077	0.013	0.087	0.076	0.069	0.062	0.040	0.058	0.027
Skewness	-1.811	-0.705	-0.257	-0.584	0.110	-1.682	-0.783	-0.544	-1.040	3.658
Kurtosis	8.464	2.300	3.874	1.292	0.186	7.794	2.055	2.674	4.058	16.139
Panel B: Stock market correlations										
Pakistan	1	0.209*	-0.053	0.085	0.045	0.145	0.293*	0.155	0.169*	0.056
India		1	0.024	0.390*	0.221*	0.699*	0.670*	0.573*	0.597*	0.235*
Bangladesh			1	-0.062	-0.170*	-0.024	0.025	-0.041	-0.020	0.111
China				1	0.072	0.374*	0.416*	0.498*	0.359*	0.004
Sri Lanka					1	0.310*	0.216*	0.324*	0.297*	0.059
Indonesia						1	0.674*	0.639*	0.650*	0.105
Korea							1	0.574*	0.475*	0.048
Malaysia								1	0.543*	0.130
Philippines									1	0.148
Thailand										1

Table 1 also highlights the important correlation values between international equity market returns. Correlation values of India and Indonesia are high with every other market excluding Thailand as compared to other markets suggesting low diversification benefits for these markets.

Pakistan and Bangladesh have low correlation values not only between them but also with other countries. This implies that frontier Asian markets present better opportunities for equity investments as compared with the emerging Asian markets (except Sri Lanka because of comparatively moderate correlation values).

Statistics	Co-movement	Financial integration	Market integration	Inflation differential	GDP differential
Mean	0.065	-0.215	-0.224	4.821	0.000
Minimum	-1.132	-4.615	-3.150	-8.243	-0.021
Maximum	2.522	3.498	-0.002	15.612	0.019
Std. deviation	0.346	1.529	0.432	4.899	0.007
Skewness	1.008	-0.193	-3.924	-0.049	-0.139
Kurtosis	4.511	-0.289	18.484	-0.427	-0.095
JB statistics	1098.471*	10.460*	18146.512*	8.626*	3.892*

Table 2 presents the descriptive statistics for our constructed variables. We can see that the average return co-movement of Pakistani equity market with other host countries has a low value of 6.53 percent suggesting high diversification benefits for local investors in making international investments. However, variance of 34 percent is reported among bilateral equity co-movement between Pakistani and other included equity markets. Our tests reject the hypothesis of normal distribution for all variables. As all variables are based either on the difference of values between the two countries or their ratio, we interpret these variables on relative basis to provide some meaningful analysis.

● Table 3. **Correlation values**

Variables	Co-movement	Financial integration	Market integration	Inflation differential	GDP differential
Co-movement	1	0.002	0.076*	0.064*	-0.019
Financial integration		1	-0.043	-0.169*	0.076*
Market integration			1	0.291*	-0.137*
Inflation rate				1	-0.146*
GDP growth rate					1

*Note: * represent values different from 0 with a significance level alpha=0.05*

To analyze unconditional correlation among included variables, we present results in Table 3. Correlation values ranging from mild to moderate levels are evident among our variables and therefore present no evidence of multicollinearity among them. Financial integration and GDP growth rate differential values have negative correlation values with other values; however these two have positive correlation values with each other. Bilateral equity market co-movement between Pakistan and other host countries has low correlation values with other variables therefore we resort to further tests to find the presence of relationship in short and long run.

● Table 4. **Panel unit root analysis for overall EFA panel**

	At level				At 1st difference			
	Drift and no trend	Prob.	Drift and trend	Prob.	Drift and no trend	Prob.	Drift and trend	Prob.
IPS panel **Unit root test**								
Co-movement	-2.536	0.006	-1.398	0.081	-13.427	0.000	-12.565	0.000
Financial integration	-2.135	0.016	-0.347	0.364	-2.400	0.008	-1.186	0.028
Market integration	-29.789	0.000	-25.821	0.000	-21.236	0.000	-22.414	0.000
Inflation rate	-2.821	0.002	-1.465	0.072	-3.524	0.000	-2.016	0.022
GDP growth rate	-4.015	0.000	-2.098	0.018	-10.960	0.000	-9.687	0.000
Fisher ADF panel **Unit root test**								
Co-movement	43.897	0.001	32.126	0.021	346.400	0.000	312.910	0.000
Financial integration	28.199	0.059	16.437	0.562	21.129	0.003	11.976	0.099
Market integration	135.042	0.000	138.920	0.000	514.550	0.000	496.830	0.000
Inflation rate	30.442	0.033	19.904	0.338	25.050	0.014	14.245	0.073
GDP growth rate	26.263	0.094	11.363	0.878	376.910	0.000	335.590	0.000

Table 4 presents panel unit root test results for all the variables. We employ IPS proposed by Im, Pesaran and Shin (2003) and ADF (Augmented Dickey Fuller) test proposed by Dickey and Fuller (1979). The IPS test assumes the whole panel data as a combination of various time series regressions while considering the independent Dickey-Fuller test for each of the individual series. This test not only allows for non-normality, heteroscedasticity and serial correlation test but also for hetero-geneity of trends with lag coefficient and with an alternative hypothesis of no unit root in the panel. We present results of both, the ADF and IPS tests i) with constant only and ii) with constant and trend. We can see that all variables are stationary at first difference for both ADF and IPS tests thus exhibiting unit root properties in the presence of both only constant and with constant and trend.

● Table 5. **Panel co-integration tests**

Tests	Statistics	p-values
Kao panel co-integration		
ADF *t*-statistics	-2.4139	0.0079
Pedroni panel co-integration		
Panel *v*-statistics	-0.2213	0.5876
Panel rho-statistics	-3.7920	0.0001
Panel PP-statistics	-4.0719	0.0000

Panel ADF-statistics	-1.2733	0.1015
Group rho-statistics	-2.8474	0.0022
Group PP-statistics	-3.7410	0.0001
Group ADF-statistics	-2.3333	0.0098
Johansen Fisher panel co-integration		
Trace statistics		
None	123.6282	0.0000
At most 1	34.0028	0.0126
At most 2	25.7937	0.1046
At most 3	32.0077	0.0219
At most 4	57.2846	0.0000
Maximum eigen statistics		
None	118.9844	0.0000
At most 1	17.0925	0.5168
At most 2	9.3308	0.9516
At most 3	14.7019	0.6823
At most 4	57.2846	0.0000

Table 5 presents panel co-integration test results for our set of variables. We apply three different panel data tests i.e. Kao panel co-integration test (Kao, 1999), Pedroni panel co-integration test (Pedroni, 2004) and Johanson Fisher panel co-integration test (Fisher, 1995) to check relationship among our selected bilateral equity co-movement determinants and stock co-movements. We see the presence of co-integrating vectors among our variables across all the three tests. The results give us an indication to proceed in investigating the long and short run relationship of bilateral equity co-movements with financial integration, market integration, inflation and GDP growth rate differentials.

● Table 6. **FMOLS/DOLS test results**

Bilateral equity co-movement	Coefficient	*t*-statistics
FMOLS		
Financial integration	-0.0416*	-2.0947
Market integration	0.0019	0.0375
Inflation rate	0.0114*	2.1567
GDP growth rate	-1.2909	-0.4230
DOLS		
Financial integration	-0.0508*	-2.2834
Market integration	-0.0210	-0.3193
Inflation rate	0.0139*	2.1348
GDP growth rate	-1.3353	-0.3755

To find the long run relationship of bilateral stock market co-movement with its determinants, we apply fully modified OLS and dynamic OLS. Our sample markets comprise of emerging and frontier markets with monthly equity pricing therefore chances of serial correlation exist. To account the problems serial correlation and endogeneity, we select fully modified OLS and dynamic OLS. Results of both these tests are presented in Table 6. According to fully modified OLS test results, financial integration and inflation rate values are significant for bilateral equity market co-movement between Pakistan and rest of the sample markets. For 10 percent increase in financial integration, bilateral co-movement between Pakistan and other sampled equity markets decreases by 0.42 percent. This suggests the adjustment of equity markets correlation to the increasing level of financial integration. Similarly, inflation rate changes of 10 percent cause bilateral stock market co-movement an increase of 1.1 percent. Other variables i.e. market integration and GDP growth rate differential values are insignificant suggesting no sensitivity of bilateral equity co-movement to these factors.

● Table 7. **VECM results**

	Statistics		
	Coefficient	Standard error	t-value
Δ Intercept	-0.0002	0.0008	-2.2483
Δ Financial integration (-1)	-0.0010	0.0035	-2.2390
Δ Financial integration (-2)	0.0009	0.0043	0.1963
Δ Market integration (-1)	-0.0043	0.0076	-0.4366
Δ Market integration (-2)	-0.0243	0.0630	-0.3560
Δ Inflation rate (-1)	0.0123	0.0536	0.3436
Δ Inflation rate (-2)	0.0232	0.0005	3.5698
Δ GDP growth rate (-1)	-0.031	0.0035	-3.7595
Δ GDP growth rate (-2)	0.0008	0.0059	0.0698
Δ ECT	-0.1396	0.0233	2.9863

To investigate the short run relationship between bilateral equity return co-movements and its determinants, we use vector error correction model. Lag values up to two periods is selected for all the variables to account for any possible short run effect on bilateral equity co-movement. Our short run results confirm the findings of FMOLS and DOLS test statistics. Both market integration and GDP growth rate differential variables have low t statistics suggesting the absence of any short run effect on bilateral stock market co-movement of Pakistan with remaining stock markets. However, financial integration has significant coefficient values at both lag values. Similarly, inflation rate differential is also significant and decreasing gap between Pakistan and any other Asian country causes a short run increase in bilateral stock market co-movement between them. Our error correction term is significant with a coefficient value of -0.1396 suggesting the reversion of our model from short to long run at moderate level.

● Table 8. **Panel data analysis**

Variable	Pooled OLS	Random effect	Fixed effect	Generalized method of moments[2]
Constant	-1.5334* (0.5698)	-1.5632* (0.5632)	-1.2356* (0.3265)	-1.8966 (0.5698)
Financial integration	0.2365 (0.5698)	0.0036 (0.1986)	0.5986* (0.0326)	0.1365* (0.1568)
Inflation rate	0.0654* (0.0865)	0.0856 (0.0856)	0.0659 (0.0533)	-0.1895* (0.1236)
GDP rate	-4.8798 (44.5325)	-3.5698 (34.16)	-16.5682 (27.0326)	-8.5689* (47.5698)
Market integration	-1.3265 (1.3659)	-1.2365 (0.6598)	-1.5688 (0.3569)	-1.7654 (0.4653)
R-squared	0.2693	0.0235	0.2365	0.2356
Adjusted *R*-squared	0.2036	0.0659	0.1698	0.1598
Durbin-Watson stat	1.9865	1.7956	1.9866	1.6598
F-stats/*J*-stats	2.0652	3.5632	3.6598	15.6251
Hausman statistic	-	0.0135	-	-

* Indicates Significance at 1percent, ** at 5 percent and *** at 10 percent level. – indicates N/A values. Values in parenthesis are standard errors. Values of constant are presented in multiples of hundred.

Based on the comment of one of the anonymous reviewer, we provide robustness to our analysis by applying fixed effect, random effect and GMM panel estimations to account for the possibilities of endogeneity and cross-section dependence. Our results for these tests support previous findings by highlighting the significant effect of inflation rate differential and financial integration on bilateral equity market co-movement of Pakistan with other sampled equity returns.

● Table 9. **Causality test results**

Direction of causality	Test statistics			Direction of causality	Test statistics		
	$W_{N,T}^{HNC}$	$Z_{N,T}^{HNC}$	P-value		$W_{N,T}^{HNC}$	$Z_{N,T}^{HNC}$	P-value
GDP Growth→FI	0.7296	-1.8906	0.0587	MI→GDP Growth	0.6789	-1.9640	0.0495
FI→GDP Growth	2.9471	1.3184	0.1874	GDP Growth→MI	0.3059	-2.5038	0.0123
Inflation→FI	1.7069	-0.4763	0.6338	MI→Inflation	1.5270	-0.7366	0.4613
FI→Inflation	2.8179	1.1315	0.2579	Inflation→MI	0.8927	-1.6545	0.0980
MI→FI	0.5929	-2.0884	0.0368	Co-movement→Inflation	2.3740	0.4891	0.6248
FI→MI	1.6262	-0.5931	0.5531	Inflation→Co-movement	3.0793	1.5097	0.1311
Co-movement→FI	1.7656	-0.3913	0.6956	Co-movement→MI	1.1876	-1.2278	0.2195
FI→Co-movement	1.6016	-0.6287	0.5295	MI→Co-movement	4.2818	3.2499	0.0012
Inflation→GDP Growth	0.8657	-1.6937	0.0903	Co-movement→GDP Growth	5.2374	4.6328	0.0000
GDP Growth→Inflation	1.6790	-0.5167	0.6054	GDP Growth→Co-movement	6.7334	6.7977	0.0000

[2] Estimations based on Generalized Method of Moment (GMM) overcome the problem of Nickel bias and handles the problem of endogeneity. However, proper and appropriate selection of instrument places it at a slight disadvantage. Without the appropriate selection and using many different set of instruments, estimation can turn out to be quite unstable. Coefficient values are presented as multiple of hundred for interpretation ease.

Table 9 present panel granger causality test results. Although we are more interested in the cause and effect relationship between bilateral equity market co-movement and its determinants, we discuss the causal relationship among determinants themselves. We see that bidirectional causality exist between GDP growth rate differentials and market integration and between bilateral stock market co-movement and GDP growth rate differential. Unidirectional causality runs from i) market integration to financial integration, ii) inflation rate differential to GDP growth rate differential and iii) from inflation rate differential to market integration and finally, iv) from market integration to bilateral stock market co-movement. Our results therefore highlight the relationship not only between bilateral equity co-movement and its determinants but among the determinants of such co-movements as well. Among others determinants of bilateral equity co-movement between Pakistan and other host countries, GDP growth rate differential has strong uni-directional as well as bi-directional cause and effect relationship with other determinants and stock market co-movement.

■ 4. Conclusion

Current literature present evidence of increasing international equity market connectedness however study about the determinants causing such interconnectedness is scarce. We investigated the determinants of bilateral stock market linkages between emerging and frontier markets of Asia. Financial integration, market integration, GDP growth rate and inflation rate differentials are selected as major determinants. Our results present significant role of financial integration and inflation rates on bilateral stock market co-movement however insignificant values are observed of GDP growth rate and market integration among Pakistan and other host countries. Financial integration and GDP growth rate induce variations in bilateral stock market co-movement not only in long but also in short run. We also provide evidence of causality between our variables where GDP growth rate differential is the most active variable. GDP growth rate differential and market integration between Pakistan and other sampled equity markets is insignificant in both short and long run suggesting the bilateral stock market co-movement insensitivity to both of these factors. These findings are also supported by our robust analysis including panel data fixed effect, random effect and GMM estimations.

Our findings have important implications for investors not only at individual but also at institutional level. Investors can benefit from the findings of our study by relying not only on returns correlation values for effective portfolio diversification but also on the underlying determinants causing such co-movements. Rather to rely on unpredictable nature of correlation among stock returns that is also vulnerable

to global financial turbulent periods, policy makers can also foresee such co-movements given the plausible explanation of underlying financial, market and macroeconomic variables.

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