# An Analysis of Returns and Volatility Spillovers and their Determinants in Emerging Asian and Middle Eastern Countries

Faruk, Balli and Syed Abul, Basher and Hassan, Ghassan and Hassan, Hajhoj

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**An Analysis of Returns and Volatility Spillovers and their Determinants in Emerging Asian and Middle Eastern Countries**[1]

Faruk BALLI[2,3]

Syed Abul BASHER[4,5]

Hassan Belkacem GHASSAN[6]

Hassan Rafdan HAJHOJ[7]

**Abstract**

This study investigates the *return spillovers* and *volatility spillovers* from developed markets (e.g., Europe, Japan and the US) into the financial markets of selected emerging countries in Asia and the Middle East and North Africa (MENA) region. Based on constant and trend spillover models, we find evidence of significant spillover effects from developed markets to emerging markets. The results from variance ratios indicate the dominance of US shocks across all emerging markets, though the effect varies widely among countries. New to these literature, we conduct an empirical analysis quantifying the underlying determinants affecting the extent of shock spillovers. The results show that bilateral factors such as trade volume, portfolio investment and distance are significant in explaining the spillover effects.

**JEL Classification:** F15, F36, G12.

**Keywords:** Return spillovers; Volatility spillovers; Market integration.

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[2] School of Economics and Finance, Massey University, QB 2.47, Albany, Auckland, New Zealand. Tel.: 64 9 4140800 ext. 43445. Email: F.Balli@massey.ac.nz

[3] Department of International Trade and Marketing, Gediz University, Izmir, Turkey.

[4] Department of Economics, East West University, Plot No-A/2, Aftabnagar Main Road, Dhaka 1219, Bangladesh. Email: syed.basher@gmail.com

[5] Fikra Research & Policy, PO Box 2664, Doha, Qatar.

[6] Department of Economics, Umm Al-Qura University, PO Box 715, Makkah, Saudi Arabia.

[7] College of Business Administration, King Faisal University, PO Box 400, Al-Ahssa, Saudi Arabia.

## 1. Introduction

The global economy today is characterized by the expanding internationalization of national capital markets. Since the early 1980s, a combination of market-oriented policies such as deregulation of interest and exchange rates as well as reductions in the barriers to foreign investments (Bekaert and Harvey, 1997; 2000) have contributed to a spectacular integration of capital markets across the developed countries and, lately, between the financial markets of developed and emerging countries. The process of increased financial integration has been accompanied by a rising trend of international and regional trade agreements among countries. Although the process and the progress of financial and trade integration have not been symmetric across countries, with some countries or regions showing more dynamism than others, the global financial crisis (GFC) of 2008–09 established the point that countries are more integrated today (both in terms of trade and financial integration) than they were in the 1980s and the 1990s.

Although financial globalization and trade integration have enabled emerging countries to attain risk-sharing through better allocations of capital and thereby higher economic development, they also produced unwanted side-effects, including increased financial fragility and unstable long-term growth (Bekaert et al., 2005; Levine and Zervos, 1998; Stiglitz, 2002). As emerging markets develop further and exhibit higher co-movement with the mature markets, they automatically become more responsive to the volatility of stock markets elsewhere in the world. A detailed assessment of the level and the nature of financial integration between developed and emerging markets is thus necessary. Such analysis can shed light not only on the sources of shock spillover (an indicator of market integration) across markets but also on the underlying determinants that characterize this integration.

The literature on equity market integration has evolved over time. Prior literature documents a slow degree of co-movement across markets in the period before the 1990s (Hilliard, 1979). Recent literature, however, has documented a notable increase in international co-movement of equity returns since the mid-1990s. Various explanations have been offered for this increased market integration, including the increase in international market co-movement linked to growing global industry factors (Baca et al., 2000; Cavaglia et al., 2000), high market correlation after the stock market bubble in the late 1990s (Brooks and Del Negro, 2004), a general increase in market integration in the 1990s and the 2000s (Ayuso and Blanco, 2001) and an increase in international bilateral trade flows (Pretorius, 2002).

The increasing interconnectedness and flows of trade, investment and finance between the emerging and developed countries has led to a number of empirical studies investigating this phenomenon. Over the past few decades, various studies have provided a general understanding on the integration of emerging markets. Bekaert and Harvey (1997, 2000), Bekaert et al. (2005) and Carrieri et al. (2007) studied the implications of increasing integration with global markets for local returns, volatility and cross-country correlations, covering a diverse set of emerging markets in Asia, Eastern and Central Europe, Latin America and the Mediterranean area. A number of studies focused upon specific regions, including Neaime (2006, 2012) and Floros (2008) on the integration of stock markets in the Middle East and Ng (2000), Tay and Zhu (2000), Worthington and Higgs (2004), Caporale et al.

(2005, 2006), Engle et al. (2012) and Yilmaz (2010) on the dynamics of stock market integration in emerging Asia.

However, these studies remain silent on the topic of return and volatility spillovers – let alone their determinants – between emerging and developed countries, which is the main focus of this analysis. In the context of emerging countries, Chen and Zhang (1997) found that cross-country stock return correlations are related to trade. Although own-country volatility is important in explaining cross-sectional returns, (bilateral) trade appears to be a major determinant in explaining (between 5% and 40%) cross-country stock return correlations. Bracker et al. (1999) used a two-step procedure to investigate, first, how the degree of co-movement for a given pair of markets varies over time and, second, why this interdependence varies over time. They found that the degree of interdependence is positively correlated with market volatility and trend but negatively correlated with exchange rate volatility, real interest rate differentials, the return on the world index and the term structure differentials.

A clear message emerging from the literature is that these stock markets are broadly interdependent and driven by certain economic factors, where the emerging stock markets also exhibit similar characteristics. However, what remains unexplored is whether the factors that drive the co-movement among developed markets are also relevant for emerging markets and to what degree. An open question that remains to be analysed is whether integration among emerging markets is driven by similar factors or whether it is driven by completely different factors that are specific to the emerging markets' nature, given the still underdeveloped financial markets of the latter in comparison with the developed world markets (Bekaert and Harvey, 1997). Factors that have been shown to influence the extent of integration among developed stock markets significantly include bilateral trade, exchange rate volatility, real interest rate differentials, physical distance, regional effects, market volatility and capitalization differentials (see, among others, Pretorius (2002), Lucey and Zhang (2010) and Graham et al. (2012)).

The existing studies have generally pointed to increasing links among emerging stock markets as well as links between emerging and mature markets. However, these results are difficult to reconcile because of the differences in econometric methodologies as well as the data frequencies and periods considered. In this paper, we quantify the extent of return and volatility spillovers from major developed countries/regions to selected Asian and Middle Eastern countries. Furthermore, we investigate the possible underlying determinants of the shock spillovers using a variety of bilateral and gravity variables commonly used in the literature. To the best of our knowledge, this analysis has not been conducted for Asian and Middle Eastern countries.

More specifically, our empirical approach comprises the following steps. First, we use a standard GARCH (1,1) process to model return and volatility for each market, which provides the extent of the spillovers of global shocks on the volatilities of the emerging markets. Return and volatility spillovers are calculated using the methods proposed by Bekaert and Harvey (1997), Ng (2000) and Bekaert et al. (2005). The estimation of shock spillovers is carried out in two ways: a constant spillover model and a trend spillover model. The constant spillover model assumes that the degree of spillover effects remains constant over time, which offers a general picture of the shock spillover effects. On the other hand, the trend spillover model allows us to obtain the time-varying aspect of integration between markets. Furthermore, we make use of variance ratios to determine how the extent of shocks from different origins are compared vis-à-vis an individual market's own shocks. Second, new to this literature, we employ a cross-section model to estimate the possible underlying determinants of shock spillovers from developed to emerging markets. This will allow us to understand the characteristics of the shock spillovers more analytically. Overall, this paper provides a general picture of how the degree of co-movement between emerging and developed markets is governed by certain macroeconomic factors and thus contributes to the ongoing literature and research on equity market integration in emerging markets.

The rest of the paper is organized as follows. Section 2 describes the data and presents some descriptive analyses. Section 3 outlines the econometric methodologies concerning the return and volatility spillover effects. Section 4 reports the empirical results and discusses the findings in detail. Section 5 concludes the paper.

## 2. Data and Descriptive Statistics

Our sample consists of 20 emerging markets from Asia and Middle East and North Africa (MENA) countries over the period 2000–2013. These include Bangladesh, India, Indonesia, South Korea, Malaysia, Pakistan, the Philippines, Singapore, Thailand and Vietnam from Asia and Bahrain, Kuwait, Oman, Qatar, Saudi Arabia, the United Arab Emirates (UAE), Egypt, Jordan, Morocco and Tunisia. The MENA countries can be classified into two parts: Gulf Cooperation Council (GCC)[8] versus non-GCC MENA[9] countries. The choice of countries is guided purely by the availability of data. The variables considered in the analysis include (i) bilateral trade volumes between emerging countries and their developed country counterparts such as US, Europe and Japan; (ii) weekly equity return data (in US dollars); (iii) the level of equity investments by developed country in emerging markets; (iv) debt securities issued by the emerging markets and held by the developed countries (US, Europe and Japan); and (v) geographic distance between the capital cities of the countries in the sample.

Bilateral trade data consisting of exports and imports of goods at quarterly frequency were collected from the International Monetary Fund's Direction of Trade Statistics database. Weekly equity data were extracted from the Morgan Stanley Capital International database. Annual aggregate values of portfolio (equity and debt) investments were extracted from the International Monetary Fund's Coordinated Portfolio Investment Survey database and geographic distance data were collected from Mayer and Zignago (2011). The data period cover significant recent events such as the 2008–09 GFC, which imparted a material impact on the economic and financial landscape of the emerging markets.

[8] GCC (Gulf Cooperation Council) countries include Bahrain, Kuwait, Oman, Qatar, Saudi Arabia and the UAE.
[9] The non-GCC MENA countries include Egypt, Jordan, Morocco and Tunisia.

A visual summary of the equity prices across the 20 emerging markets is shown in Figure 1. Table 1 presents the descriptive statistics for the weekly equity returns denominated in US dollars. As Table 1 shows, the mean values of the weekly returns vary between -0.19% (Bangladesh) and 0.24% (Oman). The standard deviation of the returns ranges from 2.42% (Tunisia) to 6.21% (Indonesia). A higher degree of equity return volatility is generally associated with countries characterized as having lower macroeconomic stability. The statistical distributions of the returns indicate that most of the returns are skewed to the left and they all show excess kurtosis, extremely high kurtosis in some cases. The last four columns of Table 1 report the Ljung and Box (1978) portmanteau test statistics Q and Q† (for the squared data) for first- and second-moment dependencies in the distribution of the emerging market equity indices. In many cases, the Q statistic is significant, suggesting that the equity indices are serially correlated whereas the Q† statistic is significant for almost every market, providing evidence of strong second-moment dependencies in the distribution of the equity returns.

Table 2 presents the summary statistics for the cross-section determinants. For each country, the measurement of bilateral trade is calculated in a way that normalizes the actual absolute volume in the original trading currency unit in order to get the relative scalar measurement of trade for the different countries. This way, we are able to measure trade as the ratio of actual annual trade volume (imports plus exports) between an emerging country and its trading partners. Equity and debt investment measures in emerging markets are also normalized using the ratio of actual volume held by a developed country to the total volume of security investments issued by an emerging market.

The mean values of bilateral exports to developed countries range between 1.57% (imports by Japan) and 16.43% (exports to the US), whereas the corresponding mean values of imports from developed countries range from 1.14 (Japan) to 14.49 (Europe). These statistics provide an overview of the differences in the relative amount of trade from emerging to developed countries. At the country level, the range is more dispersed with a minimum of about 0.05% (almost no trade) to the maximum of nearly 80%. For equity investments, the mean value varies in the range of 1.39% (Japan) to 23.70% (US). Finally, the distance to the developed markets is in the range of 6315 km (Europe) to 11,484 km (US).

## 3. Methodology

We follow Bekaert and Harvey (1997) and Ng (2000) in building the spillover models for the equity returns in the emerging markets. The effects of all return and volatility spillovers of aggregate US, Europe and Japanese equity markets are also taken into consideration to formulate their respective univariate AR-GARCH models.[10] The conditional returns based on the aggregate equity index $R_{i,t}$ of the selected developed countries are assumed to follow an AR(1) process:

[10] The GARCH(1,1) model, though widely popular among applied researchers, is not the only choice for studying volatility dynamics of equity markets. Alternative methods include the vector autoregression (VAR) model and multivariate GARCH, among others. The main advantage of the GARCH(1,1) model is its simplicity. One of the biggest challenges in multivariate GARCH modelling is finding a tradeoff between generality and feasibility, a tradeoff that is often referred to as "the curse of dimensionality" (e.g., Bauwens et al., 2006). The use of VAR models requires some method of identification (e.g., Cholesky decomposition), an approach that we use in this paper to separate shocks between developed and emerging markets. Recently, Diebold and Yilmaz (2009) proposed a simple and intuitive measure of asset return and volatility spillovers using a VAR model. Thus a potential avenue for future research is to extend this research by using alternative methods to find out the intensity of

$$R_{us,t} = a_{us} + b_{us}R_{us,t-1} + \epsilon_{us,t}; \quad (1)$$

$$R_{euro,t} = a_{euro} + b_{euro}R_{euro,t-1} + \epsilon_{euro,t}; \quad (2)$$

$$R_{japan,t} = a_{japan} + b_{japan}R_{japan,t-1} + \epsilon_{japan,t}. \quad (3)$$

The external shocks $\epsilon_{us,t}$, $\epsilon_{euro,t}$ and $\epsilon_{japan,t}$ are assumed to be independently and identically distributed. We model the conditional returns of the emerging market return $R_s$ as a linear combination of its own history and the return spillovers from all US, European and Japanese aggregate indices.

Given that our models are based on the extent of the spillovers from the developed markets to emerging markets, we have applied a contagion test following Forbes and Rigobon (2002) to show whether the developed markets and emerging markets (our samples) have co-movements more often during the GFC period. Applying the contagion and interdependence test, we showed that almost all markets (except Singapore and South Korea) demonstrated the contagion effect during the GFC.[11] Accordingly, to control for the contagion effect, following Hammoudeh et al. (2009), we have added a dummy variable for the GFC period on the top of the spillovers we detected earlier. Accordingly, the estimated equation is as follows:

$$R_{s,t} = a_s + b_sR_{s,t-1} + \eta_{us}R_{us,t-1} + \eta_{euro}R_{euro,t-1} + \eta_{japan}R_{japan,t-1} + \delta D_{GFC} + \epsilon_{s,t}, \quad (4)$$

where $a_s$ is the intercept; $b_s$ is the sensitivity to an emerging market's own past performance; and $\eta_{us}$ $\eta_{euro}$ and $\eta_{japan}$ are return spillovers from th4e US, European and Japanese equity markets, respectively. The dummy variable $D_{GFC}$ captures the GFC period. The error term $\epsilon_{s,t}$ is made up from the emerging market indices' own shocks and shocks from the chosen economic powerhouses, as follows:

$$\epsilon_{s,t} = \phi_{us}\epsilon_{us,t} + \phi_{euro}\epsilon_{euro,t} + \phi_{japan}\epsilon_{japan,t} + \varepsilon_{s,t}. \quad (5)$$

Since it is possible for both the emerging and developed markets to be driven by common news, following Ng (2000), we use Cholesky decomposition to separate shocks that are specific to each developed market from those that are specific to the emerging markets. We orthogonalized innovations so that each market was driven by its own idiosyncratic shocks, which are given by:

$$\epsilon_{euro,t} = \varepsilon_{euro,t} + K_{t-1} * \varepsilon_{US,t}; \quad (6)$$

$$\epsilon_{japan,t} = \varepsilon_{japan,t} + M_{t-1} * \varepsilon_{US,t}; \quad (7)$$

$$\epsilon_{US,t} = \varepsilon_{US,t}. \quad (8)$$

These equations imply that the US is the main originator of shocks, which are then transmitted into the European and Japanese markets. The new shocks for Europe are based on Cholesky decomposition, such that $H_{euro,t} = K_{t-1} \sum_t K'_{t-1}$ and $\sum_t = \begin{pmatrix} \sigma^2_{euro,t} & 0 \\ 0 & \sigma^2_{US,t} \end{pmatrix}$.[12] Under this specification, the aggregate shock

spillovers and the nature of any time variation between return and volatility spillovers. We thank an anonymous reviewer for bringing this point to our attention.

[11] For the sake of brevity, we have not presented the contagion test results. The results will be available upon request.

[12] Under these assumptions, it is easy to show that $K_{t-1}$ is determined by the ratio of the covariance between the European and US innovations and the variance of the US, which is as follows:

$$K_{t-1} = \frac{Cov(\varepsilon_{US,t}, \varepsilon_{euro,t})}{Var(\varepsilon_{US,t-1})} = \frac{H_{EU,Euro,t}}{H_{US,t}}$$

$\varepsilon_{euro,t}$ represents a shock that is unrelated to $\varepsilon_{US,t}$. The specification for Japan is defined in a similar way. The corresponding volatility spillover effects are introduced by the variables $\varepsilon_{us,t}$, $\varepsilon_{euro,t}$ and $\varepsilon_{japan,t}$. Hence, we measure the volatility spillover effects of each developed market by the coefficients $\phi_{us}$, $\phi_{euro}$ and $\phi_{japan}$, respectively.

Intuitively, this type of recursive structure for the transmission of shocks from developed to emerging markets can be justified on the basis that shocks originating in the US first affect financial markets in Europe and Japan before spilling over into the emerging markets. The recent GFC provides the best evidence to support this causal chain of shock transmission (i.e., from the subprime meltdown in the US in 2007 into a sovereign debt crisis in Europe in 2010, followed by weakening economic prospects in emerging countries). The tapering of the Federal Reserve's quantitative easing program that sparked a sell-off in emerging market equities (and currencies) in recent times is another case in point.

To get the volatility spillover effects, we assume that the idiosyncratic shock in Equation (5), $\varepsilon_{s,t}$, follows a normal distribution with a zero mean and conditional variance and evolves as a GARCH(1,1) process:

$$\sigma_{s,t}^2 = \omega_s + \alpha_s \varepsilon_{s,t-1}^2 + \beta_s \sigma_{s,t-1}^2. \tag{9}$$

Stability conditions require $\omega_s$, $\alpha_s$ and $\beta_s$ to all be positive and $\alpha_s + \beta_s$ be strictly less than 1. Since the idiosyncratic shock of Equation (1) follows a distribution similar to Equation (4), we model the conditional variance of the unexpected return from each emerging market based on information available at time $t-1$ as:

$$h_{s,t} = E\left(\epsilon_{s,t}^2 \middle| I_{t-1}\right) = \phi_{us}^2\, \varepsilon_{us,t}^2 + \phi_{euro}^2\, \varepsilon_{euro,t}^2 + \phi_{japan}^2\, \varepsilon_{japan,t}^2 + \sigma_{s,t}^2. \tag{10}$$

Equation (10) states that the conditional variance of the unexpected return of each emerging market depends on the variance of the current aggregate US, European and Japanese equity markets as well as its own idiosyncratic shocks. The coefficient estimates ($\phi$) are the corresponding return volatility spillovers from the US, European or Japan. Accordingly, the sign and significance of the parameters $\phi_{us}$, $\phi_{euro}$ and $\phi_{japan}$ determine whether the volatility spillover effects from the developed markets are strong enough to explain the conditional variance of equity returns for the emerging markets.

### 3.1 Constant spillover model

We model the spillover parameters of both return spillovers ($\eta_{us}$, $\eta_{euro}$, $\eta_{japan}$) from Equation (4) and the volatility spillovers ($\phi_{us}$, $\phi_{euro}$, $\phi_{japan}$) from Equation (5) as being constant throughout the entire sample period. This specification is known as the constant spillover model. However, it is quite possible that the spillover parameters are governed by a set of underlying external factors that are different from

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See **Baele (2005)** for further details.

the ones contemplated here or that these parameters vary with time, which would call for a different representation of the volatility spillover models.

### 3.2 Trend spillover model

Given the assumption that spillover parameters change over time, we estimate the trend spillover model (cf. Christiansen, 2007; Ozer Balli et al., 2013; Balli et al., 2013) to determine which of the parameters have changed over time by incorporating time trends into the original analysis. We measure the integration of the emerging market returns with the US, European or Japanese indices by letting the spillover parameters undergo a gradual transition, taking on a different value for every year throughout the sample period.

The return spillovers are thus as follows:

$$\eta_{us,t} = \eta_{us}^{0} + \eta_{us}^{1} \times TREND; \tag{11}$$

$$\eta_{euro,t} = \eta_{euro}^{0} + \eta_{euro}^{1} \times TREND; \tag{12}$$

$$\eta_{japan,t} = \eta_{japan}^{0} + \eta_{japan}^{1} \times TREND. \tag{13}$$

A similar formula is applied to volatility spillovers:

$$\phi_{us,t} = \phi_{us}^{0} + \phi_{us}^{1} \times TREND; \tag{14}$$

$$\phi_{euro,t} = \phi_{euro}^{0} + \phi_{euro}^{1} \times TREND; \tag{15}$$

$$\phi_{japan,t} = \phi_{japan}^{0} + \phi_{japan}^{1} \times TREND. \tag{16}$$

Here, $TREND$ is the time-varying independent variable that takes 1 for the year 1990 and increases by 1 for each year until 2013, i.e., $TREND_t = 1, 2, \ldots, 24$. The trend spillover model in Equation (4) thus becomes:

$$R_{s,t} = a_s + b_s R_{s,t-1} + \eta_{us,}^{0} R_{us,t-1} + TREND + \eta_{euro,}^{0} R_{euro,t-1} + \eta_{euro} R_{euro,t-1} \times TREND + \eta_{japan}^{0} R_{japan,t-1} + \eta_{japan} R_{japan,t-1} \times TREND + \phi_{us}^{0} \varepsilon_{\mathrm{US,t}} + \phi_{us}^{1} \varepsilon_{\mathrm{US,t}} \times TREND + \phi_{euro}^{0} \varepsilon_{\mathrm{Euro,t}} + \phi_{euro}^{1} \varepsilon_{\mathrm{Euro,t}} \times TREND + \phi_{japan}^{0} \varepsilon_{\mathrm{Japan,t}} + \phi_{japan}^{1} \varepsilon_{\mathrm{Japan,t}} \times TREND + \varepsilon_{s,t}. \tag{17}$$

### 3.3 Variance Ratios

To measure the magnitude of the shocks from developed markets on the volatility of the unexpected return of each emerging market's equity returns, we computed the following variance ratios (for the constant spillover model):

$$VR_{s,t}^{us} = \frac{\phi_{us,}^{2}\, \varepsilon_{us,t}^{2}}{h_{s,t}}; \tag{18}$$

$$VR_{s,t}^{euro} = \frac{\phi_{euro}^{2}\, \varepsilon_{euro,t}^{2}}{h_{s,t}}; \tag{19}$$

$$VR_{s,t}^{japan} = \frac{\phi_{japan,}^{2}\, \varepsilon_{japan,t,}^{2}}{h_{s,t}} \tag{20}$$

where $VR_{s,t}^{us}$, $VR_{s,t}^{euro}$, are $VR_{s,t}^{japan}$ measure the effects of shocks from the US, European, or Japanese aggregate indices, respectively, at time *t* on the return of emerging markets in country *s*. The variance ratios are helpful for explaining how powerful the spillover effects are in influencing the unexpected return of each market, along with own effects. By comparing the simple averages of the variance ratios, we assess the relative magnitude of all the external shocks on the volatility of the market.

### 3.4 Cross-section analysis

After determining the magnitude of shocks using the variance ratios, we turn our attention to their possible underlying determinants. Our presumption is that the extent of shocks to the markets is linked to certain bilateral variables as well standard gravity-type variables. To measure the effects of these factors, the following cross-section estimation for the market's variance ratio is used:

$$\widehat{VR}_i^j = \alpha_0 + \alpha_1 TRADE_i^j + \alpha_2 INV_i^j + \alpha_3 LANG_i^j + \alpha_4 CAPT_i + \alpha_5 COL_i^j + \alpha_6 DIST_i^j + \varepsilon_i, \qquad (21)$$

where $\widehat{VR}_i^j$ is the calculated variance ratio indicating the relative magnitude of shocks from a developed market $(j)$ to the emerging market $(i)$ of Asia or MENA countries. $TRADE_i^j$ is the magnitude of international trade (proxied by exports) between country $i$ and country $j$. $INV_i^j$ is the measure of investments given by the amount of equity security issued by market $(i)$ and held by country $(j)$. $LANG_i^j$ is a dummy variable that equals either 1 if countries $i$ and $j$ share a common language and 0 otherwise. $CAPT_i$ is the logarithm of the volume of market capitalization to capture the hypothesized size of the emerging equity market $(i)$. $COL_i^j$ is another dummy variable that captures any past or current colonial dependence between the two countries with a value of 1 if there is and 0 if there is no colonial relationship. Finally, $DIST_i^j$ is the time-invariant distance i.e., the distance in kilometers between the capital cities of countries $i$ and $j$, which captures information frictions and remoteness.

The cross-section estimation of Equation (21) is carried out as follows: data from the variance ratio analysis for each developed country/region (US, Japan and Europe) are merged altogether, so that all independent variables are present in the cross-section estimation. Since we have 20 emerging countries in our sample, the total observations equal 20 × 3 = 60, as we have three developed markets.

## 4. Empirical Analysis

### 4.1 Constant Spillover Model

The constant spillover model estimates both return spillover and volatility spillover as being constant throughout the period. The empirical results are grouped in three regions and are presented in **Table 3**. The GARCH(1,1) models are selected using the Akiaike Information Criteria. For Asia, the results show that there is evidence of both return spillover and volatility spillover from the US in the case of the Philippines and Singapore, whereas there is almost no clear indication of spillovers from either Europe or Japan to other Asian markets, except for Bangladesh, which shows a volatility spillover from Europe. This result is somewhat consistent with studies by Bekaert and Harvey (1997), Masih and

Masih (1999) and Gutierrez et al. (2009) who also documented a high level of interdependence and co-movement between the equity markets of the Philippines and Singapore and developed markets, particularly the US market. We also observed the dominance of the US spillovers on most of the Asian markets. Figures 2a and Figure 3a present the shares of the US, Europe and Japan in the trade and investment relationship between the Asian emerging markets and developed markets. Both figures indicate the dominance of US shares in Asian markets. However, we also observe that in countries with a relatively underdeveloped capital market (e.g., Bangladesh, Pakistan and the Philippines) the spillovers are stronger. We will comment more on this phenomenon in the variance ratio analysis below. As for the GFC dummy, we did not find a clear pattern on the models. The GFC dummy is negative and significant only in India and Pakistan. The models contain the transmission of the shocks from developed markets to Asia markets, since shocks contain the information about the GFC, although the coefficients of the GFC are not significant for this region. This finding partially illustrates the contagion effect between the Asian and developed markets.

In the GCC area, our results show mixed evidence relating to return spillovers from developed markets. Return spillovers from the US ($\eta_{us}$) are significant in explaining the returns of all GCC markets, whereas return spillovers from Europe ($\eta_{Eu}$) are significant for Qatar and Oman only. Our results do not indicate significant return spillover effects from Japan ($\eta_{jp}$) to GCC markets, except for Qatar and Kuwait, although they have a very weak impact on the latter country. These findings are in line with those of Hammoudeh and Choi (2004), suggesting the importance of the return spillovers from global markets, particularly the US market. Regarding volatility spillovers, we find more synchronized patterns across the GCC markets. Significant volatility spillover from the US markets to all GCC emerging markets exists and also from Europe, except for Bahrain. Spillover from Japan is significant for the markets of Kuwait, Qatar and the UAE. The strong spillover from Japan is not surprising given the high trade in goods between Japan and these three GCC countries (Figure 3b). A similar high degree of volatility spillover was also found by Neaime (2006), Yu and Hassan (2008) and Khalifa et al. (2014). The GFC coefficient is negative and highly significant for GCC markets, indicating that even the GFC by itself affected stock markets performance, even if we controlled for the shocks of the developed markets.

In the non-GCC MENA countries (i.e., Egypt, Jordan, Morocco and Tunisia), the results indicate the dominance of the US market, except in Morocco. Both the return and volatility spillovers from the US markets on the non-GCC MENA markets are highly significant. Similarly, the spillovers from European markets are also significant, except in Jordan. This finding echoes the bilateral trade pattern between the developed and non-GCC MENA countries (see Figure 3c). Indeed, in countries with a higher trade connection with Europe, the corresponding spillover coefficients are highly significant. Similarly, spillovers from Japan do not appear to be significant, which is consistent with the low trade share between Japan and the four non-GCC MENA countries.

Overall, the findings of the constant spillover model indicate that the return and volatility spillovers from the US and Europe have significant impacts on the emerging equity markets, although the impacts of the shocks originating in the US are clearly more pertinent. This result is consistent with the relatively higher trade in goods between the US and the emerging countries, compared with Europe and Japan. For the GCC region, we find that the equity markets in these oil-exporting countries are affected by shocks from all three developed markets, albeit at varying degrees, in line with the high degree of openness (both financial and goods) of the GCC countries compared to other emerging countries in our sample.

### 4.2 Trend Spillover Model

The trend spillover model allows the spillover parameters to increase or decrease with a constant value. Thus the spillover parameters may change gradually during the sample period. Table 4 shows the results of the trend spillover model and is structured in a way similar to Table 3, except that shocks from a developed country $j$ in terms of return spillovers or volatility spillovers are classified using a pair of coefficients $(\eta_j^0, \eta_j^1)$ or ($\phi_j^0$ and $\phi_j^1$), respectively. Generally, $\eta_j^0$ and $\phi_j^0$ give the initial magnitudes of the return and volatility spillovers, while $\eta_j^1$ and $\phi_j^1$ show how the spillovers have changed over time. As the time trend estimation is similar to the constant spillover estimation, there are several similarities between the results, as expected. We are interested to know how the spillover parameters have changed over time by examining the trend coefficients.

For the Asian markets, we observe mixed results across the 10 countries. In countries such as Bangladesh, Pakistan, the Philippines and Vietnam, the trend spillover effect of the US $(\phi_{US}^1)$ is positive and statistically significant; whereas the US trend spillover coefficient is significantly negative for equity markets in India, Indonesia, South Korea and Singapore. This indicates that as emerging equity markets develop, the significance of the US shocks declines. The trend spillover effect from Europe $(\phi_{EU}^1)$ is rather limited across the Asian markets. The impact is positive and significant for Bangladesh and is significantly negative but small in magnitude for Pakistan and the Philippines. As expected, the trend coefficient of the Japanese spillover $(\phi_{JP}^1)$ shows increasing relevance in some parts of the Asian market. For the equity markets of Pakistan, Malaysia, Thailand and Vietnam, the Japanese spillovers have a positive and significant trend; for the rest of the Asian markets, except for Bangladesh and Indonesia, the trend spillover effect is significantly negative.

Across the GCC markets, we document changing spillover effects from all developed markets. The equity markets of Qatar and Saudi Arabia are affected by all three developed markets. The spillover effect of the US $(\phi_{us}^1)$ and the Japanese $(\phi_{JP}^1)$ markets have a significant and positive impact on Qatar, but the European market has a negative influence from. Similar effects are also observed in the UAE from the US and Japanese equity markets. This supports the information displayed in Figure 3b, which shows a strong trade volume between Qatar and Japan. The US and Japanese markets have a positive spillover trend $(\phi_{us}^1, \phi_{JP}^1)$ on Saudi Arabia but a somewhat weaker effect on Japan. The spillover effects from these markets show increasing trend over time, as indicated by the positive and significant coefficients ($\phi_{us}^{1}$, $\phi_{EU}^{1}$). However, for Kuwait and Oman, only the spillover from the Euro region ($\phi_{EU}^{1}$) is significant and increased over the period.

In the non-GCC MENA markets, we find the dominance of the European spillovers (Table 4). As can be seen for Tunisia, Jordan and Morocco, the spillover from Europe has increased throughout the study period. We find the increased relevance of the US spillover ($\phi_{us}^{1}$) effects only for Jordan.

Overall, across different regions, the spillover effects of developed markets have different effects, in terms of the significance of the coefficients on the emerging markets. The results show that the regional spillover effect from European and Japanese markets matter most for non-GCC MENA and East Asian markets, whereas the spillover effects from the US have a general effect across all markets.

### 4.3 Variance Ratios

In this section, we present the results of the variance ratios that are used to measure the magnitude of the spillover effects from developed to emerging equity markets. Table 5 presents the results for three variance ratios of shocks, $VR_{s,t}^{us}$, $VR_{s,t}^{euro}$ and $VR_{s,t}^{japan}$, in addition to the emerging markets' own shocks.

In general, the intensity of shocks in term of variance ratios from the US, Europe or Japan shows great variation among different regions and markets. Starting with the Asian markets, we find the dominance of US shocks in the relatively small markets such as Bangladesh (26.4%), Pakistan (19.73%) and the Philippines (33.61%). As the emerging markets become deeper in terms of market capitalization (e.g., Singapore (9.88%), South Korea (13.39%) and India (15.22%)), the influence of the US shocks becomes weaker. The variance ratios of the European area are lower in the Asian markets. For Bangladesh only, it is around 16.03%; for the remaining countries, the variance ratios of the European spillovers are less than 10%. In contrast, the spillover effects from Japan on the volatility of the emerging equity markets are higher than those from the European markets. Almost all variance ratios are in double digits (except for India, Pakistan and Singapore). Once again, compared to the US, the variance ratios of Japanese market spillovers are closer to (or higher than) US spillover effects, except in the Philippines, Bangladesh and Pakistan.

For the GCC stock markets, the variance ratios again underscore the dominance of the US's spillover effects. The results show that, on average, around 20% of the shocks to the GCC equity markets can be attributed to shocks originating in the US. The impact of European spillovers are also significant at around 15%, reflecting the strong financial and trade integration between Europe and the GCC. The impact of the Japanese spillover shocks are generally higher for Qatar and the UAE, which have a strong trading relationship with Japan compared to Bahrain, Oman and Saudi Arabia, where the impact of the spillover effects is rather limited. The information depicted in Figures 2b and 3b support this finding. As Figures 2b and 3b show that except for Qatar and the UAE, which have a higher level of goods trade with Japan, for the remaining GCC countries, the dominance of the US and Europe areas in terms of investment/trade flows are clearly visible and corroborate the findings of the variance ratios.

For the non-GCC MENA markets, the dominance of the US and European markets is reconfirmed by the variance ratios. The spillover effects from Europe region are comparatively higher for Morocco and Tunisia, whereas in Jordan, there is some evidence of spillover effects from the US. Figures 2b and 3b reassert the dominance of the US and Europe for non-GCC MENA markets due to higher trade/investment flows. On the other hand, the variance ratios of the spillover effects from Japan on the non-GCC MENA countries are smaller, due to comparatively low bilateral trade/investment flows.

### 4.4 Cross-Section Analysis

In estimating the cross-section model given in Equation (21), we are able to quantify the impact of various determinants affecting the extent of the shocks given by the variance ratios based on the constant spillover model. To examine the effect on both the sign and loading of each control variable on the dependent variable (the variance ratios), we include the control variables separately in the regression estimation. This yields seven models, where the final model presents the results of the full model.

The results are presented in Table 6. Models [1] and [2] show highly substantive evidence for trade and financial investment flows having positive parameter values at 16.25 and 10.45, respectively. The results show that a 1% increase in the level of bilateral trade causes a corresponding increase of 0.16% in the variance ratio of shocks. This finding is in line with studies by Bodurtha et al. (1989), Campbell and Hamao (1992) and Bracker et al. (1999), who found bilateral trade to be a major determinant of international stock market co-movement. Similarly, a 1% increase in the level of asset investment leads to an increase of 0.10% in the variance ratio of shocks. This is a new result in the literature on equity market integration in emerging countries. The impact of a common language, although positive, is statistically insignificant in explaining the magnitude of variance ratios.

According to Model [4], a higher level of domestic market capitalization is negatively associated with the magnitude of the variance ratios. This suggests that as emerging markets become stronger, the influence of shock spillovers from developed countries diminishes. The estimated coefficient of past colonial ties is positive and significant, suggesting that culture has a role in explaining the level of spillover effects. Similar to the findings of empirical trade studies, the role of distance also has a significantly negative effect on the magnitude of the spillover effects from advanced to emerging countries. The negative impact of distance can be interpreted as a proxy for information asymmetries and other non-standard costs in the asset markets. Model [7] in Table 6 shows the results for the full model. We find that the magnitude and sign (along with their significance levels) of the model's parameters did not change much. The $R^2$ of the full model indicates that about 50% of the variations in the level of the spillover effects (measured by the variance ratios) are explained by the factors considered in the cross-section regression. Overall, the findings indicate that bilateral trade, foreign portfolio investment, domestic market capitalization, past colonial ties and distance play important roles in explaining the return and volatility spillovers from advanced to emerging countries.

## 5. Conclusions

The purpose of this paper has been to study the dynamics of the equity market integration between Asian and MENA emerging markets and selected developed countries. The results show that shock spillovers from major developed markets exert a heterogeneous effect on emerging markets and that the magnitude of the shocks also varies widely across the countries in our sample. These results reconcile the different stages of financial and economic development experienced by the Asian and MENA emerging countries over the past decade. Our paper makes a distinctive contribution to the literature on equity market integration in emerging markets by investigating the role of the underlying determinants in explaining the shock spillovers from advanced to emerging equity markets. The results indicate that bilateral trade, foreign portfolio investment, domestic market capitalization, past colonial ties and distance play important roles in explaining the return and volatility spillovers from advanced to emerging countries.

One implication for policy arising from these results is that as emerging countries become more integrated with developed markets or have a greater amount of foreign flows invested in their markets, they should strengthen prudential regulations to mitigate rising risks of financial spillovers. New research indicates that the asset management industry could potentially be a source of vulnerability for emerging asset markets (Miyajima and Shim, 2014). Therefore, any existing prudential policy framework that focuses on microprudential and consumer protection needs to change its perspective towards macroprudential regulation to deal with vulnerabilities created by asset managers. Another lesson for policy is the importance of fostering stronger and more liquid capital markets to help improve the resilience of emerging financial markets against shocks. However, this itself requires more granular and timely information from market participants. Emerging markets can use big data to improve information flows and market monitoring.

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**Table 1 – Stock Return Statistics**

| | Mean | STD | Skew | Kurt | Q(1) | Q(4) | Q†(1) | Q†(4) |
|---|---|---|---|---|---|---|---|---|
| **Asia** | | | | | | | | |
| Bangladesh | -0.19 | 3.6 | -0.24 | 5.11 | -0.07 | -0.02 | 0.20[a] | 0.13[a] |
| India | 0.13 | 4.41 | -0.29 | 5.35 | -0.04 | -0.03[b] | 0.22[a] | 0.17[a] |
| Indonesia | 0.02 | 6.21 | -0.48 | 12.34 | -0.02 | 0.07[a] | 0.26[a] | 0.25[a] |
| South Korea | 0.06 | 5.2 | -0.51 | 9.94 | -0.07[b] | -0.03[a] | 0.31[a] | 0.34[a] |
| Malaysia | 0.08 | 4.12 | -0.29 | 18.20 | -0.01 | -0.12[a] | 0.19[a] | 0.47[a] |
| Pakistan | 0.02 | 4.61 | -1.00 | 7.62 | 0.10[a] | 0.02[a] | 0.30[a] | 0.20[a] |
| Philippines | 0.06 | 4.4 | -0.14 | 6.71 | -0.05[c] | -0.01[a] | 0.22[a] | 0.11[a] |
| Singapore | 0.09 | 3.29 | -0.34 | 6.52 | 0.02 | 0.01 | 0.29[a] | 0.18[a] |
| Thailand | 0.02 | 5.23 | 0.59 | 10.70 | -0.02 | -0.01[b] | 0.10[a] | 0.07[a] |
| Vietnam | -0.12 | 5.27 | 0.27 | 5.12 | 0.22[a] | 0.13[a] | 0.34[a] | 0.25[a] |
| **GCC** | | | | | | | | |
| Bahrain | -0.46 | 3.21 | -1.39 | 13.35 | 0.05 | 0.09[a] | 0.21[a] | 0.16[a] |
| Kuwait | 0.00 | 3.51 | -0.85 | 6.85 | 0.08[c] | -0.05[a] | 0.32[a] | 0.18[a] |
| Oman | 0.24 | 3.7 | -1.03 | 12.69 | 0.03 | 0.05[a] | 0.13[a] | 0.10[a] |
| Qatar | 0.06 | 3.51 | -0.03 | 7.33 | -0.01 | 0.07 | 0.30[a] | 0.20[a] |
| Saudi Arabia | -0.07 | 4.32 | -1.32 | 8.22 | 0.03 | -0.04 | 0.19[a] | 0.30[a] |
| UAE | 0.10 | 5.1 | -0.65 | 9.53 | 0.04 | 0.02[b] | 0.08[c] | 0.07[a] |
| **Non-GCC MENA** | | | | | | | | |
| Egypt | 0.19 | 4.21 | -0.55 | 5.55 | 0.05[b] | 0.00[a] | 0.09[a] | 0.11[a] |
| Jordan | 0.03 | 2.47 | -0.43 | 9.19 | 0.00 | 0.05[a] | 0.25[a] | 0.31[a] |
| Morocco | 0.11 | 2.63 | -0.48 | 7.69 | -0.02 | 0.06[c] | 0.14[a] | 0.08[a] |
| Tunisia | 0.12 | 2.42 | -0.15 | 8.29 | -0.05 | 0.07 | 0.15[a] | 0.14[a] |
| **US** | 0.13 | 2.33 | -0.57 | 7.40 | -0.10[a] | -0.04[a] | 0.21[a] | 0.19[a] |
| **Euro** | 0.07 | 3.47 | -0.32 | 5.56 | -0.12[a] | -0.03[a] | 0.42[a] | 0.21[a] |
| **Japan** | -0.03 | 3.19 | -0.10 | 5.40 | -0.06[b] | -0.02[c] | 0.19[a] | 0.04[a] |

The table reports the summary statistics for the weekly returns in US dollars (in %) of the selected emerging markets and the economic powerhouses US, Europe and Japan. The following statistics are reported: mean, standard deviation (STD), skewness (Skew), kurtosis (Kurt), autocorrelations of order 1 and 4 (Q(1) and Q(4)) and autocorrelations of the squared time series of order 1 and 4 (Q†(1) and Q†(4)). a, $p < 0.01$; b $p < 0.05$; c, $p < 0.10$. UAE, United Arab Emirates.

**Table 2 – Determinant Factor Statistics**

| | Mean (%) | STD | Maximum (%) | Minimum (%) | Observations |
|---|---|---|---|---|---|
| Export to US | 16.43 | 9.62 | 34.23 | 1.98 | 20 |
| Export to Europe | 14.11 | 19.24 | 73.76 | 1.71 | 20 |
| Export to Japan | 1.57 | 1.39 | 5.58 | 0.05 | 20 |
| Import to US | 9.62 | 5.26 | 21.45 | 2.66 | 20 |
| Import to Europe | 14.49 | 18.13 | 62.28 | 5.37 | 20 |
| Import to Japan | 1.14 | 0.71 | 2.45 | 0.01 | 20 |
| Equity investment from US | 23.70 | 20.69 | 51.91 | 0.00 | 20 |
| Equity investment from Europe | 16.78 | 14.00 | 52.37 | 0.00 | 20 |
| Equity investment from Japan | 1.39 | 1.30 | 4.18 | 0.00 | 20 |
| Distance to US (km) | 11,484 | 2,643 | 16,180 | 5840 | 20 |
| Distance to Europe (km) | 6315 | 2,226 | 9951 | 955 | 20 |
| Distance to Japan (km) | 6781 | 2642 | 11534 | 1,157 | 20 |

This table reports the summary statistics for the bilateral trade, security investments and distances between selected emerging markets and the economic powerhouses US, Europe and Japan. STD, standard deviation.

**Table 3 – Constant Spillover Analysis**

| | $b_s$ | $\eta_{us}$ | $\eta_{euro}$ | $\eta_{japan}$ | $\phi_{us}$ | $\phi_{euro}$ | $\phi_{japan}$ | $\delta_{gfc}$ | $\alpha_s$ | $\beta_s$ |
|---|---|---|---|---|---|---|---|---|---|---|
| **Asia** | | | | | | | | | | |
| Bangladesh | 0.10 | -1.65$^{c}$ | -1.11$^{b}$ | -0.18 | 1.63$^{b}$ | 1.15$^{b}$ | -0.09 | 0.00 | 0.27$^{a}$ | 0.59$^{a}$ |
| | (0.08) | (0.89) | (0.51) | (0.88) | (0.54) | (0.45) | (0.90) | (0.01) | (0.11) | (0.13) |
| India | -0.08$^{b}$ | -0.69 | -0.22 | 0.20 | 0.89$^{b}$ | 0.27 | -0.21 | -0.03$^{b}$ | 0.09$^{a}$ | 0.88$^{a}$ |
| | (0.04) | (1.11) | (0.34) | (0.39) | (0.41) | (0.34) | (0.39) | (0.01) | (0.01) | (0.03) |
| Indonesia | -0.08$^{c}$ | -0.03 | 0.01 | 0.12 | 0.55$^{b}$ | -0.12 | -0.04 | 0.00 | 0.17$^{a}$ | 0.82$^{a}$ |
| | (0.05) | (0.67) | (0.38) | (0.41) | (0.24) | (0.38) | (0.41) | (0.01) | (0.02) | (0.01) |
| South Korea | -0.13$^{a}$ | 0.34 | -0.11 | 0.62$^{c}$ | -0.04 | 0.42$^{b}$ | -1.05$^{a}$ | 0.00 | 0.14$^{a}$ | 0.84$^{a}$ |
| | (0.04) | (0.74) | (0.40) | (0.36) | (0.73) | (0.21) | (0.31) | (0.02) | (0.02) | (0.03) |
| Malaysia | -0.01 | 0.41$^{c}$ | -0.25 | 0.09 | 0.71$^{b}$ | 0.31$^{c}$ | -0. 13$^{c}$ | 0.00 | 0.13$^{a}$ | 0.85$^{a}$ |
| | (0.04) | (0.24) | (0.22) | (0.28) | (0.31) | (0.16) | (0.07) | (0.01) | (0.02) | (0.03) |
| Pakistan | 0.06$^{b}$ | -1.21$^{c}$ | 0.43$^{c}$ | -0.35$^{c}$ | 1.31$^{a}$ | 0.51$^{b}$ | 0.38$^{c}$ | -0.02$^{b}$ | 0.19$^{a}$ | 0.77$^{a}$ |
| | (0.03) | (0.67) | (0.26) | (0.40) | (0.22) | (0.25) | (0.20) | (0.01) | (0.02) | (0.03) |
| Philippines | -0.05 | -1.52$^{b}$ | 0.06 | -0.13 | 1.45$^{a}$ | -0.14 | 0.61$^{a}$ | 0.02 | 0.12$^{a}$ | 0.81$^{a}$ |
| | (0.03) | (0.65) | (0.33) | (0.41) | (0.21) | (0.33) | (0.14) | (0.02) | (0.02) | (0.03) |
| Singapore | -0.06 | 0.01 | 0.01 | 0.11 | 0.21 | 0.03 | -0.11 | -0.03$^{c}$ | 0.15$^{a}$ | 0.82$^{a}$ |
| | (0.04) | (0.41) | (0.26) | (0.31) | (0.53) | (0.21) | (0.10) | (0.01) | (0.02) | (0.03) |
| Thailand | -0.06 | 0.78 | -0.47$^{b}$ | 0.64$^{b}$ | 1.12$^{a}$ | 0.45$^{b}$ | 0.82$^{a}$ | -0.01 | 0.13$^{a}$ | 0.84$^{a}$ |
| | (0.04) | (0.67) | (0.22) | (0.32) | (0.25) | (0.14) | (0.25) | (0.02) | (0.02) | (0.03) |
| Vietnam | 0.23$^{a}$ | 0.22$^{c}$ | 0.12 | 0.51 | 0.17$^{c}$ | -0.24 | -0.60$^{b}$ | -0.01 | 0.21$^{a}$ | 0.55$^{a}$ |
| | (0.04) | (0.09) | (0.45) | (0.31) | (0.53) | (0.21) | (0.10) | (0.01) | (0.02) | (0.03) |
| **GCC** | | | | | | | | | | |
| Bahrain | 0.14$^{a}$ | -0.08 | -0.11 | 0.19 | 0.83$^{a}$ | -0.05 | -0.14 | -0.03$^{b}$ | 0.05$^{a}$ | 0.88$^{a}$ |
| | (0.04) | (0.09) | (0.35) | (0.52) | (0.21) | (0.33) | (0.79) | (0.01) | (0.02) | (0.03) |
| Kuwait | 0.12$^{b}$ | -1.19$^{b}$ | 0.09 | -0.79$^{b}$ | 1.22$^{b}$ | -0.25$^{c}$ | 0.83$^{b}$ | -0.03$^{b}$ | 0.17$^{a}$ | 0.77$^{a}$ |
| | (0.04) | (0.59) | (0.28) | (0.33) | (0.60) | (0.14) | (0.35) | (0.01) | (0.02) | (0.03) |
| Oman | 0.15$^{a}$ | -0.76$^{c}$ | 0.72$^{b}$ | -0.30 | 0.73$^{a}$ | -0.66$^{b}$ | 0.22 | -0.04$^{c}$ | 0.21$^{a}$ | 0.76$^{a}$ |
| | (0.04) | (0.38) | (0.30) | (0.21) | (0.22) | (0.32) | (0.35) | (0.02) | (0.02) | (0.03) |
| Qatar | -0.25$^{a}$ | -0.18$^{b}$ | 0.22$^{a}$ | -0.30$^{c}$ | 0.26$^{a}$ | -0.21$^{a}$ | 0.28$^{c}$ | -0.04$^{a}$ | 0.15$^{a}$ | 0.78$^{a}$ |
| | (0.04) | (0.09) | (0.06) | (0.05) | (0.09) | (0.06) | (0.05) | (0.01) | (0.01) | (0.03) |
| Saudi Arabia | 0.07 | -0.82$^{a}$ | 1.31$^{a}$ | -0.19 | 1.01$^{a}$ | -1.39$^{c}$ | 0.23 | -0.03 | 0.19$^{a}$ | 0.78$^{a}$ |
| | (0.07) | (0.24) | (0.32) | (0.65) | (0.20) | (0.69) | (0.63) | (0.02) | (0.01) | (0.02) |
| United Arab Emirates | 0.09$^{c}$ | -1.89$^{c}$ | 0.41 | -0.450 | 1.94$^{a}$ | -0. 32 | 0.36$^{c}$ | -0.03$^{b}$ | 0.19$^{a}$ | 0.80$^{a}$ |
| | (0.04) | (1.12) | (0.40) | (0.65) | (1.01) | (0.30) | (0.65) | (0.01) | (0.01) | (0.03) |
| **Non-GCC MENA** | | | | | | | | | | |
| Egypt | -0.01 | -1.08 | 0.08 | -0.53 | 1.45$^{b}$ | -0.01 | 0.58 | -0.02$^{c}$ | 0.12$^{a}$ | 0.85$^{a}$ |
| | (0.04) | (0.75) | (0.33) | (0.44) | (0.70) | (0.33) | (0.44) | (0.01) | (0.01) | (0.03) |
| Jordan | 0.03 | -0.47$^{c}$ | 0.32 | -0.04 | 0.81$^{c}$ | -0.26 | 0.05 | -0.02$^{c}$ | 0.09$^{a}$ | 0.88$^{a}$ |
| | (0.04) | (0.25) | (0.19) | (0.25) | (0.44) | (0.20) | (0.25) | (0.01) | (0.02) | (0.03) |
| Morocco | 0.02 | -0.27 | -0.35$^{c}$ | 0.16 | 0.35$^{b}$ | 0.31$^{b}$ | -0.18 | 0.02 | 0.11$^{a}$ | 0.82$^{a}$ |
| | (0.04) | (0.45) | (0.19) | (0.22) | (0.11) | (0.14) | (0.14) | (0.02) | (0.03) | (0.03) |
| Tunisia | -0.07 | 0.44$^{c}$ | 0.27$^{c}$ | 0.31 | -0.48 | 0.79$^{b}$ | -0.34 | -0.01 | 0.60$^{a}$ | 0.34$^{a}$ |
| | (0.04) | (0.24) | (0.14) | (0.32) | (0.75) | (0.36) | (0.31) | (0.02) | (0.12) | (0.06) |

The constant spillover model for the emerging markets is defined as follows:
$R_{s,t} = a_s + b_s R_{s,t-1} + \eta_{us,} R_{us,t-1} + \eta_{euro,} R_{euro,t-1} + \eta_{japan} R_{japan,t-1} + \epsilon_{s,t}$
where $R_{s,t}$ is the conditional return of the emerging market ***s*** at time *t*; $a_s$ is the intercept; $b_s$ is the sensitivity to an emerging market's own past performance; $\eta_{us,t-1}$, $\eta_{euro,t-1}$ and $\eta_{japan,t-1}$ are in order the return spillovers from US, European and Japanese equity markets and $\epsilon_{s,t}$ is the error term. The GARCH model is $\sigma^2_{s,t} = \omega_s + \alpha_s \varepsilon^2_{s,t-1} + \beta_s \sigma^2_{s,t-1}$. $^{a}$ *p < 0.01,* $^{b}$ *p < 0.05,* $^{c}$ *< 0.10.*

**Table 4 – Trend Spillover Analysis**

| | $b_s$ | $\eta^0_{us}$ | $\eta^1_{us}$ | $\eta^0_{euro}$ | $\eta^1_{euro}$ | $\eta^0_{japan}$ | $\eta^1_{japan}$ | $\phi^0_{us}$ | $\phi^1_{us}$ | $\phi^0_{euro}$ | $\phi^1_{euro}$ | $\phi^0_{japan}$ | $\phi^1_{japan}$ | $\alpha_s$ | $\beta_s$ |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **Asia (*n* = 10)** | | | | | | | | | | | | | | | |
| Bangladesh | 0.01 | 47.90$^{c}$ | -2.25$^{c}$ | 18.25$^{a}$ | -0.89$^{a}$ | -12.32 | 0.55 | -48.93$^{c}$ | 2.33$^{c}$ | -21.35$^{a}$ | 1.02$^{a}$ | 12.82 | -0.58$^{b}$ | 0.31$^{a}$ | 0.65$^{a}$ |
| | (0.08) | (27.29) | (1.23) | (7.20) | (0.32) | (9.32) | (0.55) | (26.67) | (1.20) | (7.32) | (0.32) | (12.45) | (0.55) | (0.11) | (0.09) |
| India | -0.08$^{b}$ | -2.16 | 0.10 | -1.11 | 0.05 | 1.37 | -0.06 | 2.16 | -0.09 | 1.38 | -0.07 | -1.33 | 0.06 | 0.09$^{a}$ | 0.88$^{a}$ |
| | (0.04) | (1.86) | (0.11) | (1.13) | (0.06) | (1.14) | (0.06) | (1.86) | (0.11) | (1.11) | (0.07) | (1.14) | (0.06) | (0.01) | (0.02) |
| Indonesia | -0.07$^{c}$ | -2.29 | 0.16 | 0.96 | -0.03 | -1.75 | 0.11 | 3.34$^{c}$ | -0.17$^{c}$ | -0.95 | 0.05 | 1.99$^{c}$ | -0.12$^{b}$ | 0.17$^{a}$ | 0.82$^{a}$ |
| | (0.04) | (1.80) | (0.11) | (1.23) | (0.06) | (1.38) | (0.06) | (1.96) | (0.10) | (1.27) | (0.07) | (1.11) | (0.06) | (0.02) | (0.02) |
| South Korea | -0.15$^{a}$ | 0.01 | 0.03 | -2.32 | 0.08 | 3.28$^{b}$ | -0.14$^{c}$ | -0.07 | -0.09$^{b}$ | 2.73$^{c}$ | -0.12 | -2.90$^{b}$ | 0.12$^{c}$ | 0.14$^{a}$ | 0.84$^{a}$ |
| | (0.04) | (2.01) | (0.10) | (1.47) | (0.06) | (1.39) | (0.08) | (2.01) | (0.05) | (1.45) | (0.08) | (1.37) | (0.07) | (0.02) | (0.03) |
| Malaysia | -0.01 | -013 | 0.02 | -0.30 | 0.01 | 0.88 | -0.06 | 0.16 | -0.02 | 0.67 | -0.02 | -1.44$^{c}$ | 0.07$^{b}$ | 0.12$^{a}$ | 0.87$^{a}$ |
| | (0.04) | (1.27) | (0.08) | (1.86) | (0.05) | (0.97) | (0.06) | (1.33) | (0.08) | (0.86) | (0.04) | (0.86) | (0.04) | (0.02) | (0.02) |
| Pakistan | 0.07$^{c}$ | -1.60 | 0.02 | -1.77$^{c}$ | 0.11$^{c}$ | 1.42 | -0.13$^{c}$ | 1.53 | 0.14$^{b}$ | 1.93$^{c}$ | -0.12$^{b}$ | -1.50 | 0.12$^{b}$ | 0.18$^{a}$ | 0.79$^{a}$ |
| | (0.04) | (1.65) | (0.10) | (1.01) | (0.06) | (1.26) | (0.08) | (1.74) | (0.07) | (1.11) | (0.06) | (1.32) | (0.06) | (0.02) | (0.02) |
| Philippines | -0.05 | -4.32$^{c}$ | 0.18$^{c}$ | -1.87$^{c}$ | 0.11$^{b}$ | 1.21 | -0.08 | 4.42$^{c}$ | 0.16$^{b}$ | 1.98$^{c}$ | -0.13$^{c}$ | -1.25$^{b}$ | 0.08 | 0.14$^{a}$ | 0.80$^{a}$ |
| | (0.04) | (2.20) | (0.10) | (1.01) | (0.05) | (2.05) | (0.11) | (2.41) | (0.06) | (1.13) | (0.06) | (1.32) | (0.06) | (0.02) | (0.02) |
| Singapore | -0.07$^{c}$ | -3.06$^{b}$ | 0.19$^{b}$ | 0.04 | -0.01 | -0.47 | 0.04 | 2.93$^{b}$ | -0.17$^{b}$ | 0.35 | -0.02 | 0.38 | -0.04 | 0.14$^{a}$ | 0.84$^{a}$ |
| | (0.04) | (1.34) | (0.08) | (0.92) | (0.06) | (1.06) | (0.06) | (1.35) | (0.07) | (0.90) | (0.05) | (1.20) | (0.06) | (0.02) | (0.03) |
| Thailand | -0.05 | 0.58 | 0.01 | -1.27 | 0.04 | 1.60 | -0.06 | -0.50 | 0.01 | 1.60 | -0.06 | -1.70$^{c}$ | 0.16$^{b}$ | 0.13$^{a}$ | 0.85$^{a}$ |
| | (0.04) | (2.33) | (0.13) | (1.38) | (0.07) | (1.42) | (0.08) | (2.37) | (0.03) | (1.40) | (0.07) | (1.06) | (0.06) | (0.02) | (0.03) |
| Vietnam | 0.23$^{a}$ | -1.77 | 0.09 | 6.73 | -0.31 | 3.60 | -0.15 | -22.51$^{c}$ | 0.81$^{b}$ | -0.36 | 0.22 | -3.51$^{a}$ | 0.14$^{b}$ | 0.44$^{a}$ | 0.50$^{a}$ |
| | (0.06) | (12.80) | (0.39) | (6.05) | (0.30) | (8.79) | (0.42) | (12.37) | (0.32) | (0.29) | (0.22) | (1.04) | (0.06) | (0.09) | (0.09) |
| **GCC (*n* = 6)** | | | | | | | | | | | | | | | |
| Bahrain | 0.14$^{b}$ | -1.53$^{b}$ | 0.38$^{c}$ | 3.62 | -0.17 | -1.29 | -0.05 | 1.26 | -0.40 | -3.62 | 0.17 | 0.45 | -0.04 | 0.09$^{a}$ | 0.84$^{a}$ |
| | (0.06) | (0.59) | (0.21) | (3.65) | (0.14) | (4.12) | (0.20) | (6.76) | (0.36) | (3.76) | (0.20) | (0.65) | (0.20) | (0.02) | (0.03) |
| Kuwait | 0.12$^{b}$ | 0.45$^{b}$ | -0.11$^{c}$ | 3.56$^{b}$ | -0.20$^{b}$ | -1.42 | 0.05 | -1.30 | 0.10 | -4.05$^{b}$ | 0.61$^{b}$ | 1.51 | -0.01 | 0.39$^{a}$ | 0.53$^{a}$ |
| | (0.05) | (0.21) | (0.05) | (1.78) | (0.10) | (3.12) | (0.21) | (1.30) | (0.51) | (1.95) | (0.28) | (3.41) | (0.12) | (0.01) | (0.01) |
| Oman | 0.14$^{a}$ | -4.21 | 0.20$^{b}$ | 2.13 | -0.15$^{b}$ | (-0.56 | 0.02 | 3.13 | -0.26 | -3.41$^{c}$ | 0.15$^{c}$ | 1.31 | -0.04 | 0.24$^{a}$ | 0.74$^{a}$ |
| | (0.03) | (5.20) | (0.07) | (1.70) | (0.07) | (1.11) | (031) | (2.12) | (0.71) | (2.15) | (0.08) | (2.44) | (0.04) | (0.02) | (0.02) |
| Qatar | -0.24$^{a}$ | 1.45$^{c}$ | -0.10$^{c}$ | -1.15$^{b}$ | 0.12$^{c}$ | -0.20 | 0.09$^{c}$ | -1.79$^{c}$ | 0.14$^{b}$ | 2.41$^{a}$ | -0.08$^{a}$ | -0.18 | 0.11$^{c}$ | 0.42$^{a}$ | 0.48$^{a}$ |
| | (0.06) | (0.78) | (0.06) | (0.51) | (0.04) | (1.34) | (005) | (1.06) | (0.05) | (0.45) | (0.02) | (0.25) | (0.20) | (0.02) | (0.03) |
| Saudi Arabia | 0.05 | 6.10 | 0.32 | 3.67 | -0.21$^{b}$ | 3.50 | -0.15 | -5.12 | 0.25 | -5.05$^{c}$ | 0.17$^{a}$ | -2.32 | 0.02$^{c}$ | 0.311$^{a}$ | 0.63$^{a}$ |
| | (0.05) | (4.31) | (0.45) | (2.80) | (0.10) | (3.45) | (0.21) | (5.55) | (0.11) | (2.46) | (0.06) | (2.41) | (0.01) | (0.01) | (0.01) |
| UAE | 0.10 | 1.54 | -0.03 | 0.45 | 0.03 | -1.15 | 0.21$^{b}$ | 0.45 | 0.09$^{c}$ | -0.48$^{c}$ | -0.02 | -2.54 | 0.17$^{a}$ | 0.28$^{a}$ | 0.71$^{a}$ |
| | (0.07) | (1.18) | (0.06) | (0.42) | (0.04) | (1.21) | (009) | (1.20) | (0.05) | (0.31) | (0.03) | (3.12) | (0.05) | (0.03) | (0.03) |
| **MENA(*n* = 4)** | | | | | | | | | | | | | | | |
| Egypt | -0.03 | 0.12 | -0.09 | -1.11 | 0.04 | -0.44 | 0.01 | -0.29 | 0.06 | 1.28 | -0.06 | 0.45 | -0.01 | 0.16$^{a}$ | 0.76$^{a}$ |
| | (0.05) | (0.44) | (0.38) | (2.46) | (0.37) | (1.46) | (0.27) | (2.54) | (1.12) | (1.54) | (0.21) | (0.47) | (0.13) | (0.02) | (0.02) |
| Jordan | 0.02 | 1.12 | -0.06 | 0.29 | -0.02 | 0.48 | -0.07 | -0.85 | 0.12$^{b}$ | -0.23$^{c}$ | 0.06$^{b}$ | -0.67 | 0.09 | 0.17$^{a}$ | 0.74$^{a}$ |
| | (0.03) | (0.88) | (048) | (1.27) | (1.05) | (1.51) | (0.15) | (1.15) | (0.06) | (0.14) | (0.03) | (0.61) | (0.12) | (0.02) | (0.02) |
| Morocco | 0.05 | 0.49 | -0.26 | -0.29 | 0.07 | 0.71 | -0.05 | -0.44 | 0.09 | -0.47 | 0.18$^{b}$ | -0.44 | 0.05 | 0.16$^{a}$ | 0.78$^{a}$ |
| | (0.05) | (0.51) | (044) | (1.58) | (0.94) | (1.26) | (0.05) | (1.25) | (0.06) | (0.34) | (0.08) | (0.69) | (0.14) | (0.01) | (0.03) |
| Tunisia | -0.06 | 1.12 | -0.06 | 3.12$^{b}$ | -0.19$^{b}$ | 0.21 | 0.00 | -1.52 | 0.07 | -2.44 | 0.16$^{b}$ | -0.22 | 0.15 | 0.74$^{a}$ | 0.25$^{a}$ |
| | (0.04) | (1.15) | (028) | (1.45) | (0.08) | (1.15) | (0.07) | (1.20) | (0.12) | (2.42) | (0.07) | (0.12) | (0.21) | (0.04) | (0.04) |

**Notes:** The trend spillover model for the emerging markets is defined as follows:
$R_{s,t} = a_s + b_s R_{s,t-1} + \eta^0_{us,} R_{us,t-1} + \text{TREND} + \eta^0_{euro,} R_{euro,t-1} + \eta^1_{euro} R_{euro,t-1} \times \text{TREND} + \eta^0_{japan} R_{japan,t-1} + \eta^1_{japan} R_{japan,t-1} \times \text{TREND} + \phi^0_{us}\varepsilon_{US,t} + \phi^1_{us}\varepsilon_{US,t} \times \text{TREND} + \phi^0_{euro}\varepsilon_{Euro,t} + \phi^1_{euro}\varepsilon_{Euro,t} \times \text{TREND} + \phi^0_{japan}\varepsilon_{Japan,t} + \phi^1_{japan}\varepsilon_{Japan,t} \times \text{TREND} + + \varepsilon_{s,t.}$ where $R_{s,t}$ is the conditional return of the emerging market $s$ at time $t$; $a_s$ is the intercept; $b_s$ is the sensitivity to an emerging market's own past performance; $\eta_{us,t-1}$, $\eta_{euro,t-1}$ and $\eta_{japan,t-1}$ are the return spillovers from the US, European and Japanese equity markets, respectively; $\epsilon_{s,t}$ is the error term; and $TREND$ is the time trend variable. $\phi_{us}$, $\phi_{euro}$ and $\phi_{japan}$ are the volatility spillover effects from the US, Europe and Japan market, respectively. a, $p < 0.01$; b, $p < 0.05$; c, $p < 0.10$.

## Table 5 – Variance Ratios

| | US | Euro | Japan | Own |
|---|---|---|---|---|
| **Asia** | | | | |
| Bangladesh | 28.13 | 13.46 | 11.14 | 49.27 |
| India | 15.98 | 10.13 | 11.34 | 62.55 |
| Indonesia | 16.45 | 8.14 | 19.21 | 56.20 |
| South Korea | 12.26 | 9.07 | 13.41 | 65.26 |
| Malaysia | 14.01 | 7.04 | 13.45 | 65.50 |
| Pakistan | 18.78 | 4.29 | 6.57 | 70.36 |
| Philippines | 30.21 | 8.42 | 14.45 | 46.91 |
| Singapore | 8.41 | 6.53 | 7.48 | 77.68 |
| Thailand | 15.12 | 6.29 | 13.67 | 64.92 |
| Vietnam | 17.15 | 4.04 | 13.01 | 65.80 |
| **GCC** | | | | |
| Bahrain | 18.05 | 12.25 | 2.01 | 67.69 |
| Kuwait | 21.61 | 19.14 | 12.35 | 46.90 |
| Oman | 20.45 | 20.41 | 3.64 | 55.50 |
| Qatar | 19.56 | 14.14 | 14.51 | 51.79 |
| Saudi Arabia | 23.13 | 14.23 | 1.98 | 60.66 |
| UAE | 18.78 | 16.26 | 10.96 | 54.00 |
| **Non-GCC MENA** | | | | |
| Egypt | 17.67 | 12.12 | 4.71 | 65.50 |
| Jordan | 16.76 | 7.65 | 2.71 | 72.88 |
| Morocco | 21.12 | 23.41 | 3.03 | 52.44 |
| Tunisia | 20.14 | 20.19 | 2.15 | 57.55 |

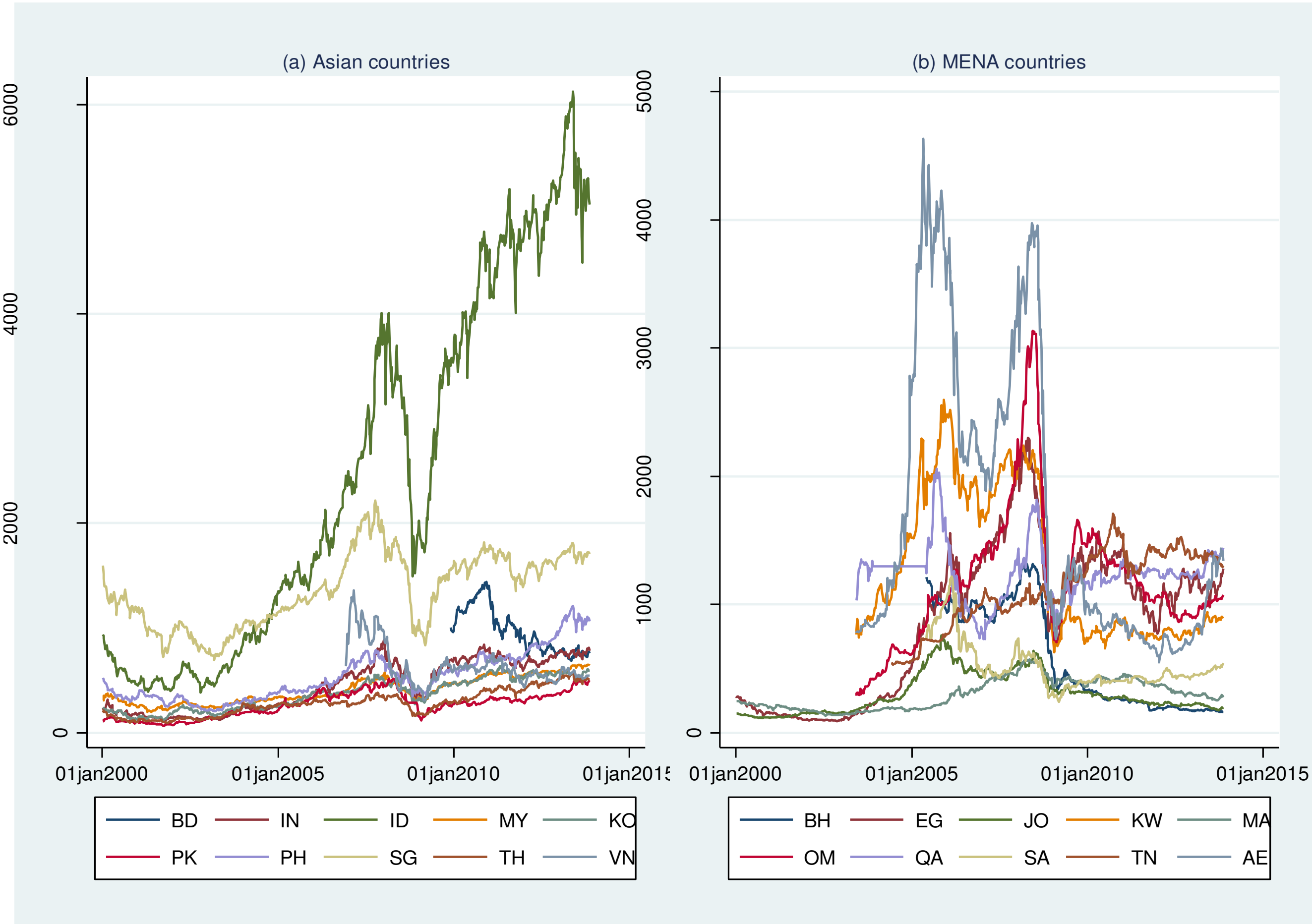
This table represents the percentage variance ratios of spillover shocks for the constant spillover model from the US, European and Japanese market and the emerging market's own shocks. Shocks from developed markets are given by $VR^{us}_{s,t} = \frac{\phi^2_{us}\ \varepsilon^2_{us,t}}{h_{s,t}}$, $VR^{euro}_{s,t} = \frac{\phi^2_{euro}\ \varepsilon^2_{euro,t}}{h_{s,t}}$ and $VR^{japan}_{s,t} = \frac{\phi^2_{japan}\ \varepsilon^2_{japan,t}}{h_{s,t}}$, where $h_{s,t} = E(\epsilon^2_{s,t}|I_{t-1}) = \phi^2_{us}\ \varepsilon^2_{us,t} + \phi^2_{euro,t-1}\ \varepsilon^2_{euro,t} + \phi^2_{japan}\ \varepsilon^2_{japan,t} + \sigma^2_{s,t}$. The last column "Own" represents the emerging market's own shocks, given by $(1 - VR^{us}_{s,t} - VR^{euro}_{s,t} - VR^{japan}_{s,t})$.

**Table 6 – Aggregate Cross-Section Analysis**

| | (1) | (2) | (3) | (4) | (5) | (6) | (7) |
|---|---|---|---|---|---|---|---|
| Trade (*TRADE*) | 21.12[a] | | | | | | 19.19[a] |
| | (5.78) | | | | | | (5.61) |
| Investment (*INV*) | | 12.22[b] | | | | | 12.72[b]** |
| | | (5.35) | | | | | (5.62) |
| Language (*LANG*) | | | 0.78 | | | | 0.73 |
| | | | (1.06) | | | | (1.13) |
| Capitalization (*CAPT*) | | | | -1.13[b] | | | -0.61[b] |
| | | | | (0.51) | | | (0.30) |
| Colonial (*COL*) | | | | | 1.97[c] | | 1.93[c] |
| | | | | | (1.05) | | (1.16) |
| Distance (log) (*DIST*) | | | | | | -1.90[c] | -2.03[b] |
| | | | | | | (1.00) | (0.87) |
| $R^2$ | 0.30 | 0.28 | 0.07 | 0.13 | 0.11 | 0.11 | 0.45 |

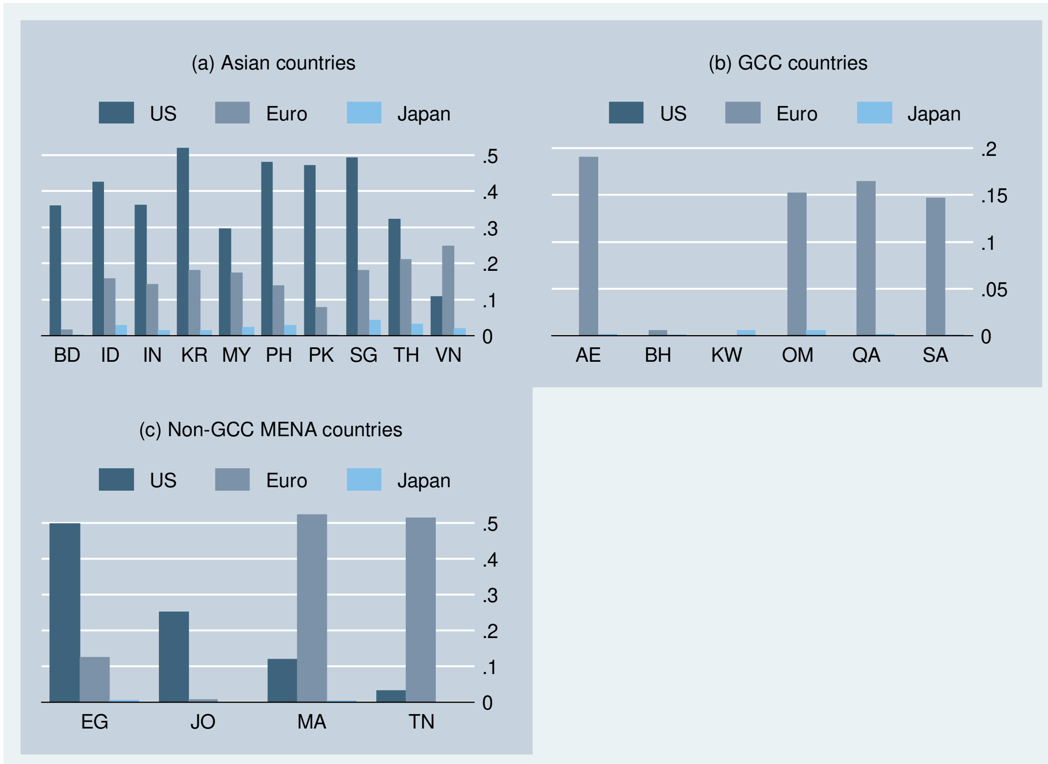
This table shows the cross section estimation results for all three developed markets together following the formula: $\widehat{VR}_i^j = \alpha_0 + \alpha_1 TRADE_i^j + \alpha_2 INV_i^j + \alpha_3 LANG_i^j + \alpha_4 CAPT_i + \alpha_5 COL_i^j + \alpha_6 DIST_i^j + \varepsilon_i$, where $\widehat{VR}_i^j$ is the calculated variance ratio of shocks from developed market $j$ to emerging market $i$, $TRADE_i^j$ is the bilateral trade variable, $INV_i^j$ is the variable of security investments, $LANG_i^j$ is a dummy variable for common language, $CAPT_i$ is market capitalization, $COL_i^j$ is another dummy variable for colonial dependence and $DIST_i^j$ is the time-invariant distance. Standard deviations are shown in parentheses. $N$ = 60. a, $p < 0.01$; b, $p < 0.05$; c, $p < 0.10$.

**Figure 1:** Stock prices in selected Asian and MENA countries



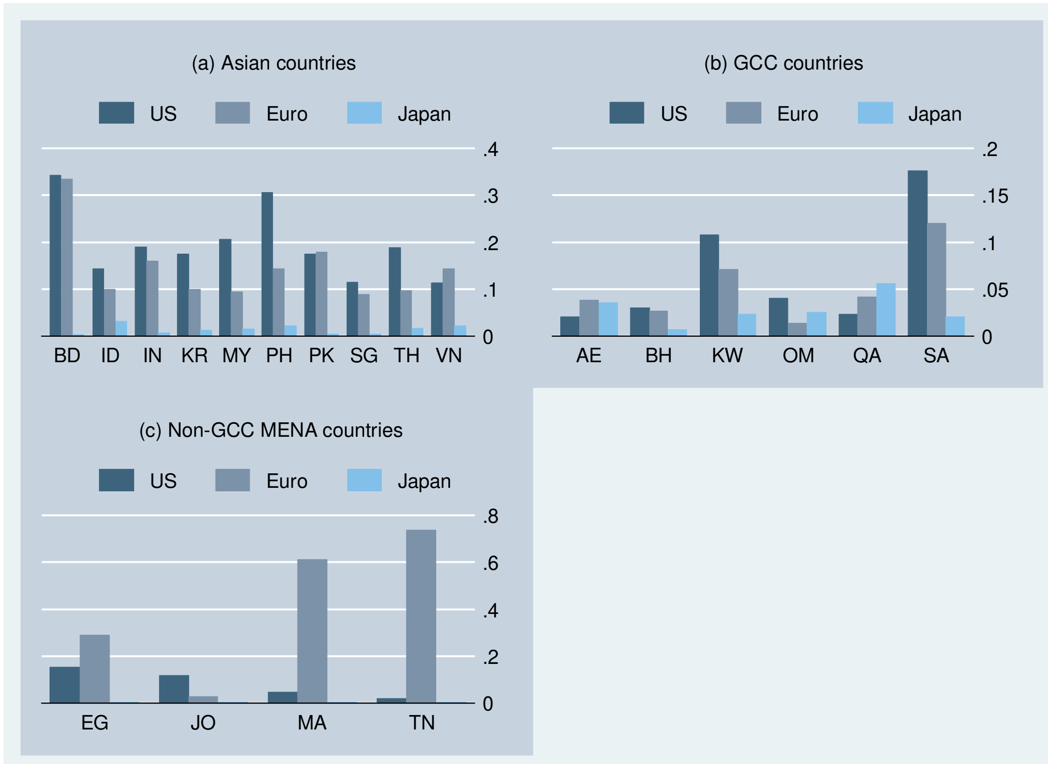

BD, Bangladesh; IN, India; ID, Indonesia; KO, South Korea; MY, Malaysia; PK, Pakistan; PH, the Philippines; SG, Singapore; TH, Thailand; VN, Vietnam; BH, Bahrain; EG, Egypt; JO, Jordan; KW, Kuwait; MA, Morocco; OM, Oman; QA, Qatar; SA, Saudi Arabia; TN, Tunisia; AE, United Arab Emirates

**Figure 2:** Security investments from developed markets to emerging markets (percent)




BD, Bangladesh; IN, India; ID, Indonesia; KO, South Korea; MY, Malaysia; PK, Pakistan; PH, the Philippines; SG, Singapore; TH, Thailand; VN, Vietnam; BH, Bahrain; EG, Egypt; JO, Jordan; KW, Kuwait; MA, Morocco; OM, Oman; QA, Qatar; SA, Saudi Arabia; TN, Tunisia; AE, United Arab Emirates

**Figure 3:** Exports from emerging markets to developed markets (percent of total)




BD, Bangladesh; IN, India; ID, Indonesia; KO, South Korea; MY, Malaysia; PK, Pakistan; PH, the Philippines; SG, Singapore; TH, Thailand; VN, Vietnam; BH, Bahrain; EG, Egypt; JO, Jordan; KW, Kuwait; MA, Morocco; OM, Oman; QA, Qatar; SA, Saudi Arabia; TN, Tunisia; AE, United Arab Emirates