Patterns and causes of stock market comovement: Latin America vs. Asia Pacific

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Abstract

Stock markets of emerging economies of Latin America and Asia Pacific region play an important role in a global portfolio as these markets promise better risk-return profile to investors. Hence it is of interest to international investors to analyze the pattern and causes of comovement between these emerging equity markets with developed market like the USA. The findings suggest that Latin American emerging equity markets share a higher degree of comovement with USA as compared to its counterparts in Asia Pacific region. Further, the 2008 global financial crisis had a deep impact on stock market comovement between Latin American markets and USA. The Asia Pacific emerging markets were able to withstand the effects of crisis. The results indicate bilateral trade relationship and distance as the key determinant that influence stock market comovement between emerging markets of both the regions and USA.

Keywords: Emerging Markets, Latin America, Asia Pacific, Stock Market Comovement, DCC GARCH

Introduction

International investors are always in search for attractive investment avenues that can improve the diversification benefits of their portfolio. In this context, emerging markets of Latin America and Asia Pacific regions are gaining prominent mindshare among global investors. Latin American equity markets faced tumultuous years till 2015. However, over the past three years, these markets showed signs of recovery which resulted in increased investors' confidence. The increase in annual performance of MSCI Emerging Markets Latin America Index from -30 percent in 2015 to 31 percent in 2016 and then to 24 percent in 2017, reflects investors' optimistic outlook towards Latin American region. IMF projects GDP growth rate of Latin America to rise from 1.9 percent in 2018 to 2.9 percent in 2019 because of its growing domestic consumption, rising commodity exports, and a better global environment. Asia is the fastest growing region of the world and accounts for almost two-thirds of the global growth. MSCI Emerging Markets Asia Index provided returns of 10.09 percent in 2017, outperforming the MSCI Emerging Market Index which produced gross returns of only 8.20 percent. Owing to its strong macroeconomic fundamentals and attractive valuations, Asia Pacific region continues to capture investors' attention.

Since emerging markets of Latin America and Asia Pacific provide good investment opportunities, it is of interest to investors to understand the degree of comovement of these emerging equity markets with the developed market like USA. Knowledge about the extent of strong stock market comovement is pertinent to global investors as strong comovement implies reduced international diversification benefits. Investors must also understand the factors that influence stock market comovement as this information will facilitate them in designing an optimal international portfolio.

The purpose of this paper is first to examine the degree to which emerging equity markets of Latin America and Asia Pacific regions are integrated with that of USA. The paper also investigates the impact of the 2008 global financial crisis (GFC) on stock market comovement. The second objective of the paper is to identify the factors that can explain the stock market comovement between these emerging equity markets and USA. Overall, the results indicate that Latin American emerging equity markets share stronger links with USA as compared to emerging markets of Asia Pacific region. The three phases of crisis spillover, i.e. contagion, herding and post-crisis adjustment can be observed in Latin American region. However, the Asia

Pacific equity markets were able to withstand the adverse effects of 2008 GFC. The findings show that bilateral trade relationship is the important determinant of stock market integration in both the regions.

The present research makes following contributions to the scholarly work on stock market integration. First, this study compares the stock market comovement and its factors across two geographies viz. Latin America and Asia Pacific. Such a comparative assessment will offer valuable regional and global perspective to international investors. Second, it investigates if the impact of GFC on equity comovement differed in these two regions. Such an investigation offers deeper isnsights coupling hypothesis. Lastly, it adds to the scant empirical work on factors that explain stock market comovement. The rest of the paper is systematized as follows. Section 2 presents brief literature on stock market integration and its determinants. Section 3 describes the empirical framework and data while Section 4 shows the results. Section 5 concludes the paper.

Literature Review

Stock market integration is a topical issue in the area of finance as it has important implications for global investors. On the one hand, well-integrated markets offer investors an opportunity to allocate the capital to productive regions. On the other hand, it also leads to reduced international diversification benefits. Hence, there are voluminous studies that explore stock market linkages. Gilmore and McManus (2002) found that Central and East European emerging markets shared short-term correlation with USA during 1995-2001. They failed to find a long run relationship between them. However, Voronkova (2004) showed that during 1993-2002 long run relationship existed between Central European emerging markets and equity markets of UK, Germany, and France. Similarly, Syriopoulos (2007) documented that long run relationship was there between Central and East European markets, USA and Germany during 1997-2003. Batareddy, Gopalaswamy and Huang (2012) found that equity markets of India, China and South Korea are well integrated with USA. Kim, Kim and Choi (2015) and Huyghebaert and Wang (2010) have provided evidence that USA exercises strong influence on Asian equity markets. Narayan, Sriananthakumar and Islam (2014) showed that Australian equity market is more integrated with Asian markets as compared to USA. Cardona, Gutiérrez and Agudelo (2017) documented increasing integration of Latin American equity markets with USA. However, Chuliá, Guillén

and Uribe (2017) have shown that equity markets of Chile and Colombia are segmented from USA and hence provide good diversification opportunities. Arouri, Bellalah and Nguyen (2010) also suggest that Latin American equity markets provide diversification opportunities to international investors.

Over the last couple of decades, studies have started focusing on identifying the determinants of stock market comovement. Forbes and Chinn (2004) have shown that a strong trade relationship fosters stock market comovement. According to Wälti (2011), trade and financial integration result in higher stock market comovement. Alotaibi and Mishra (2017) have identified market size, liquidity and trade openness as key factors that explain comovement among GCC markets. Johnson and Soenen (2002) and Lee and Cho (2017) examined the factors that determine stock market comovement in Asia and Pacific Basin region respectively. Their results show that greater differential in inflation rates, interest rates and GDP growth rates have a negative effect on stock market integration. Frijns, Tourani-Rad and Indriawan (2012) conclude that political crisis has a adverse effect on equity market integration. The review of literature shows that there is dearth of studies conducting relative examination of equity market comovement and its factors across Latin America and Asia- Pacific region. This study aims to focus this gap and contribute to the body of knowledge on stock market integration.

Data and Research Method

The study includes the emerging markets of Latin America and Asia Pacific regions. For Latin America, stock indices of Brazil (IBOVESPA), Chile (IPSA), Colombia (COLCAP), Mexico (S&P/ BMV IPC) and Peru (S&P/BVL PEN) are used. For Asia Pacific region, stock indices of China (SSE Composite Index), India (Nifty 50), Indonesia (JCI), Malaysia (KLCI) and Philippines (PSEi) are used. The S&P 500 index is used to represent the USA which is considered as a proxy for the global market. The stock price data expressed in US dollar terms is collected from Bloomberg, and the data spans from 1 January 2002 till 31 December 2017.

The study has two objectives. The first objective is to examine time-varying comovement between (i) Latin American emerging markets and USA (LA-USA) and (ii) Asia Pacific emerging markets and USA (AP-USA). For this purpose, Dynamic Conditional Correlation Generalised Autoregressive Conditional Heteroscedastic (DCC GARCH) model as developed by Engle (2002) is employed. Bai and Perron (2003) multiple structural break test is employed to

examine the impact of the 2008 global financial crisis on stock market comovement. The second objective is to identify the factors that influence the comovement between stock markets of LA-USA and AP-USA. To achieve the second objective, pooled regression with clustered standard errors are used.

DCC- GARCH Method

For DCC GARCH model, daily stock returns which are computed as natural log differences of daily index closing prices are used. The stock return process is expressed as below

$$r_{x,t} = \theta_0 + \theta_1 r_{x,t-1} + \theta_2 r_{USA,t-1} + \varepsilon_{x,t} \qquad where \quad \varepsilon_{x,t}|\phi_{t-1} \sim N(0, H_t) \qquad (1)$$

$$h_{x,t} = \varphi_0 + a_{x,1}\varepsilon_{x,t-1}^2 + b_{x,1}h_{x,t-1} \qquad (2)$$

$$\varepsilon_{x,t} = \sqrt{h_{x,t}}\,\tau_{x,t}, \quad where\ \tau_{x,t} \sim N(0,I) \qquad (3)$$

$$H_t = D_t R_t D_t \qquad (4)$$

where $r_{x,t}$ is stock return of emerging market x at time t, $r_{USA,t-1}$ is the lagged stock return of equity market of USA, ε_x is the error term, ϕ_{t-1} is the information set at time t-1, $h_{x,t}$ is the conditional variance which follows GARCH (1,1) model, τ_i is the standardized residual, H_t is the conditional covariance matrix, D_t is the diagonal matrix that has $\sqrt{h_{x,t}}$ on its xth diagonal and R_t is the time-varying correlation matrix. The dynamic correlation structure is expressed by equations 5 and 6.

$$Q_t = (1 - \alpha_1 - \beta_1)\bar{Q} + \alpha_1 \tau_{t-1}\tau'_{t-1} + \beta_1 Q_{t-1} \qquad (5)$$

$$R_t = Q_t^{*-1} Q_t Q_t^{*-1} \qquad (6)$$

where $\bar{Q}$ is the unconditional covariance matrix of τ_t; α_1 and β_1 are non-negative parameters to be estimated which must satisfy the condition that $\alpha_1+\beta_1 < 1$ to ensure the stability of the conditional variances; Q_t^* is a diagonal matrix including the square root of the diagonal entries of Q_t. The conditional correlation between x and USA at time t can be found in matrix R_t and is defined as

$$\rho_{xUSA,t} = \frac{q_{xUSA,t}}{\sqrt{q_{xx,t}\ q_{USA\,USA,t}}} \qquad (7)$$

Structural Break Test

Bai and Perron's (2003) multiple structural break test is used to analyse different phases of crisis spillover during the 2008 global financial crisis (GFC). Suppose there are 'b' structural breaks $(n_1,…,n_b)$ in the conditional correlation series. The breakpoints should be identified such that it minimizes the objective function $(\widehat{n_1}, …, \widehat{n_b}) = \arg \min\limits_{n_1,…,n_b} RSS_n(n_1, …, n_b)$ where RSS_n is the residual sum of squares from b linear regressions of the form $DCC_t = \beta_j + \varepsilon_t$. Here, DCC_t is dynamic conditional correlation at time t, βj is the mean level in the jth regime, and j takes value from 1 till b+1. Here the null hypothesis of no structural break is tested against the alternate hypothesis of unknown number of structural breaks given an upper bound of B ($1 \leq b \leq B$). As is the convention, B is set to 5 breakpoints. The optimal number of breaks is selected on the basis of the least value of the Bayesian Information Criterion (BIC). Though the Bai and Perron test identifies five structural breaks for each of the conditional correlation series, this study highlights breaks that happen on and after 2008 to better comprehend the effect of the Global Financial Crisis.

Pooled regression

Pooled ordinary least squares (POLS) method is employed to identify the factors that explain stock market comovement between LA-USA and AP-USA. Standard errors are clustered by market pairs to deal with the serial correlation of residuals for a given pair. The model specification is as follows:

$$\rho_{xUSA,t} = \alpha + \beta_1 Trade_{x\,USA,t-1} + \beta_2 GDP_{x\,USA,t-1} + \beta_3 Inf_{x\,USA,t-1} + \beta_4 Mcap_{x\,USA,t-1} +$$

$$\beta_5 STR_{x\,USA,t-1} + \beta_6 GFC + \beta_7 Distance + \beta_8 D.year + \varepsilon_{x\,USA,t} \qquad (8)$$

where ρ denotes the annual dynamic conditional correlation between emerging market x and USA at time t, Trade represents bilateral trade relationship, GDP refers to GDP growth rate differential, Inf is inflation rate differential, Mcap denotes market capitalization to GDP ratio differential, STR is stock turnover ratio differential, GFC stands for 2008 global financial crisis, Distance refers to the distance between principal centers of the two markets, and D.year is the dummy for years. The variables trade, GDP, Inf, Mcap, and STR are lagged by one year to mitigate the problem of endogeneity. The data on trade and distance is taken from the IMF Direction of Trade Statistics and CEPII respectively. The data on GDP growth rate, inflation rate, market capitalization to GDP ratio and stock turnover ratio is obtained from World Development Indicators, World Bank.

Results

Preliminary Analysis

The descriptive statistics of daily log returns of all equity markets under study are presented in Table 1. In Latin America region, Peru, Colombia and Chile are the top three performers in terms of both returns and risk per unit of return. In Asia Pacific region, Indonesia, India, and Philippines have registered the highest returns during the sample period. The coefficient of variation indicates that these three emerging markets also provided better risk-adjusted returns. Stock returns in both the regions are negatively skewed and are leptokurtic. Shapiro Wilk test rejects the null hypothesis that the stock returns are normally distributed. Engle's (1982) test for conditional heteroscedasticity rejects the null hypothesis of no ARCH effect for all stock returns at 12 lags. This suggests that GARCH specification is appropriate for conditional variance processes. It is interesting to observe that the risk-return profiles of equity markets across both the regions are comparable.

Dynamic Conditional Correlation GARCH

Table 2 displays the results of DCC GARCH model between each of the emerging equity markets and the USA. Panel A of Table 2 shows results of DCC GARCH model between emerging markets of Latin America and USA (LA-USA) and Panel B of Table 2 shows results of bivariate DCC GARCH model between emerging markets of Asia-Pacific and USA (AP-USA).

In Table 2, the constant term (θ_0) of the mean equation is not statistically significant for most of the markets across both the regions. The AR (1) term, θ_1 is statistically significant for Chile, Colombia, and Peru in Latin America. This term is statistically significant for Indonesia, Malaysia, and Philippines in Asia Pacific region. The results suggest that price friction exists in these emerging equity markets. The coefficient θ_2 which denotes lagged influence of USA on emerging equity markets is positive and significant. This indicates that USA is a global disturbance factor that has a substantial influence on emerging markets of both Latin America and Asia Pacific region (Mollah, Quoreshi and Zafirov 2016). The coefficients a and b are statistically significant. This affirms the appropriateness of GARCH (1,1) model specification. Since the sum of coefficients of variance equation is close to one, we can infer that volatility continues for a longer duration. Further, the value of a is lower than that of b which indicates that

there is a low rate of change in conditional market volatility. A comparison of DCC values across Panel A and Panel B of Table 2 reveals that Latin American equity markets have stronger comovement with USA as compared to Asia Pacific equity markets. One may surmise that investors may better enjoy diversification benefits in a portfolio of USA and Asia Pacific equity markets.

Table 1: Summary statistics of daily stock returns

	USA	Latin America					Asia Pacific				
		Brazil	Chile	Colombia	Peru	Mexico	China	India	Indonesia	Malaysia	Philippines
Mean (%)	0.020	0.033	0.039	0.054	0.069	0.031	0.022	0.048	0.061	0.021	0.048
Standard Deviation	1.17	2.32	1.28	1.60	1.48	1.55	1.57	1.61	1.60	0.90	1.32
Coefficient of Variation	57.81	70.76	33.01	29.50	21.31	50.51	69.96	33.20	26.50	42.62	27.28
Skewness	-0.24	-0.30	-0.24	-0.29	-0.41	-0.18	-0.45	-0.15	-0.77	-0.48	-0.60
Kurtosis	13.60	8.90	12.67	15.24	15.09	10.49	8.10	13.25	13.74	11.41	10.22
Shapiro Wilk W	14.54***	12.62***	13.49***	14.24***	14.77***	13.39***	13.50***	13.67***	14.26***	12.96***	12.87***
ARCH (12)	1253.98***	1089.33***	832.33***	1204.21***	949.12***	908.65***	394.52***	374.67***	375.78***	223.68***	499.98***

*** denotes statistical significance at 1% level.

Table 2: Results of the DCC GARCH model between each of the emerging markets and the USA

	θ_0	θ_1	θ_2	a	b	Persistence	DCC
Panel A: Latin America with the USA							
Brazil	0.001***	0.000	0.098**	0.091***	0.885***	0.98	0.59
	(0.000)	(0.019)	(0.038)	(0.008)	(0.01)		
Chile	0.001***	0.099***	0.091***	0.11***	0.855***	0.97	0.48
	(0.000)	(0.017)	(0.019)	(0.011)	(0.014)		
Colombia	0.001***	0.114***	0.108***	0.155***	0.808***	0.96	0.37
	(0.000)	(0.017)	(0.019)	(0.014)	(0.017)		
Peru	0.001***	0.144***	0.085***	0.143***	0.838***	0.98	0.39
	(0.000)	(0.017)	(0.016)	(0.013)	(0.014)		
Mexico	0.001***	0.024	0.092***	0.095***	0.883***	0.98	0.66
	(0.000)	(0.019)	(0.026)	(0.009)	(0.011)		
Panel B: Asia Pacific with the USA							
	θ_0	θ_1	θ_2	a	b	Persistence	DCC
China	0.000*	0.001	0.140***	0.054***	0.939***	0.99	0.05
	0.000	(0.015)	(0.018)	(0.007)	(0.007)		
India	0.000***	0.014	0.271***	0.085***	0.904***	0.99	0.25
	(0.000)	(-0.017)	(-0.016)	(-0.013)	(-0.014)		
Indonesia	0.001***	0.037**	0.408***	0.157***	0.821***	0.98	0.18
	(0.000)	(0.017)	(0.021)	(0.015)	(0.018)		
Malaysia	0***	0.081***	0.24***	0.067***	0.926***	0.99	0.19
	(0.000)	(0.016)	(0.012)	(0.01)	(0.011)		
Philippines	0.001***	0.088***	0.43***	0.112***	0.844***	0.96	0.10
	(0.000)	(0.015)	(0.017)	(0.016)	(0.024)		

*** and ** denote significance at 1% and 5% respectively

Structural Break Test

Figure 1 and Figure 2 displays pairwise dynamic conditional correlations between each of the Latin American equity markets and USA, Asia Pacific emerging equity markets and USA during the sample period of 2002 to 2017. The structural breaks as identified by Bai and Perron (2003) test are highlighted as red vertical lines.

For all the pairs of markets (except Indonesia-USA and Philippines-USA), the first structural break occurred in 2008-2009. This indicates that the global financial crisis had an impact on stock market comovement across the world. The second structural break is mostly found in late 2012 or early 2013. The explanation of this breakpoint time can be the US quantitative easing that impacted almost all stock markets worldwide. The third break is observed in 2015 which suggests the impact of March 2015 and August 2015 flash crises on stock markets.

In Figure 1, we will observe that there is increase in conditional correlation during the first structural break at 2008-2009. The results suggest spread of contagion on account of GFC across all the markets in Latin America region. Until the second structural break at 2012-2013, this high level of correlation is maintained. Post-2012, the correlation in the Latin American region goes to pre-crisis level. The results reflect the three phases of crisis transmission as identified by Chiang, Jeon and Li (2007). In the first phase of contagion, there is increase in correlation in the crisis-hit markets. In the second phase of herding, the high level of correlation is maintained. In the third phase of post-crisis adjustment, the correlation levels fall back to pre-crisis level.

However, Figure 2 paints a different picture. The correlation level did not rise substantially during the first structural break in 2008-2009 for China-USA and Malaysia-USA. These two equity markets do not display the herding phase as well as post-crisis adjustment phase. Further, the 2008 GFC had no impact on comovement between Indonesia-USA and Philippines-USA. Overall, one can infer that Asia Pacific equity markets were adept to endure the adverse effects of 2008 GFC.
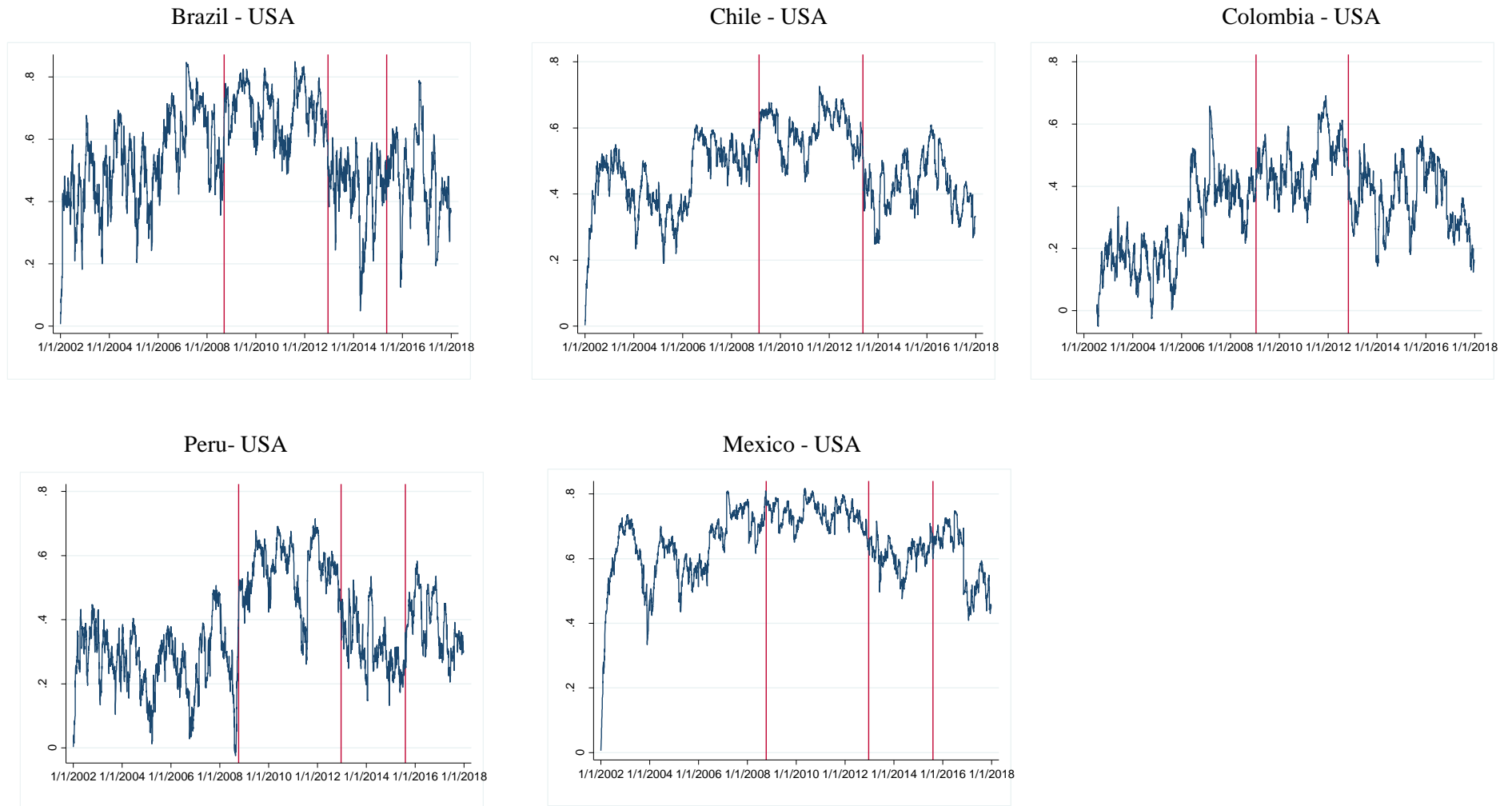
Figure 1: Dynamic conditional correlations between Latin American emerging markets and the USA

Figure 2: Dynamic conditional correlations between Asia Pacific emerging markets and the USA

Pooled Regression

To find the causal factors of stock market comovement between Latin American emerging markets and USA (LA-USA) and the Asia Pacific emerging markets and USA (AP-USA), pooled regression with clustered standard errors as specified in equation 8 is performed. Panel A and Panel B of Table 3 presents regression results LA-USA and AP-USA respectively.

Table 3: Pooled Regression Results

	Panel A: Latin America and USA		Panel B: Asia Pacific and USA	
Trade	1.43***	(0.12)	-1.98***	(0.19)
GDP	-0.02**	(0.01)	0.01	(0.02)
Inflation	0.01	(0.01)	0.00	(0.01)
Market Capitalization	0.002	(0.02)	-0.02***	(0.00)
Stock Turnover Ratio	-0.07	(0.05)	0.00	(0.01)
GFC	0.33***	(0.05)	0.10**	(0.03)
Distance	0.36**	(0.08)	-0.30*	(0.12)
Intercept	-2.64	(0.96)	3.18	(1.17)
R^2	0.85		0.71	

** and *** represent statistical significance at 5% and 1% levels respectively.

Results of Panel A and Panel B of Table 3 indicates that bilateral trade relationship, 2008 global financial crisis, and distance are the common driving factors that influence stock market comovement between LA-USA and AP-USA. It is interesting to observe the adverse effect of trade relationship on comovement between AP-USA. Literature suggests that strong trade relationship results in business cycle synchronization which in turn leads to strong stock market comovement. However, Krugman (1993) suggests that a robust bilateral trade relationship allows countries to specialize in specific industrial activity. This enables the country to gain a comparative advantage. It is possible that such a comparative advantage results in business cycle divergence thereby leading to weak stock market comovement. The coefficient of GFC is positive and statistically significant, thereby indicating that the crisis had an impact on stock market comovement. Distance, which is a proxy for information asymmetry, is also a common significant determinant of stock market comovement. However, the positive impact of distance on Latin American comovement with USA is an unanticipated finding. In the Asia Pacific region, we find that market capitalization to GDP ratio differential to be a significant determinant of comovement with USA.

Conclusion

The study examines the pattern and causes of comovement between markets of Latin American emerging markets and USA, and Asia Pacific emerging markets and USA during the period of 2002 to 2017. Dynamic conditional correlation method is employed to examine how the degree of comovement between these two pairs of markets have evolved. Pooled regression with clustered standard errors is used to recognize the factors that impact stock market comovement between these market pairs. The key results of the study are discussed below.

The summary statistics of the daily stock returns reveal that the risk-return profile of emerging equity markets of both Latin America and Asia Pacific regions are similar. The results of DCC GARCH model confirm the role of USA as a global disturbance factor. Further, the results suggest that Latin American equity markets share a higher degree of comovement with USA as compared to Asia Pacific equity markets. Hence prima-facie, one may infer that investor may enjoy diversification benefits in a portfolio of Asia Pacific emerging equity markets and USA. The Bai and Perron (2003) structural break test indicate that unlike Asia Pacific markets, Latin American equity markets were deeply affected by the 2008 global financial crisis. The results of pooled regression indicate that bilateral trade relationship, 2008 global financial crisis, and distance are the significant determinants that drive stock market comovement between emerging equity markets and USA.

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