

Equity market contagion during global financial and Eurozone crises:

Evidence from a dynamic correlation analysis

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ABSTRACT

The devastation resulting from the recent global financial and Eurozone crises is immense. Most researchers commonly believe that the global financial crisis originated in the United States, and spread immediately to global financial hubs where it eventually became the Eurozone crisis. Several studies have been conducted on financial market contagion during both global and Eurozone crises; however, the issue of whether equity market contagion spreads from the United States to the world equity markets during these crises has not been addressed yet. Using US dollar-denominated MSCI daily indices from fifty-five equity markets for the period 2003–2013, we have found evidence of contagion in developed and emerging markets during the global and Eurozone crises. We show that contagion spread from the United States to the world markets during both crises. Our regression results identify that the bank risk transfer between the United States and other countries is the key transmission channel for cross-country correlations. This study has an important policy implication for portfolio diversification between the United States and other countries during these crises.

Keywords: Contagion, Financial markets, Global financial crisis, Eurozone crisis

JEL classification: F36, G01, C58

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1. Introduction

The world financial system has experienced two interrelated crises in recent years— the global financial crisis (hereafter GFC) and the Eurozone crisis (hereafter EZC). The source of the GFC was the subprime credit crisis in the United States. The bankruptcy of Lehman Brothers was the world's first indication of the imminent global financial crisis. The Lehman bankruptcy was followed by the takeover of Merrill Lynch by Bank of America, and the consequent rescue of AIG. The crisis inevitably spread throughout the world, especially to Europe. Although the PIIGS (Portugal, Italy, Ireland, Greece and Spain) countries were severely affected, the situation in Greece has been worse since the EZC hit the Euro area in 2010. Analysts agree that the world has experienced the deepest recession since World War II.

Financial market contagion⁴ is a widely discussed term within financial market research. The empirical studies investigate equity market contagions in the 1987 US stock market crash, the Asian, Russian, Mexican, Brazilian, global, and Eurozone crises. King and Wadhvani (1990) show that the correlations between the United States, the United Kingdom, and other developed markets increased significantly following the 1987 crash. Lee and Kim (1993), extending this analysis to a dozen countries that include emerging markets, confirmed increased correlations, and thus contagion, during the 1987 crash. Calvo and Reinhart (1996) investigate the 1994 Mexican crisis, and show that correlations increased in a group of emerging markets. Forbes and Rigobon (2002), studying the 1994 Mexican and the 1997 Asian crises, report no contagion but find interdependence in both episodes among 24 developed and emerging countries. However, Chiang et al. (2007) show contagion during the two phases of the Asian crisis, using a longer sample period. Baig and Goldfajn (1998) also find the presence of a contagion effect between equity and currency markets during the Asian currency crisis. Caporale et al. (2005) study the Asian crisis, and find a significant increase in co-movements among a group of South East Asian countries, and thereby conclude the co-movements are contagion. The study by Corsetti et al.

⁴ Researchers define contagion as an excessive increase in the correlation among the countries causing the crisis and all other countries (see Masson, 1998 and 1999; Masson and Mussa, 1995; Calvo and Reinhart, 1996; Forbes and Rigobon, 2002; Pesaran and Pick, 2003; Pericoli and Sbracia, 2003; and Corsetti et al., 2005). Dornbusch et al. (2000) and Pritsker (2001) adopt the definition of contagion as the dissemination of market disturbances, primarily with negative consequences, from one market to another. Bekaert et al. (2005) also identify contagion in equity markets as the idea that markets move more closely together during periods of crisis. However, Sachs et al. (1996) illustrate financial market contagion as a significant increase in cross-country correlations of stock market returns and volatilities.

(2005) is somewhat different from the existing studies on Asian crisis. Their study offers contagion for only five countries from a sample of seventeen countries (developed and emerging).

Goldfajn and Baig (2000) examine whether there was contagion during the Russian crisis with regard to Brazil, and conclude that contagion occurred, and that the mechanism of propagation was the debt securities market. Hon et al. (2004) test whether the terrorist attacks on the United States of September 11, 2001, resulted in contagion in the financial market. Their results indicate that international stock markets, particularly in Europe, responded closely to the US stock market shocks during the three to six months following the attacks. Capiello et al. (2006) also conclude that, during periods of financial turmoil, equity market volatilities show important linkages, and conditional equity market correlations among similar regional groups increase dramatically.

Furthermore, by pursuing a contagion analysis on BRIC (Brazil, Russia, India and China) countries, UK, and US data, Kenourgios et al. (2011) conclude that contagion spreads from the crisis country to other countries during the Brazilian, Asian, and Russian crises. Chudik and Fratzscher (2011) study 26 economies (defining the European Union area as a single economy) by using weekly data, and find that the tightening of financial conditions was the key transmission channel in advanced economies, whereas the real side of the economy was the main channel in emerging economies. Samitas and Tsakalos (2013) examine the correlation dynamics between Greek and European markets during the GFC and Greek crises, and report contagion during GFC, but not during the Greek crisis. Nevertheless, Kenourgios (2014) investigates volatility contagion across the United States and European stock markets during GFC and EZC, and finds the evidence of volatility contagion during both crises. In a nutshell, researchers have come to different conclusions depending on the econometric methods⁵ they use to identify contagion, even though the general definition of contagion is the same.

⁵ Using a correlation analysis, Lee and Kim (1993) find evidence of contagion in the global stock markets after the 1987 US stock market crash. Chiang et al. (2007) use the dynamic conditional correlation (DCC) model of Engle (2002) to capture contagion in nine Asian stock markets (using daily stock-returns) during the 1997 crisis. Their study provides evidence of contagion in terms of increasing correlations. However, Boyer et al. (1999) and Forbes and Rigobon (2002) develop a measure of interdependence in order to test the change in correlation due to co-movements in the volatility of asset prices. A linear transmission mechanism is used where restrictions on the variance of the common factors relative to the variance of the country-specific shock are imposed. On the other hand, Corsetti et al. (2005) define contagion for asset prices as the observed pattern of co-movements that is too strong (or too weak) compared to the predicted co-movements that are conditional on a linear transmission mechanism across countries. Corsetti et al. (2005) argue that enhanced correlations across countries during a financial crunch does not provide evidence for contagion. Samarakoon (2011) uses a VAR framework on 63 emerging and frontier markets to produce counterintuitive results that contagion does not spread from the United States to emerging markets (except for Latin America), but from emerging markets to the US market.

The purpose of our paper is to investigate market contagion across countries due to the GFC and the EZC. Although a large number of studies have been conducted on the 1987 US stock market crash and the Asian, Russian, Mexican, Brazilian, global (GFC), and Eurozone (EZC) crises, the studies on equity market contagion due to the GFC and the EZC are still scarce, especially considering the United States as the source of contagion; however several recent studies examine sovereign bond and CDS contagion (for example Arghyrou and Kontonikas, 2012; Kalbaska and Gatkowski, 2012; Metiu, 2012; Mink and Haan, 2013; Claeys and Vasicek, 2014; and Gunduz and Kaya, 2014). We adopt a definition of contagion as the significant increase in the conditional correlations between the pre-crisis and crisis periods. By using daily MSCI US-dollar denominated price indices for 55 stock markets for the period from 2003 to 2013, we find that the evidence of contagion in developed and emerging markets during both the GFC and the EZC indicates the United States as a source of contagion. We find that Latin American emerging countries are affected during both crises, but Asian emerging countries are partially affected by the GFC. Conversely, African and Middle Eastern emerging countries are unaffected by the GFC, although they are partially affected by the EZC. We also report that crises (either GFC or EZC) are common phenomena for developed countries. We additionally show bank risk transfer between the United States and other countries as the primary transmission channel for the cross-country correlation, even though an exception is reported in African and Middle Eastern countries. We further show that the difference in the real interest rates between the United States and other countries is the secondary transmission channel only for the cross-country correlations in developed markets.

This paper contributes to the literature in several ways: **First**, our study builds on Forbes and Rigobon (2002) and extends to Hon et al. (2004) and Chiang et al. (2007) for the GFC and the EZC. Forbes and Rigobon (2002) emphasize that correlation coefficients are subject to market volatility, and hence, after adjusting this bias, there is no increasing correlation (contagion). However, by employing a similar heteroskedasticity adjustment, Hon et al. (2004) and Chiang et al. (2007) show contagion during the 9/11 terrorist attack and Asian crisis respectively. We show a similar result as Hon et al. (2004) and Chiang et al. (2007) during GFC and EZC, after taking into account Forbes and Rigobon's heteroskedasticity adjustment. We also distinguish the contagion effect between developed and emerging markets, and classify differences in contagion behaviour between five emerging market groups. **Second**,

our study complements Caporale et al. (2005), Carrieri et al. (2007), Wälti (2011), and Christoffersen et al. (2012) by offering empirical evidence on transmission channels of contagion. These studies illustrate that the channel of transmission can vary during the crisis due to a change in the investors' behaviour. Our study tests several economic and financial channels as possible sources for the changes in the correlations during both the GFC and the EZC, and identify bank risk transfer between the United States and other countries as the primary transmission channel for contagion. **Third**, our study also complements Christoffersen et al. (2012) with regards to co-movement and portfolio diversification. Christoffersen et al. (2012) highlight that the diversification opportunities in the developed markets have diminished in recent years, while the emerging markets still possess some diversification benefits for global investors. However, our results indicate that diversification benefits decay for most of the countries during the GFC and for European countries during the EZC.

The remainder of the paper is structured as follows: In Section 2 we describe the correlation analysis, which is the backbone of the contagion research. Section 3 presents the vector autoregressive framework, while in Section 4 we describe the dynamic conditional correlations and how they are obtained. In Section 5 we present the determinants of contagion, and Section 6 concludes the paper.

2. Correlation analysis

A correlation analysis is widely used for measurement of financial market contagion. Contagion is defined as the significant increase in the conditional correlations between the pre-crisis and crisis periods. This correlation refers to when volatility transmits from a crisis-affected country to another country. However, Forbes and Rigobon (2002) argue that heteroskedasticity (changing volatility) in the market returns cause increasing correlation, or contagion, and disappear fully through the adjustment of the correlation coefficients for the heteroskedasticity. As we consider the United States to be the source of the contagion, we generate bi-variate conditional correlations between the United States and other countries. We conduct the heteroskedasticity-adjusted correction of the coefficients to test for contagion⁶.

⁶Forbes and Rigobon (2002) propose an adjusted correlation coefficient, ρ^* , as: $\rho^* = \rho / \sqrt{1 + \delta[1 - \rho^2]}$ with $\delta = \left(\frac{\text{Var}(r_{2,t})_h}{\text{Var}(r_{2,t})_l} \right) - 1$, where ρ is the unadjusted correlation coefficient varying with the high volatility period (crisis) or low-volatility period (pre-crisis); $\rho = \text{Corr}(r_{1,t}, r_{2,t}) = \frac{\text{Cov}(r_{1,t}, r_{2,t})}{\sqrt{\text{Var}(r_{1,t})\text{Var}(r_{2,t})}} = \frac{\beta_1 \text{Var}(r_{2,t})}{\sqrt{[\beta_1^2 \text{Var}(r_{2,t}) + \text{var}(v_1)]\text{Var}(r_{2,t})}} = \left[1 + \frac{\text{Var}(v_1)}{\beta_1^2 \text{Var}(r_{2,t})} \right]^{-1/2}$, where $r_{1,t}$ and $r_{2,t}$ are stock returns in markets 1 and 2 at time t , respectively, in

However, we use the Fisher Z transformation⁷ of the correlation coefficients to test the pairwise cross-country significance. For the contagion test, we consider the one year before the beginning of the GFC as the pre-GFC period, and 01 January 2010 to 01 May 2010 as the pre-EZC period. We use daily MSCI US-dollar denominated stock price indices from 01 January 2003 to 31 December 2013 for 55 stock markets⁸.

The test results are reported in Table 1. The heteroskedasticity adjusted Z-statistics confirm contagion in 19 (30) countries during the GFC (EZC). These results support Chiang et al. (2007) and Hon et al. (2004), who argue that there is contagion even after the heteroskedasticity adjustment. The adjusted Z-statistics show that 10 (9) developed (emerging) countries are affected by contagion out of 21 (34) sample countries during the GFC, whereas 17 (13) developed (emerging) countries are affected by contagion out of 21 (34) sample countries during the EZC. These results demonstrate that the United States is a source of contagion during the EZC compared to the GFC. Among the European countries, of the 23 (15) developed and 8 emerging) in the sample, 11 (8 developed and 3 emerging) are affected during the GFC and 22 (14 developed and 8 emerging) are affected during the EZC. These results show that the GFC spread across global countries, whereas the EZC is more specific to European countries. However, Latin American emerging countries are equally affected during both crises. The Asian emerging countries are partially affected by the GFC, but are untouched during the EZC. African and Middle Eastern emerging countries are unaffected by the GFC, but partially affected by the EZC.

[Insert Table 1 about here]

3. Vector autoregressive and endogeneity problem

To estimate the cross-market correlations, we follow Hon et al. (2004) and use the unrestricted vector auto regression (VAR), which was originally developed by Forbes and Rigobon (2002). We use five

the equation $r_{1,t} = \beta_0 + \beta_1 r_{2,t} + v_{1,t}$; and $v_{1,t}$ is the stochastic noise independent of $r_{2,t}$; δ is the relative increase in variance of r_2 . The $Var(r_2)_h$ and $Var(r_2)_l$ are the variance of r_2 in a high-volatility period and a low-volatility period, respectively.

⁷ Morrison (1983) suggests that test statistics for the null hypothesis of no increase in the correlations, $T = \frac{(Z_0 - Z_1)}{\sqrt{\left(\frac{1}{(N_0 - 3)} + \frac{1}{(N_1 - 3)}\right)}}$, where

$Z_0 = 0.5 * \ln((1 + \rho_0) / (1 - \rho_0))$ and $Z_1 = 0.5 * \ln((1 + \rho_1) / (1 - \rho_1))$ are Fisher transformations in the pre- and crisis periods; N_0 and N_1 are the number of observations in the pre- and crisis periods. The test statistics are approximately normally distributed and are fairly robust to the non-normality of the correlation coefficients after the Fisher transformation. Hon et al. (2004), Chiang et al. (2007), Basu (2002), and Corsetti et al. (2005) use the Fisher Z transformation in their studies.

⁸ We collect the data from Thomson Reuters' Datastream. Out of 55 countries, 21 are developed and 34 are emerging. We classify the developed markets by region as European, Asian, and American developed markets. We also classify the emerging countries by following Wang and Moore (2012) as African and Middle Eastern, American, Asian, and European emerging markets. By following Mobarek et al. (2014) and Ahmed et al. (2009), we determine the GFC as the period from 09 August 2007 to 31 December 2009 and the EZC as for the period from 02 May 2010 to 09 June 2013.

lags to filter out the possible autocorrelations in trading patterns, and we implement the VAR framework as specified below to estimate the variance-covariance matrix for pre-crisis and crisis periods. The model is specified as follows:

$$R_t = m + \Phi(L)R_t + \Gamma_t \dots \dots (1)$$

$$R_t = \{r_t^{US}, r_t^i\} \dots \dots (2)$$

where R_t is the vector of returns in two markets, m is the constant, $\Phi(L)$ is the vector of the lags, Γ_t is the vector of disturbances, r_t^{US} is the US market return as a global factor⁹, and r_t^i is the market return in market i .

Due to the fact that the global crisis originated in the United States, we assume that the observable shock on the US market transmits to the other countries during both the GFC and the EZC. We use the VAR-Granger causality approach to test the significance of off-diagonal elements. The VAR process is adjusted for heteroskedasticity in the sample. By following Hon et al. (2004), we report the results for VAR-Granger causality in Table 2. We find that the null hypothesis of no causality is rejected in all of the countries except for Nigeria and Pakistan during the GFC and in Spain, Morocco, Argentina, Brazil, and Mexico during the EZC. However, we find a low degree of reverse causality for some developed countries like Canada, Australia, France, Germany, and the United Kingdom during the GFC, but none during the EZC. These results indicate that there is no feedback effect from other markets during the EZC and a weak feedback effect during the GFC. Nevertheless, they support weak exogeneity and also confirm that the GARCH specification does not suffer from endogeneity problems.

[Insert Table 2 about here]

4. Dynamic conditional correlation

We test whether the correlations are static or dynamic in nature. Testing the model for constant correlations is difficult, because testing for dynamic correlations requires using data with time-varying volatilities that can result in a misleading conclusion (Engle and Sheppard, 2001), and rejection of a true constant correlation because of mis-specified volatility models. On the one hand, Tse (2000) conducts a null constant conditional correlation (CCC) against an autoregressive conditional heteroskedasticity

⁹By following Chiang et al. (2007) and Dungey et al. (2003), we use lagged US return as a global disturbance factor in our mean model.

(ARCH) as a correlation alternative. Bera and Kim (1996) also test a null CCC against a diffuse alternative. Engle and Sheppard (2001) stress that both alternatives fail to generalize the vector at a higher order, which has been identified as a limitation in the testing procedure of a null CCC against a dynamic (DCC) alternative; therefore, they suggest testing a null CCC against a DCC within a vector autoregressive framework.

Following Engle and Sheppard (2001), we use a null CCC against a DCC alternative in a higher order vector autoregressive (VAR) to satisfy the condition that the specific return series and the US returns experience a dynamic correlation. We apply a seemingly uncorrelated regression (SUR) between individual series; US returns have a null $H_0: \alpha = 1 - \beta$ against the DCC alternative. Under the null, the constant and all of the lagged parameters in the model should be zero. The primary conditions of a DCC are satisfied through the estimations,¹⁰ thus we apply the DCC framework to identify the presence of contagion at the country level and augment this model with asymmetric influences, as shown by Cappiello et al. (2006).

For each country i at time t , we specify the return equation as:

$$r_{i,t} = \alpha_0 + \beta_i r_{i,t-1} + \beta_2 r_{t-1}^{US} + \varepsilon_{i,t} \quad (3)$$

where $r_{i,t}$ is the country-specific return, $r_{i,t-1}$ is the country-specific lag return, r_{t-1}^{US} is the US market return at time $t-1$, and $\varepsilon_{i,t} | \mathfrak{F}_{t-1} \approx N(0, H_t)$. By following our earlier definition, we use lagged US return as a global disturbance factor in our mean model (see Chiang et al., 2007; and Dungey et al., 2003).

Following Engle (2002) and Cappiello et al. (2006), we estimate the multivariate DCC-GARCH using the following equations:

$$r_{i,t} | \mathfrak{F}_{t-1} \approx N(0, D_t R_t D_t) \quad (4)$$

$$D_t = \text{diag}\{\sqrt{h_{i,t}}\} \quad (5)$$

$$Q_t = (1 - a - b)\bar{R} + a\varepsilon_{t-1}\varepsilon'_{t-1} + bQ_{t-1} \quad (6)$$

$$R_t = Q_t^{*-1} Q_t Q_t^{*-1} \quad (7)$$

where $D_t = \text{diag}\{\sqrt{h_{i,t}}\}$ is an $n \times n$ diagonal matrix with the square roots of the conditional variances in the diagonal, $h_{i,t}$ is obtained by a GARCH(1,1), $\varepsilon_{it} = r_{it}/\sqrt{h_{it}}$ is the standardized residual, r_{it} is the

¹⁰The results are available on request.

return of series i at time t , and $\bar{R} = E[\varepsilon_t \varepsilon_t']$; $Q_t^* = [q_{iit}^*] = [\sqrt{q_{iit}}]$. We obtain the a and b by maximizing the log-likelihood of the DCC process given by the following equation:

$$L = -\frac{1}{2} \sum_{t=1}^T (n \log(2\pi) + 2 \log|D_t| + \log|R_t| + \varepsilon_t' R_t^{-1} \varepsilon_t + r_t' D_t^{-1} D_t^{-1} r_t - \varepsilon_t' \varepsilon_t) \quad (8)$$

An imposed restriction on the model is that $a + b < 1$. We obtain the pattern of the dynamic correlations by using Eq. (7), for which the dynamic correlation between series i and j at time t is equal to R_{ijt} . We proceed to apply the DCC framework to identify the presence of contagion at the country level.

Table 3 reports the estimates of the returns by using Eq. (3) and the conditional variance by using Eq. (6). We report the estimates of the returns in Panel A. We find that the AR (1) is negative (significant) for all of the developed countries that indicate the presence of positive feedback trading in these markets. However, the AR(1) is positive (significant) in emerging markets with a few exceptions, which indicates that price friction or partial adjustment exists in the emerging markets. These results are consistent with Antoniou et al. (2005) and Chiang et al. (2007), who find that advanced markets have a positive feedback effect, and emerging markets have price friction. The lagged US coefficients (r_{t-1}^{US}) are large (positive) and highly significant for all of the countries. These coefficients show that the United States is a global disturbance factor that has a significant influence on the returns of other countries.

We report conditional variance GJR estimates from the DCC-GARCH (1,1) model in Panel B of Table 3. The coefficients for the lagged variance and shock-squared terms in the DCC-GARCH equation (Eq. 6) are highly significant, and indicate a time-varying volatility. These results also justify the specification of the GARCH (1,1). However, the sum of the lagged variance and the shock-squared terms ($\alpha + \beta$) is close to one. This result shows the presence of volatility persistence in both developed and emerging markets. We report the DCC coefficients in column 9. We find from this column that the dynamic correlations are generally high in developed countries; diverse correlations are reported in emerging markets. Specifically, the dynamic correlations between the United States and the emerging countries of Africa, the Middle East, and Asia are very low; they are high with the Latin American emerging markets, and moderate with European emerging markets.

[Insert Table 3 about here]

We also present the pairwise regional DCC graphs in Figure 1. The graph illustrates that developed markets have a high degree of correlation with the United States, whereas emerging markets have a low degree of correlation. However, market contagion is visible during both the GFC and EZC periods.

[Insert Figure 1 about here]

Furthermore, we estimate the dynamic feature of the correlation changes during the GFC and the EZC. We introduce GFC and EZC dummies to capture the crises regimes in the mean equation (Eq. 9) as below:

$$\widehat{\rho}_{i,US,t} = \gamma_0 + \gamma_1 \widehat{\rho}_{i,US,t-1} + \delta_1 GFC + \delta_2 EZC + v_t \quad (9)$$

where $\widehat{\rho}_{i,US,t}$ is the DCC coefficient between market i and the US market at time t , the GFC and EZC are dummy variables for the crises period, and v_t is the error term. The ARCH-LM test statistics are rejected for all countries. This result confirms the significant heteroskedasticity in the DCC coefficient, and indicates that the conditional variance equation follows a GARCH (1,1) process. Thus, we propose Eq. (10) for the variance equation:

$$h_t = \omega + \alpha h_{t-1} + \beta \varepsilon_{t-1}^2 + \delta_1 GFC_t + \delta_2 EZC_t + \varepsilon_t \dots \quad (10)$$

where, h_t is $\rho_{i,US}^2$. The presence of contagion is identified with the significant positive coefficient of δ .

The significance of the estimated coefficients of the dummy variables indicates structural changes in mean/variance shifts of the correlation coefficients, due to external shocks during the GFC and/or EZC. Table 4 reports the results for the mean model (Panel A: Eq. 9) and the variance model (GARCH) (Panel B: Eq. 10).

In Panel A, we find that both the GFC and EZC coefficients are highly significant for developed markets. This significance indicates that crises are common phenomena for developed countries, and structural shifts in the correlation coefficients are due to external shocks during the GFC and the EZC. However, the coefficients for the crises are largely insignificant for African, Middle Eastern, and Asian emerging markets with some exceptions, but the coefficients for the European emerging markets are

highly significant during the EZC. In Panel B, the estimates of the GARCH (1,1) model are reported. The coefficients for both crises are positive and highly significant except for Egypt, Lebanon, Mauritius, and Pakistan. The results indicate more volatile changes in the correlation coefficients during the crises. The evidence thus suggests that when the crisis hits the market, the correlation coefficients could vary greatly, and this variability could be prolonged for a significant period of time. The test statistics for the robustness checks for crisis dummies are rejected for all countries except for Egypt, Lebanon, Mauritius, and Pakistan, indicating that the results are robust between the crisis periods¹¹.

[Insert Table 4 about here]

5. Determinants of cross-country correlation

Despite the fact that the noise of the correlation coefficients could be sensitive to cross-country variation in the macroeconomic variables and country characteristics, we apply the multivariate regression analysis in Eq. (11) to the country-year setting, to determine the driving forces behind the cross-country correlation:

$$\rho_{i,US,t} = \alpha_0 + \alpha_1\rho_{i,US,t-1} + \beta_1Risk_{i,t} + \beta_2Interest_{i,t} + \beta_3Trade_{i,t} + \beta_4GDP_{i,t} + \beta_5Spread_{i,t} + \beta_6Market_{i,t} + \beta_7Corruption_{i,t} + \gamma_1GFC_t + \gamma_2EZC_t + \varepsilon_t \dots (11)$$

Where the yearly average of the DCC coefficient ($\rho_{i,US,t}$) is the dependent variable. The independent variables are the difference in the net bank risk transfers between the United States and other countries (risk)¹², the difference in the real interest rates between the United States and other countries (interest), the difference in the trade balances between the United States and other countries (trade), the difference in the GDP growth rates between the United States and other countries (GDP), the difference in the term spreads between the United States and other countries (spread), the difference in the market capitalizations between the United States and other countries (market), the difference in the perceptions of corruption between the United States and other countries (corruption), and the GFC and EZC dummies.

¹¹The results for the robustness tests are available on request.

¹²Net risk transfer is the proxy for country risk exposure. Bank for International Settlements (BIS) reports annualized data for banks' financial claims for one country on other countries. We have calculated the difference of net risk transfer between the United States and other countries in the sample on an immediate borrower basis (i.e. the claims allocated to the country where the original risk lies). We have collected net risk transfer data from Thomson Reuters.

The results are reported in Table 5. Models 1–3 report the results for the full sample; model 4 reports the results for developed countries; model 5 is for results from emerging countries; and models 6–9 are for results from African, American, Asian, and European emerging countries. In general, our results illustrate that the United States’ bank risk transfer is a key driving force for the cross-country conditional correlations, with the exceptions of African and Middle Eastern emerging countries. The difference in real interest rates influences the cross-country correlations in developed countries.

[Insert Table 5 about here]

6. Conclusion

The purpose of this paper is to investigate market contagion across countries due to the GFC and the EZC. By using daily MSCI US-dollar stock price indices for 55 stock markets for the period from 2003 to 2013, we find evidence of contagion in developed and emerging markets during the GFC and the EZC. This evidence shows that the United States is a source of contagion during both crises. These results also indicate that the GFC is more of a global phenomenon than the EZC. However, Latin American emerging countries are equally affected during both crises, but Asian emerging countries are partially affected by the GFC and untouched by the EZC. African and Middle Eastern emerging countries are unaffected by the GFC but partially affected by the EZC. We find that both the GFC and EZC dummies are highly significant for developed markets, but the EZC dummy is particularly significant for European emerging markets. Finally, we find that the net bank risk transfers between the United States and other countries are a key driving force for changes in the cross-country conditional correlations for markets, except those in Africa and the Middle East. Our findings are robust across the crisis periods.

The paper has a major implication for international portfolio diversification. The findings of the paper indicate that the benefits of portfolio diversification were significantly decayed during both crises. Our contagion results between the United States and developed countries illustrate that diversification was not beneficial during either crisis. The contagion results for the emerging markets have different implications on portfolio diversification. For example, diversification decays equally between both crises for the Latin American emerging countries. On the other hand, the benefits of diversification partly mitigate the GFC in Asian emerging countries, but they affect African and Middle Eastern emerging

countries during the EZC. Nevertheless, bank risk transfer leaves an important implication for cross-country banking portfolios.

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Figure 1 -Dynamic Conditional Correlation (DCC) of the stock returns between US, Developed, and Emerging Countries for the period 2003-2013.

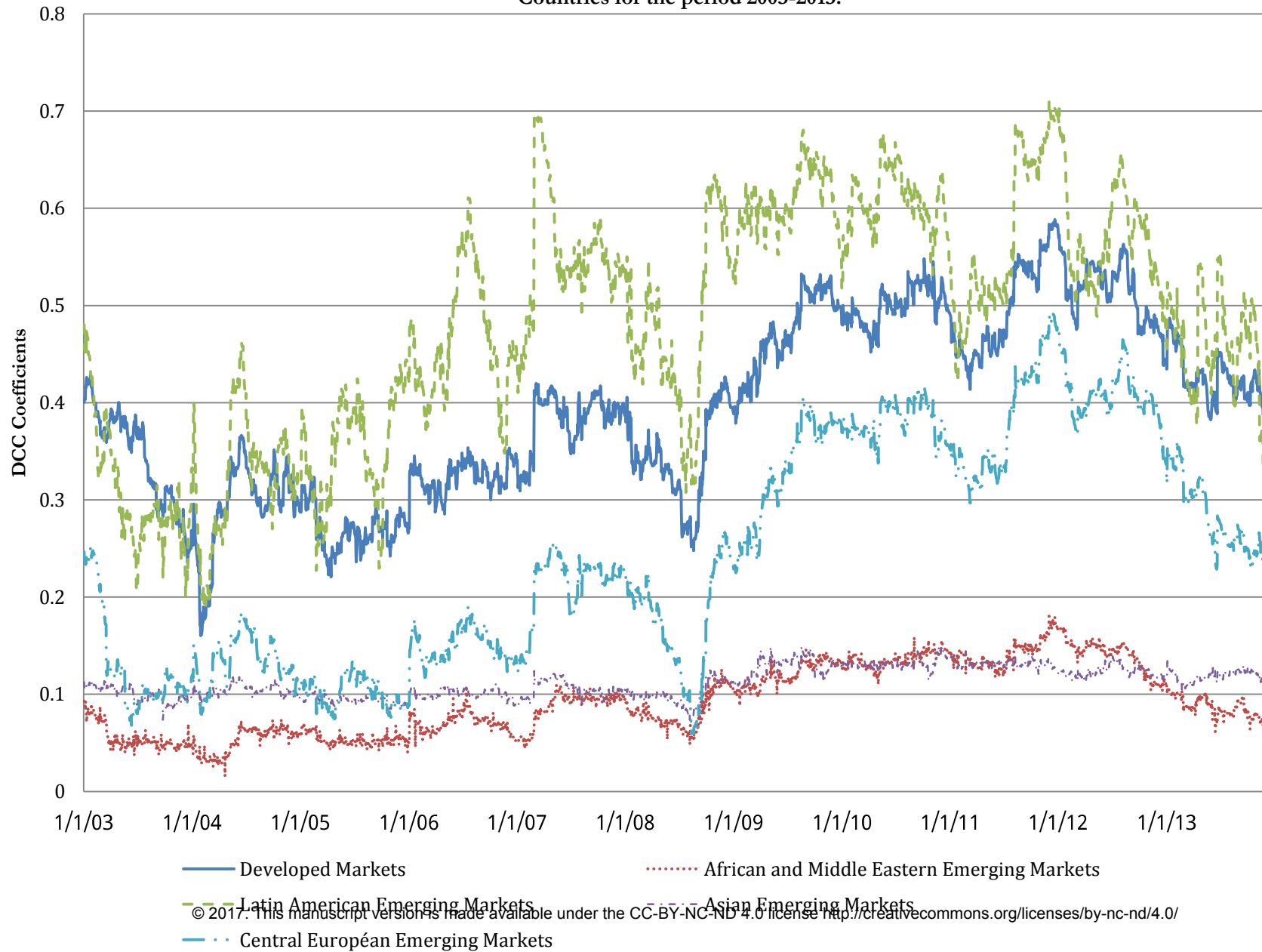


Table 1
Test of significant increases in conditional correlation coefficients between the US and other countries

This table reports the test statistics for contagion. We define contagion as a significant increase in the conditional correlations between pre-crisis and crisis periods. The C indicates contagion and N indicates no contagion. The **, and *** represent the p-values <0.10, <0.05, and <0.01.

Country	Category	Conditional Correlations (Adjusted FR)				Z-statistics (adjusted)				Country	Category	Conditional Correlations (Adjusted FR)				Z-statistics (adjusted)			
		Global Crisis		Eurozone Crisis		Global Crisis	Contagion?	Eurozone Crisis	Contagion?			Global Crisis		Eurozone Crisis		Global Crisis	Contagion?	Eurozone Crisis	Contagion?
		Pre-crisis Period	Crisis Period	Pre-crisis Period	Crisis Period							Pre-crisis Period	Crisis Period	Pre-crisis Period	Crisis Period				
Canada	Developed America	0,252	0,413	0,474	0,706	-2,463***	C	-3,161***	C	South Africa	Emerging Africa & Middle East	0,104	0,174	0,206	0,431	-0,954	N	-2,182**	C
Australia	Developed Asia	0,045	0,097	0,144	0,350	-0,711	N	-1,913**	C	Turkey	Emerging Africa & Middle East	0,115	0,203	0,253	0,362	-1,227	N	-1,052	N
Japan	Developed Asia	0,001	0,010	0,059	0,053	0,119	N	-0,971	N	Argentina	Emerging America	0,231	0,275	0,392	0,504	-0,628	N	-1,222	N
New Zealand	Developed Asia	0,011	0,085	0,151	0,261	-1,005	N	-1,000	N	Brazil	Emerging America	0,329	0,380	0,422	0,627	-0,783	N	-2,489***	C
Singapore	Developed Asia	0,055	0,146	0,128	0,342	-1,240	N	-1,971**	C	Chili	Emerging America	0,182	0,286	0,208	0,481	-1,489*	C	-2,719***	C
Austria	Developed Europe	0,091	0,206	0,234	0,532	-1,582*	C	-3,074***	C	Colombia	Emerging America	0,117	0,167	0,273	0,362	-0,685	N	-0,856	N
Belgium	Developed Europe	0,141	0,226	0,261	0,539	-1,196	N	-2,913***	C	Mexico	Emerging America	0,324	0,427	0,404	0,646	-1,623*	C	-2,947***	C
Denmark	Developed Europe	0,122	0,204	0,214	0,451	-1,143	N	-2,328***	C	Peru	Emerging America	0,132	0,318	0,459	0,531	-2,660***	C	-0,831	N
Finland	Developed Europe	0,127	0,215	0,162	0,562	-1,219	N	-4,098***	C	China	Emerging Asia	0,036	0,108	0,082	0,169	-0,978	N	-0,766	N
France	Developed Europe	0,181	0,268	0,299	0,608	-1,237	N	-3,442***	C	Hong Kong	Emerging Asia	0,049	0,106	0,104	0,165	-0,775	N	-0,536	N
Germany	Developed Europe	0,175	0,295	0,313	0,606	-1,724**	C	-3,285***	C	India	Emerging Asia	0,046	0,147	0,106	0,228	-1,386*	C	-1,089	N
Greece	Developed Europe	0,111	0,145	0,163	0,266	-0,476	N	-0,938	N	Indonesia	Emerging Asia	0,013	0,065	0,081	0,141	-0,708	N	-0,530	N
Ireland	Developed Europe	0,120	0,210	0,166	0,517	-1,248	N	-3,509***	C	Korea	Emerging Asia	0,049	0,090	0,067	0,187	-0,550	N	-1,060	N
Italy	Developed Europe	0,145	0,245	0,284	0,554	-1,404*	C	-2,878***	C	Malaysia	Emerging Asia	0,028	0,057	0,103	0,128	-0,401	N	-0,218	N
Netherlands	Developed Europe	0,155	0,270	0,294	0,593	-1,624*	C	-3,298***	C	Pakistan	Emerging Asia	0,012	0,008	0,011	0,026	0,057	N	0,131	N
Norway	Developed Europe	0,097	0,218	0,294	0,554	-1,682**	C	-2,788***	C	Philippine	Emerging Asia	0,007	0,028	0,027	0,053	-0,288	N	-0,696	N
Spain	Developed Europe	0,156	0,253	0,278	0,510	-1,371*	C	-2,405***	C	Sri Lanka	Emerging Asia	0,007	0,008	0,015	0,006	-0,017	N	0,186	N
Sweden	Developed Europe	0,127	0,245	0,322	0,583	-1,653**	C	-2,889***	C	Taiwan	Emerging Asia	0,006	0,059	0,047	0,167	-0,713	N	-1,060	N
Switzerland	Developed Europe	0,133	0,229	0,239	0,527	-1,335*	C	-2,966***	C	Thailand	Emerging Asia	0,013	0,136	0,045	0,151	-1,672**	C	-0,932	N

UK	Developed Europe	0,155	0,265	0,350	0,584	-1,548*	C	-2,626***	C	Croatia	Emerging Europe	-	0,004	0,121	0,062	0,230	-1,694**	C	-1,491*	C
Egypt	Emerging Africa & Middle East	-	0,022	0,045	0,053	0,008	-0,910	0,393	N	Czech Republic	Emerging Europe	0,085	0,151	0,175	0,388	-0,912	N	-2,018**	C	
Jordan	Emerging Africa & Middle East	-	0,005	0,015	0,071	0,035	0,279	-0,312	N	Estonia	Emerging Europe	0,042	0,057	0,016	0,254	-0,202	N	-2,121**	C	
Kenya	Emerging Africa & Middle East	-	0,042	0,014	0,074	0,036	-0,746	0,328	N	Hungary	Emerging Europe	0,064	0,208	0,229	0,448	-1,983**	C	-2,159**	C	
Lebanon	Emerging Africa & Middle East	-	0,015	0,042	0,037	0,015	-0,773	0,184	N	Poland	Emerging Europe	0,118	0,177	0,204	0,493	-0,808	N	-2,890***	C	
Mauritius	Emerging Africa & Middle East	0,029	0,014	0,039	0,006	0,209	0,284	0,284	N	Portugal	Emerging Europe	0,086	0,181	0,307	0,472	-1,303*	C	-1,701**	C	
Morocco	Emerging Africa & Middle East	-	0,029	0,058	0,012	0,200	-1,167	-1,656**	N	Russia	Emerging Europe	0,078	0,190	0,283	0,484	-1,541*	C	-2,058**	C	
Nigeria	Emerging Africa & Middle East	-	0,024	0,011	0,029	0,033	0,475	-0,543	N	Slovenia	Emerging Europe	0,007	0,080	0,042	0,196	-0,990	N	-1,362*	C	

Table 2
Granger Causality

This table reports the bi-directional Granger causality test statistics between the US and other countries before and during both the GFC and the EZC. The symbol → implies a null hypothesis of no Granger causality. A significant value (with White's [1980] correction for heteroskedasticity) rejects no causation and implies that the lagged variables can help explain or predict current movements in the other countries. The *, **, and *** represent p-values <0.10, <0.05, and <0.01.

Direction of Causality	Country Category	Before GFC	During GFC	Before EZC	During EZC	Direction of Causality	Country Category	Before GFC	During GFC	Before EZC	During EZC
		F-Statistic	F-Statistic	F-Statistic	F-Statistic			F-Statistic	F-Statistic	F-Statistic	F-Statistic
US → Canada	Developed America	2,224*	7,939***	2,817**	4,309***	US → Kenya	Emerging Africa & Middle East	0,509	7,769***	0,978	3,007***
Canada → US	Developed America	0,452	4,825***	2,590**	0,674	Kenya → US	Emerging Africa & Middle East	0,523	0,928	1,516	0,953
US → Australia	Developed Asia	22,177***	90,613***	5,143***	52,767***	US → Lebanon	Emerging Africa & Middle East	0,377	4,131***	0,940	1,854*
Australia → US	Developed Asia	3,679***	3,087***	2,242*	0,850	Lebanon → US	Emerging Africa & Middle East	0,217	1,012	1,497	0,561
US → Japan	Developed Asia	8,477***	78,965***	4,846***	47,261***	US → Mauritius	Emerging Africa & Middle East	0,561	9,031***	0,596	14,254***
Japan → US	Developed Asia	2,966**	1,493	1,681	1,728	Mauritius → US	Emerging Africa & Middle East	0,977	1,579	1,496	0,676
US → New Zealand	Developed Asia	15,389***	70,565***	3,399***	25,042***	US → Morocco	Emerging Africa & Middle East	0,657	6,711***	0,554	1,336
New Zealand → US	Developed Asia	1,773	1,880*	1,233	1,040	Morocco → US	Emerging Africa & Middle East	1,345	2,317**	0,567	1,535
US → Singapore	Developed Asia	23,417***	23,125***	3,050**	33,817***	US → Nigeria	Emerging Africa & Middle East	0,808	1,631	2,939**	7,649***
Singapore → US	Developed Asia	4,940***	1,413	2,376**	0,246	Nigeria → US	Emerging Africa & Middle East	1,607	1,223	0,974	1,109
US → Austria	Developed Europe	18,691***	24,967***	2,331*	7,764**	US → South Africa	Emerging Africa & Middle East	12,221***	29,860***	3,602***	9,452***
Austria → US	Developed Europe	4,135***	1,261	2,114*	0,927	South Africa → US	Emerging Africa & Middle East	2,621**	3,418***	3,027**	1,120
US → Belgium	Developed Europe	8,501***	11,066***	2,096*	7,279***	US → Turkey	Emerging Africa & Middle East	7,471***	15,714***	1,112	3,807***
Belgium → US	Developed Europe	2,278**	3,414***	2,591**	0,326	Turkey → US	Emerging Africa & Middle East	2,397**	3,306***	0,380	0,555
US → Denmark	Developed Europe	9,902***	27,147***	2,206*	6,821***	US → Argentina	Latin America	0,563	7,217***	1,707	0,379
Denmark → US	Developed Europe	2,667**	2,603**	2,796**	1,041	Argentina → US	Latin America	0,927	3,730***	1,234	0,578
US → Finland	Developed Europe	9,935***	18,702***	0,623	5,663***	US → Brazil	Latin America	1,313	7,318***	1,017	1,215

Finland→ US	Developed Europe	2,842**	2,233**	3,668***	0,907	Brazil→ US	Latin America	2,559**	0,492	1,963*	0,847
US → France	Developed Europe	8,605***	29,786***	2,349**	7,509***	US → Chili	Latin America	3,408***	6,676***	0,938	4,683***
France→ US	Developed Europe	2,299**	2,603**	2,347**	0,409	Chili→ US	Latin America	2,968**	1,662	4,106***	0,992
US → Germany	Developed Europe	9,120***	15,631***	2,048*	8,328***	US→ Colombia	Latin America	4,258***	21,141***	2,650**	3,000**
Germany → US	Developed Europe	2,585**	2,766**	2,478**	0,883	Colombia → US	Latin America	1,573	0,680	1,213	0,619
US → Greece	Developed Europe	7,331***	15,724***	1,293	4,366***	US → Mexico	Latin America	0,503	4,881***	2,986**	1,747
Greece→ US	Developed Europe	1,130	3,914***	1,009	1,662	Mexico → US	Latin America	1,294	2,174*	1,628	1,489
US→ Ireland	Developed Europe	10,088***	15,625***	4,768***	6,266***	US → Peru	Latin America	2,720**	5,387***	1,814	4,524***
Ireland→ US	Developed Europe	2,556**	1,597	0,638	1,658	Peru → US	Latin America	2,224*	1,442	0,816	1,288
US → Italy	Developed Europe	8,185***	23,299***	2,990**	3,155***	US→ China	Emerging Asia	14,132***	29,574***	4,942***	58,800***
Italy→ US	Developed Europe	3,026**	3,405***	2,608**	0,364	China→ US	Emerging Asia	3,616***	0,584	1,829	1,067
US → Netherlands	Developed Europe	8,841***	23,900***	1,719	7,862***	US → Hong Kong	Emerging Asia	17,631***	36,390***	3,595***	51,941***
Netherlands→ US	Developed Europe	4,194***	3,270***	1,630	0,591	Hong Kong→ US	Emerging Asia	5,701***	0,248	2,408**	0,472
US→ Norway	Developed Europe	7,270***	17,698***	2,469**	9,642***	US → India	Emerging Asia	14,525***	11,386***	3,810***	14,591***
Norway → US	Developed Europe	1,669	1,297	3,457***	1,128	India→ US	Emerging Asia	2,566**	0,367	3,131**	0,622
US → Spain	Developed Europe	7,868***	21,908***	2,614**	0,976	US → Indonesia	Emerging Asia	16,179***	24,056***	7,724***	28,103***
Spain → US	Developed Europe	2,224	3,183***	2,950**	0,131	Indonesia → US	Emerging Asia	3,840***	0,652	1,419	1,656
US→ Sweden	Developed Europe	9,700***	18,609***	1,610	8,740***	US → Korea	Emerging Asia	15,329***	31,023***	8,930***	68,529***
Sweden → US	Developed Europe	0,818	1,965*	1,303	1,053	Korea→ US	Emerging Asia	3,425***	2,950**	0,972	0,968
US → Switzerland	Developed Europe	9,240***	29,681***	3,302***	9,322***	US → Malaysia	Emerging Asia	25,206***	26,628***	6,725***	45,537***
Switzerland→ US	Developed Europe	1,869*	1,746	1,669	0,376	Malaysia → US	Emerging Asia	1,855	2,681**	1,297	0,587
US → UK	Developed Europe	11,300***	29,029***	3,195**	16,401***	US → Pakistan	Emerging Asia	2,904**	1,737	3,711***	10,259***
UK→ US	Developed Europe	3,696***	2,515**	2,499**	0,932	Pakistan→ US	Emerging Asia	0,849	0,826	0,668	0,217
US → Egypt	Emerging Africa & Middle East	9,552***	21,729***	1,376	4,575***	US→ Philippines	Emerging Asia	38,062***	65,940***	10,625***	46,641***
Egypt→ US	Emerging Africa & Middle East	0,615	3,183***	1,408	0,548	Philippines→ US	Emerging Asia	3,388***	1,086	1,936*	0,590
US → Jordan	Emerging Africa & Middle East	0,457	12,158***	0,572	3,100***	US→ Sri Lanka	Emerging Asia	2,316**	2,463**	0,589	3,415***
Jordan→ US	Emerging Africa & Middle East	0,767	0,600	1,439	0,564	Sri Lanka → US	Emerging Asia	0,538	1,397	1,164	1,404
US → Taiwan	Emerging Asia	9,788***	30,869***	5,028***	48,778***	US → Hungary	Emerging Europe	6,033***	13,542***	2,860**	2,674**
Taiwan→ US	Emerging Asia	5,322***	1,515	2,731**	0,441	Hungary → US	Emerging Europe	1,953*	2,987**	3,469***	0,361
US → Thailand	Emerging Asia	2,871**	18,365***	2,409**	26,323***	US → Poland	Emerging Europe	4,075***	13,784***	2,979**	5,368***
Thailand→ US	Emerging Asia	0,402	2,142*	0,892	1,648	Poland→ US	Emerging Europe	2,330**	1,648	2,768**	0,663
US → Croatia	Emerging Europe	2,372**	33,318***	2,562**	8,001***	US → Portugal	Emerging Europe	7,162***	22,288***	2,023*	2,046*
Croatia → US	Emerging Europe	0,392	2,228**	0,567	1,145	Portugal → US	Emerging Europe	2,445**	5,249***	1,859	0,357
US → Czech Republic	Emerging Europe	4,403***	22,650***	1,394	2,889**	US → Russia	Emerging Europe	4,995***	7,925***	1,313	7,983***
Czech Republic→ US	Emerging Europe	1,356	1,242	1,462	0,329	Russia→ US	Emerging Europe	0,828	2,848**	2,419**	0,666
US → Estonia	Emerging Europe	3,871***	22,729***	1,020	13,752***	US → Slovenia	Emerging Europe	3,558***	39,005***	0,310	8,264***
Estonia→ US	Emerging Europe	0,404	0,854	3,134**	1,376	Slovenia → US	Emerging Europe	0,286	0,426	1,261	1,120

Table 3
Estimation of results from returns and DCC-GARCH model

This table reports the return estimates by using Eq. (3) (Panel A) and the GJR variance estimates by using the DCC-GARCH (1,1) model (Panel B). T-values are in the parentheses. The*,**, and *** represent the p-values <0.10,<0.05, and <0.01.

Country	Category	Panel A: Return Equation			Panel B: Variance Equation: Multivariate DCC GARCH Model				Country	Category	Panel A: Return Equation			Panel B: Variance Equation: Multivariate DCC GARCH Model			
		α_0 (T-value)	β_1 (T-value)	β_2 (T-value)	Alpha (T-value)	Beta (T-value)	Persistence	DCC Coefficient			α_0 (T-value)	β_1 (T-value)	β_2 (T-value)	Alpha (T-value)	Beta (T-value)	Persistence	DCC Coefficient
Canada	Developed America	0.001* (1.82)	-0.153** (-2.49)	0.288*** (3.80)	0.962*** (106.10)	0.029*** (4.45)	0.992	0.635	South Africa	Emerging Africa & Middle East	0.000 (0.97)	- 0.115*** (-3.81)	0.557*** (0.56)	0.991*** (243.80)	0.008*** (2.63)	0.998	0.341
US	Developed America	0.000 (1.58)	- 0.127*** (-6.58)	-	-	-	-	-	Turkey	Emerging Africa & Middle East	0.001 (1.55)	-0.084** (-2.48)	0.469*** (7.37)	0.991*** (332.80)	0.007*** (3.16)	0.999	0.290
Australia	Developed Asia	0.000 (0.33)	- 0.121*** (-3.68)	0.745*** (17.24)	0.993*** (376.80)	0.006*** (3.03)	0.999	0.210	Argentina	Emerging America	0.001 (-1.55)	-0.050 (-1.10)	0.201*** (-2.63)	0.947*** (-66.17)	0.041*** (-4.11)	0.988	0.459
Japan	Developed Asia	0.000 (0.27)	- 0.110*** (-3.53)	0.533*** (16.49)	0.370*** (3.65)	0.042*** (2.62)	0.972	0.038	Brazil	Emerging America	0.001 (1.58)	-0.053 (-1.35)	0.304*** (4.29)	0.971*** (111.30)	0.022*** (3.77)	0.993	0.597
New Zealand	Developed Asia	0.000 (0.16)	-0.065** (-2.49)	0.537*** (17.30)	0.989*** (228.40)	0.009*** (2.83)	0.998	0.158	Chili	Emerging America	0.001*** (2.95)	0.019 (0.52)	0.199 (4.38)	0.982*** (221.70)	0.013*** (4.07)	0.996	0.442
Singapore	Developed Asia	0.001** (2.02)	- 0.100*** (-3.08)	0.387*** (10.13)	0.993*** (302.90)	0.005** (2.26)	0.998	0.246	Colombia	Emerging America	0.001*** (3.41)	0.027 (0.52)	0.303*** (5.60)	0.977*** (71.52)	0.017** (2.04)	0.994	0.290
Austria	Developed Europe	0.000 (0.36)	-0.071** (-1.98)	0.487*** (8.10)	0.989*** (246.30)	0.009*** (3.10)	0.998	0.395	Mexico	Emerging America	0.000 (1.38)	0.004 (0.10)	0.180*** (2.92)	0.979*** (113.70)	0.014*** (2.76)	0.992	0.652
Belgium	Developed Europe	0.000 (0.59)	-0.101** (-2.48)	0.327*** (4.38)	0.988*** (240.90)	0.008*** (2.99)	0.996	0.474	Peru	Emerging America	0.001** (1.97)	-0.027 (-0.83)	0.192*** (3.09)	0.956*** (111.60)	0.039*** (5.39)	0.995	0.440
Denmark	Developed Europe	0.000 (1.42)	- 0.118*** (-3.63)	0.404*** (8.95)	0.982*** (152.20)	0.011*** (2.94)	0.993	0.359	China	Emerging Asia	0.000 (0.70)	-0.072** (-2.13)	0.566*** (13.31)	0.995*** (222.30)	0.002 (1.26)	0.998	0.156
Finland	Developed Europe	0.000 (0.13)	- 0.143***	0.456*** (8.55)	0.988*** (187.30)	0.009** (2.58)	0.997	0.433	Hong Kong	Emerging Asia	0.000 (0.80)	-0.089** (-2.11)	0.442*** (14.44)	0.464 (0.37)	0.012 (0.50)	0.975	0.167

			(-4.81)														
France	Developed Europe	0.000 (0.80)	- 0.238*** (-7.48)	0.498*** (9.13)	0.983*** (158.60)	0.011*** (2.98)	0.994	0.545	India	Emerging Asia	0.001* (1.76)	-0.048 (-1.48)	0.356*** (8.17)	0.996*** (809.70)	0.003*** (2.86)	0.999	0.200
Germany	Developed Europe	0.000 (1.13)	- 0.186*** (-5.85)	0.399*** (7.80)	0.975*** (105.60)	0.015*** (2.96)	0.990	0.557	Indonesia	Emerging Asia	0.001*** (2.88)	0.048* (1.65)	0.491*** (11.71)	0.842 (0.53)	0.000 (0.00)	0.942	0.114
Greece	Developed Europe	0.000 (0.01)	-0.015 (-0.47)	0.408*** (7.54)	0.977*** (104.00)	0.011*** (2.64)	0.988	0.234	Korea	Emerging Asia	0.000 (0.70)	-0.043 (-1.29)	0.642*** (10.11)	0.842** (2.11)	0.000 (0.02)	0.947	0.160
Ireland	Developed Europe	-0.000 (-0.07)	-0.094** (-2.26)	0.440*** (6.89)	0.989*** (275.70)	0.009*** (3.17)	0.998	0.399	Malaysia	Emerging Asia	0.000*** (2.62)	0.049 (1.55)	0.289*** (14.07)	0.990*** (151.30)	0.005* (1.90)	0.995	0.108
Italy	Developed Europe	0.000 (0.54)	- 0.156*** (-4.51)	0.410*** (7.10)	0.981*** (214.70)	0.012*** (3.93)	0.994	0.496	Pakistan	Emerging Asia	0.001*** (2.38)	0.072** (2.06)	0.134*** (4.46)	0.827*** (7.65)	0.000 (0.79)	0.927	0.021
Netherlands	Developed Europe	0.000 (0.67)	- 0.203*** (-5.95)	0.432 (8.19)	0.987*** (179.10)	0.008** (2.47)	0.996	0.533	Philippines	Emerging Asia	0.001** (2.47)	0.064*** (2.66)	0.586*** (20.91)	0.844* (1.82)	0.000 (0.07)	0.944	0.064
Norway	Developed Europe	0.000 (0.90)	- 0.169*** (-5.34)	0.504*** (8.33)	0.979*** (143.40)	0.017*** (3.36)	0.997	0.383	Sri Lanka	Emerging Asia	0.001** (2.53)	0.189*** (5.93)	0.134*** (5.02)	0.948*** (29.37)	0.008 (1.18)	0.956	0.001
Spain	Developed Europe	0.001 (1.42)	- 0.102*** (-2.78)	0.369*** (6.01)	0.981*** (122.60)	0.011*** (2.57)	0.992	0.494	Taiwan	Emerging Asia	0.000 (0.75)	-0.025 (-1.09)	0.445*** (13.89)	0.848* (1.78)	0.000 (0.09)	0.948	0.118
Sweden	Developed Europe	0.000 (1.00)	- 0.177*** (-5.38)	0.477*** (8.16)	0.984*** (145.40)	0.012*** (2.61)	0.996	0.470	Thailand	Emerging Asia	0.001** (2.51)	-0.057 (-1.57)	0.349*** (8.15)	0.939*** (27.42)	0.013* (1.79)	0.952	0.129
Switzerland	Developed Europe	0.000* (1.66)	- 0.179*** (-5.88)	0.360*** (9.65)	0.982*** (111.40)	0.012** (2.34)	0.995	0.432	Croatia	Emerging Europe	0.000 (1.08)	0.022 (0.70)	0.366*** (11.47)	0.984*** (64.30)	0.011 (1.25)	0.995	0.135
UK	Developed Europe	0.000 (0.53)	- 0.261*** (-7.13)	0.484*** (9.20)	0.991*** (235.30)	0.007** (2.38)	0.998	0.515	Czech Republic	Emerging Europe	0.000 (0.66)	-0.047 (-1.19)	0.429*** (6.13)	0.986*** (131.10)	0.011** (2.27)	0.996	0.260
Egypt	Emerging Africa & Middle East	0.000 (1.27)	0.083*** (3.24)	0.316*** (9.24)	0.836*** (2.47)	0.000 (0.18)	0.936	0.019	Estonia	Emerging Europe	0.000 (1.01)	0.000 (-0.01)	0.417*** (11.14)	0.991*** (146.70)	0.006 (1.74)	0.997	0.124
Jordan	Emerging Africa & Middle East	0.000 (0.73)	0.062** (2.26)	0.138*** (5.80)	0.815*** (6.19)	0.000** (1.98)	0.915	-0.003	Hungary	Emerging Europe	0.000 (-0.41)	-0.025 (-0.68)	0.484*** (6.29)	0.985*** (135.80)	0.012** (2.30)	0.997	0.295
Kenya	Emerging Africa & Middle East	0.001*** (2.79)	0.312*** (6.40)	0.092*** (3.19)	0.833*** (2.70)	0.000 (0.21)	0.933	0.046	Poland	Emerging Europe	-0.000 (-0.11)	-0.056* (-1.86)	0.422*** (6.72)	0.991*** (369.60)	0.008*** (3.58)	0.998	0.358
Lebanon	Emerging Africa & Middle East	0.000 (0.80)	0.078* (1.78)	0.107*** (3.54)	0.000 (0.00)	0.031 (0.24)	0.931	0.023	Portugal	Emerging Europe	0.000 (0.17)	-0.038 (-1.28)	0.290*** (6.74)	0.984*** (218.30)	0.013*** (3.84)	0.997	0.339
Mauritius	Emerging Africa & Middle East	0.001** (2.35)	0.091* (1.90)	0.180*** (5.33)	0.836*** (3.32)	0.000 (0.08)	0.936	0.041	Russia	Emerging Europe	-0.000 (-0.02)	-0.021 (-0.47)	0.400*** (4.81)	0.990*** (328.50)	0.008*** (3.36)	0.999	0.347
Morocco	Emerging Africa & Middle East	0.000 (1.10)	0.159*** (5.79)	0.096*** (3.96)	0.987*** (179.30)	0.009*** (2.66)	0.996	0.071	Slovenia	Emerging Europe	0.000 (1.31)	0.034 (1.12)	0.375*** (10.10)	0.993*** (347.80)	0.005** (2.28)	0.998	0.115
Nigeria	Emerging Africa & Middle East	0.001*** (2.01)	0.408*** (12.29)	0.088*** (2.82)	0.847 (0.76)	0.000 (0.01)	0.947	0.007									

Table 4
Changes in dynamic correlations between market stock returns during different crises

This table reports the impact of the GFC and the EZC on the dynamic conditional correlations. We estimate the effect both at the mean (Eq. 9) and variance (Eq. 10) levels. We implement the GFC and EZC dummies in the mean and variance models. Q(5) is the Ljung-Box Q-statistics up to fivedays, testing the serial correlation of the residuals. ARCH(5) is the ARCH LM test up to five days, testing the heteroscedasticity of the residuals. T-values are in the parentheses. The *, **, and *** represent the p-values <0.10, <0.05, and <0.01.

		Panel A: Mean Model				Panel B: Variance Model (GARCH 1,1)						
		$\hat{\rho}_{i,US,t} = \gamma_0 + \gamma_1 \hat{\rho}_{i,US,t-1} + \delta_1 GFC_t + \delta_2 EZC_t + v_t$				$h_t = \omega + \alpha h_{t-1} + \beta \varepsilon_{t-1}^2 + \delta_1 GFC_t + \delta_2 EZC_t + \varepsilon_t$						
Country	Category	Constant (T-Value)	$\rho_{i,US,t-1}$ (T-Value)	GFC _t (T-Value)	EZC _t (T-Value)	Constant (T-Value)	Alpha (T-Value)	Beta (T-value)	GFC (T-Value)	EZC (T-Value)	Q-stat (5)	ARCH(5)
Canada	Developed America	0.009*** (4.55)	0.984*** (291.97)	0.002* (1.74)	0.003** (2.52)	0.000*** (12.39)	1.036*** (18.19)	0.001 (0.04)	0.214*** (232.78)	0.237*** (209.37)	13.083	0.662
Australia	Developed Asia	0.000 (1.48)	0.996*** (660.13)	0.001* (1.91)	0.001** (2.24)	0.000*** (12.31)	1.058*** (23.29)	-0.022 (-1.05)	0.033*** (64.10)	0.261*** (631.60)	5.466	0.640
Japan	Developed Asia	0.023*** (18.72)	0.432*** (25.64)	-0.005*** (-2.77)	0.000 (0.05)	0.001*** (20.55)	0.246*** (13.46)	0.147*** (4.49)	-0.009*** (-5.37)	-0.001 (-0.45)	9.563	1.247
New Zealand	Developed Asia	0.000 (0.83)	0.994*** (526.81)	0.001*** (2.68)	0.001** (2.39)	0.000*** (9.06)	1.033*** (16.66)	-0.001 (-0.07)	0.103*** (132.89)	0.240*** (446.93)	6.555	2.246
Singapore	Developed Asia	0.000 (1.20)	0.998*** (654.03)	0.000 (1.34)	0.000 (0.57)	0.000*** (9.46)	1.025*** (10.72)	-0.001*** (-5.63)	0.010*** (13.08)	0.165*** (379.95)	6.581	0.777
Austria	Developed Europe	0.001** (2.32)	0.995*** (569.10)	0.001* (1.84)	0.001** (2.15)	0.000*** (10.65)	1.024*** (17.59)	-0.005 (-0.19)	0.078*** (103.17)	0.268*** (491.80)	6.279	0.082
Belgium	Developed Europe	0.002** (2.51)	0.995*** (540.36)	0.001* (1.68)	0.001* (1.75)	0.000*** (11.11)	1.112*** (15.27)	-0.018*** (-7.75)	0.073*** (107.11)	0.162*** (284.22)	14.155	0.261
Denmark	Developed Europe	0.003*** (3.43)	0.990*** (386.41)	0.001** (2.00)	0.001** (2.20)	0.000*** (12.52)	0.969*** (11.50)	0.027 (0.93)	0.121*** (127.56)	0.180*** (211.28)	7.020	0.898
Finland	Developed Europe	0.003*** (3.19)	0.993*** (475.29)	0.001* (1.78)	0.001*** (2.85)	0.000*** (8.57)	1.001*** (14.15)	0.036 (0.94)	0.069*** (72.67)	0.198*** (296.69)	1.393	0.086
France	Developed Europe	0.003*** (3.05)	0.993*** (443.52)	0.001 (1.50)	0.000* (1.90)	0.000*** (12.10)	0.982*** (9.55)	0.002 (0.06)	0.051*** (68.84)	0.137*** (182.22)	11.276	0.067
Germany	Developed Europe	0.005*** (3.60)	0.990*** (369.67)	0.001 (1.02)	0.001 (1.49)	0.000*** (13.80)	1.018*** (16.39)	-0.002 (-0.22)	0.026*** (20.61)	0.091*** (110.32)	9.156	0.440
Greece	Developed Europe	0.003*** (4.11)	0.986*** (310.85)	0.001 (1.26)	0.000 (0.93)	0.000*** (12.68)	0.983*** (16.73)	0.022 (0.96)	0.074*** (83.04)	0.027*** (38.08)	3.051	0.433
Ireland	Developed Europe	0.002*** (2.73)	0.994*** (552.52)	0.001** (2.40)	0.001** (2.55)	0.000*** (10.28)	1.011*** (14.47)	0.009 (0.44)	0.166*** (241.71)	0.248*** (321.59)	8.509	0.792
Italy	Developed Europe	0.004*** (3.21)	0.992*** (405.89)	0.001 (1.56)	0.001* (1.69)	0.000*** (13.11)	0.995*** (12.46)	-0.008 (-0.61)	0.024*** (21.72)	0.121*** (127.78)	8.332	0.236
Netherlands	Developed Europe	0.003*** (2.68)	0.995*** (508.08)	0.001* (1.83)	0.001* (1.83)	0.000*** (7.86)	0.974*** (10.96)	0.035 (1.24)	0.026*** (37.46)	0.144*** (235.31)	6.001	0.540
Norway	Developed Europe	0.002*** (2.61)	0.992*** (422.32)	0.001 (1.43)	0.002** (2.09)	0.000*** (18.06)	1.027*** (15.60)	-0.017** (-2.38)	0.168*** (139.45)	0.332*** (313.63)	1.033	0.172
Spain	Developed Europe	0.004*** (3.56)	0.991*** (381.00)	0.001 (1.46)	0.001 (1.51)	0.000*** (21.31)	0.996*** (12.27)	-0.019 (-0.93)	0.046*** (46.99)	0.075*** (117.62)	10.060	0.485
Sweden	Developed Europe	0.002*** (2.85)	0.993*** (442.05)	0.001 (1.44)	0.001* (1.94)	0.000*** (12.45)	1.013*** (12.88)	-0.008 (-0.32)	0.088*** (96.57)	0.205*** (285.20)	3.371	3.051
Switzerland	Developed Europe	0.003***	0.990***	0.001*	0.001**	0.000***	1.006***	-0.002***	0.054***	0.156***	5.163	0.096

		(3.42)	(381.12)	(1.94)	(2.33)	(17.81)	(13.80)	(-8.43)	(62.91)	(206.41)		
UK	Developed Europe	0.001** (1.97)	0.997*** (661.28)	0.001* (1.68)	0.001 (1.50)	0.000*** (10.81)	1.069*** (13.07)	-0.002 (-0.41)	0.089*** (167.17)	0.204*** (528.19)	8.716	0.167
Egypt	Emerging Africa & Middle East	0.003*** (16.91)	0.818*** (76.23)	0.000 (0.90)	0.000 (-0.16)	0.000 (0.43)	0.150*** (3.38)	0.600*** (5.80)	0.000 (1.32)	0.000 (-0.53)	12.235	2.126
Jordan	Emerging Africa & Middle East	-0.001*** (-18.00)	0.797*** (70.51)	-0.000* (-1.88)	0.000 (-1.59)	0.000*** (44.54)	0.150*** (22.68)	0.600*** (46.36)	-0.000*** (-14.67)	-0.000*** (-11.16)	1.372	8.925
Kenya	Emerging Africa & Middle East	0.008*** (14.06)	0.832*** (69.65)	0.000 (-0.45)	0.000 (0.34)	0.000*** (59.04)	0.150*** (25.79)	0.600*** (58.40)	-0.000*** (-3.45)	0.000*** (6.46)	1.003	5.363
Lebanon	Emerging Africa & Middle East	0.023*** (27.42)	0.030 (1.62)	0.000 (-0.31)	0.000 (-0.24)	0.001* (1.92)	0.009** (2.54)	0.294 (0.80)	0.000 (-0.35)	0.000 (-0.19)	0.949	0.385
Mauritius	Emerging Africa & Middle East	0.008*** (17.67)	0.803*** (72.24)	0.000 (-0.37)	0.000 (-0.25)	0.000 (1.17)	0.150*** (3.23)	0.600*** (4.52)	0.000 (-0.51)	0.000 (-0.30)	8.333	28.982
Morocco	Emerging Africa & Middle East	0.000 (0.10)	0.991*** (405.09)	0.001 (1.17)	0.001** (2.53)	0.000*** (12.93)	1.039*** (24.42)	0.000*** (0.02)	0.059*** (52.15)	0.215*** (352.15)	5.653	0.121
Nigeria	Emerging Africa & Middle East	0.001*** (16.42)	0.828*** (78.96)	0.000 (-1.32)	0.000 (0.69)	0.000 (0.59)	0.150*** (2.88)	0.600*** (3.82)	-0.000** (-2.33)	0.000 (1.28)	11.579	25.612
South Africa	Emerging Africa & Middle East	0.001** (2.12)	0.995*** (578.93)	0.001* (1.78)	0.001* (1.95)	0.000*** (12.47)	1.006*** (12.44)	-0.001 (-0.08)	0.102*** (192.44)	0.240*** (403.89)	1.754	0.772
Turkey	Emerging Africa & Middle East	0.000 (1.21)	0.998*** (607.86)	0.000 (0.87)	0.000 (-0.12)	0.000*** (17.81)	1.001*** (14.17)	-0.006 (-0.35)	0.241*** (270.49)	0.288*** (496.64)	3.943	0.093
Argentina	Emerging America	0.007*** (4.41)	0.981*** (269.02)	0.002 (1.37)	0.002 (1.35)	0.001*** (22.82)	0.928*** (15.75)	-0.045*** (-12.17)	0.135*** (53.78)	0.097*** (34.16)	2.993	0.133
Brazil	Emerging America	0.006*** (3.64)	0.989*** (336.40)	0.001 (1.25)	0.001 (1.29)	0.000*** (12.35)	0.957*** (14.79)	0.040* (1.70)	0.163*** (138.84)	0.181*** (154.12)	2.502	0.324
Chili	Emerging America	0.002*** (2.90)	0.992*** (423.20)	0.002** (2.37)	0.001** (2.06)	0.000*** (19.34)	0.997*** (15.82)	-0.008 (-0.58)	0.155*** (119.59)	0.202*** (197.33)	5.777	0.175
Colombia	Emerging America	0.002*** (2.71)	0.991*** (391.65)	0.001 (1.08)	0.001 (1.42)	0.000*** (17.58)	0.991*** (12.97)	-0.001 (-0.02)	0.105*** (61.77)	0.174*** (109.12)	5.142	0.288
Mexico	Emerging America	0.006*** (3.55)	0.989*** (339.08)	0.001* (1.69)	0.001 (1.20)	0.000*** (11.23)	1.050*** (13.41)	-0.005 (-0.49)	0.116*** (226.12)	0.097*** (156.32)	2.598	0.125
Peru	Emerging America	0.005*** (3.61)	0.984*** (303.31)	0.004*** (2.61)	0.005*** (2.92)	0.001*** (15.41)	1.007*** (16.50)	0.000 (-0.02)	0.264*** (92.41)	0.359*** (159.15)	6.847	0.753
China	Emerging Asia	0.001** (2.26)	0.995*** (519.99)	0.000 (1.13)	0.002* (1.87)	0.000*** (16.32)	1.001*** (10.72)	-0.018 (-0.73)	-0.031*** (-117.06)	0.052*** (291.94)	0.947	0.105
Hong Kong	Emerging Asia	0.087*** (31.59)	0.479*** (29.18)	0.000 (0.51)	0.001* (1.78)	0.000*** (53.09)	0.293*** (12.36)	-0.113*** (-16.41)	0.001** (2.01)	0.003*** (4.40)	4.427	0.255
India	Emerging Asia	0.000 (1.12)	0.998*** (900.03)	0.000** (2.45)	0.000 (1.25)	0.000*** (13.49)	0.969*** (10.82)	0.015 (0.52)	0.006*** (15.58)	0.151*** (581.50)	5.598	0.075
Indonesia	Emerging Asia	0.018*** (13.72)	0.840*** (72.24)	0.000 (1.59)	0.000 (1.53)	0.000*** (14.56)	0.150*** (13.99)	0.600*** (22.54)	0.000*** (7.31)	0.000*** (8.98)	4.041	35.120
Korea	Emerging Asia	0.028*** (14.94)	0.822*** (68.83)	0.000 (0.38)	0.000** (2.21)	0.000*** (7.80)	0.150*** (10.66)	0.600*** (15.88)	0.000** (2.47)	0.000*** (7.80)	5.093	21.211
Malaysia	Emerging Asia	0.000** (2.13)	0.994*** (469.67)	0.000 (0.92)	0.000 (0.74)	0.000*** (21.61)	1.189*** (13.91)	-0.007 (-2.10)	-0.001*** (-3.76)	0.056*** (93.38)	3.127	0.125
Pakistan	Emerging Asia	0.004*** (17.36)	0.810*** (73.81)	0.000 (0.62)	0.000 (-0.82)	0.000 (1.13)	0.150*** (2.99)	0.600*** (4.29)	0.000 (0.64)	0.000 (-1.59)	5.882	26.041
Philippine	Emerging Asia	0.011***	0.820***	0.000	0.000*	0.000***	0.150***	0.600***	0.000	0.000***	4.063	12.457

		(14.65)	(66.75)	(0.30)	(1.83)	(3.99)	(7.33)	(10.51)	(-0.80)	(4.60)		
Sri Lanka	Emerging Asia	0.000 (-0.72)	0.955*** (172.73)	0.001* (1.65)	0.000 (0.70)	0.000*** (17.35)	0.836*** (15.41)	0.101*** (4.02)	0.004*** (7.69)	-0.001** (-2.12)	5.385	0.376
Taiwan	Emerging Asia	0.019*** (13.59)	0.842*** (72.47)	0.000 (0.95)	0.000* (1.64)	0.000*** (11.63)	0.150*** (12.89)	0.600*** (20.06)	0.000*** (4.41)	0.000*** (8.50)	1.167	30.848
Thailand	Emerging Asia	0.006*** (7.70)	0.949*** (161.02)	0.001** (2.44)	0.001** (2.14)	0.000*** (25.35)	0.974*** (18.47)	-0.006 (-0.31)	0.018*** (20.18)	0.011*** (16.72)	4.477	0.149
Croatia	Emerging Europe	0.001** (1.97)	0.989*** (368.51)	0.001** (1.97)	0.002*** (2.68)	0.000*** (23.03)	1.033*** (20.50)	-0.008*** (-8.96)	0.068*** (53.68)	0.110*** (116.17)	6.635	0.139
Czech Republic	Emerging Europe	0.001** (2.50)	0.993*** (449.58)	0.000 (0.62)	0.001* (1.79)	0.000*** (11.95)	1.005*** (15.94)	0.010 (0.35)	0.071*** (61.09)	0.212*** (300.79)	2.837	0.087
Estonia	Emerging Europe	0.000** (2.01)	0.994*** (438.20)	0.000 (0.44)	0.001** (2.18)	0.000*** (14.81)	1.012*** (13.08)	0.009 (0.40)	-0.008*** (-19.10)	0.149*** (365.72)	4.577	0.448
Hungary	Emerging Europe	0.001** (2.17)	0.994*** (500.88)	0.002*** (2.68)	0.002** (2.42)	0.000*** (13.98)	0.997*** (11.00)	0.002 (0.08)	0.221*** (159.27)	0.311*** (341.36)	1.744	0.282
Poland	Emerging Europe	0.001* (1.94)	0.996*** (596.44)	0.001 (1.58)	0.001* (1.68)	0.000*** (11.12)	0.902*** (12.26)	0.115*** (6.14)	0.115*** (125.62)	0.273*** (471.44)	3.520	0.146
Portugal	Emerging Europe	0.001* (1.92)	0.995*** (494.67)	0.001* (1.66)	0.001 (1.30)	0.000*** (13.90)	1.015*** (12.12)	-0.010 (-0.72)	0.093*** (67.05)	0.279*** (321.68)	2.411	0.416
Russia	Emerging Europe	0.001 (1.53)	0.997*** (684.77)	0.001** (2.03)	0.001 (1.49)	0.000*** (15.32)	0.990*** (11.31)	-0.001*** (-7.81)	0.139*** (156.26)	0.322*** (435.98)	1.819	0.224
Slovenia	Emerging Europe	0.000 (1.15)	0.995*** (587.77)	0.001** (2.17)	0.001** (2.52)	0.000*** (13.98)	0.992*** (14.12)	0.003 (0.16)	0.045*** (72.95)	0.156*** (437.40)	13.965	0.369

Table 5
Determinants of cross-country dynamic conditional correlation (DCC)

This table reports the regression results for the determinants of the cross-country dynamic conditional correlation by following the Eq. (11):

$$\rho_{i,US,t} = \alpha_0 + \alpha_1\rho_{i,US,t-1} + \beta_1Risk_{i,t} + \beta_2Interest_{i,t} + \beta_3Trade_{i,t} + \beta_4GDP_{i,t} + \beta_5Spread_{i,t} + \beta_6Market_{i,t} + \beta_7Corruption_{i,t} + \gamma_1GFC_t + \gamma_2EZC_t + \varepsilon_t$$

Where, $\rho_{i,US,t}$ is the DCC coefficient between the US and other countries, DCC_{t-1} is the lagged DCC coefficient, Bank Risk Transfer is the difference in the bank risktransfers between the US and other countries, Real Interest is the difference in the real interest rates between the US and other countries, Trade Balance is the difference in the trade balances between the US and other countries, GDP Growth Rate is the difference in the GDP growth rates between the US and other countries, Term Spread is the difference in the termspreads between the US and other countries, Market Capitalization is the difference in the market capitalizations between the US and other countries, Corruption is the difference in the perceptionsof corruption between the US and other countries, and the GFC and the EZC are the crises dummies. T-values are reported in the parentheses. The ** and *** represent the p-values<0.05 and <0.01 respectively.

	Full Sample			Developed Countries	Emerging Countries	Africa-Middle Eastern Emerging Countries	Latin American Emerging Countries	Asian Emerging Countries	European Emerging Countries
	Model 1	Model 2	Model 3	Model 4	Model 5	Model 6	Model 7	Model 8	Model 9
DCC _{t-1}	0.540 (12.83)***	0.636 (15.19)***	0.646 (12.70)***	0.530 (3.14)***	0.665 (12.45)***	0.889 (8.62)***	0.481 (2.69)***	0.279 (2.37)**	0.520 (3.00)***
GFC	0.042 (5.53)***	0.030 (4.26)***	0.023 (2.41)**	0.042 (1.67)*	0.016 (1.58)	0.008 (0.56)	0.051 (0.97)	0.005 (0.75)	0.037 (1.12)
EZC	0.041 (4.78)***	0.062 (7.07)***	0.049 (4.71)***	0.099 (2.87)***	0.038 (3.38)***	0.010 (0.78)	0.061 (1.05)	0.020 (3.01)***	0.156 (3.40)***
Bank Risk Transfer		0.022 (7.20)***	0.018 (5.17)***	0.019 (2.40)**	0.017 (4.35)***	0.004 (0.72)	0.032 (2.28)**	0.006 (2.58)***	0.025 (2.69)***
Real Interest		0.003 (2.99)***	0.003 (2.03)**	0.007 (2.31)**	0.001 (0.63)	-0.001 (0.63)	0.006 (1.27)	-0.001 (0.50)	0.001 (0.15)
Trade Balance		-0.001 (1.26)	-0.001 (1.13)	-0.002 (1.06)	0.000 (0.20)	-0.000 (0.30)	0.000 (0.07)	-0.001 (0.99)	-0.007 (1.52)
GDP Growth Rate			0.001 (0.60)	-0.000 (0.06)	0.001 (0.40)	-0.000 (0.16)	0.002 (0.33)	-0.000 (0.07)	0.008 (1.46)
Term Spread			-0.003 (0.78)	0.003 (0.28)	-0.002 (0.55)	0.001 (0.11)	-0.018 (1.46)	0.003 (0.71)	0.011 (0.84)
Market Capitalization			0.010 (1.19)	0.007 (0.33)	0.008 (0.80)	0.003 (0.17)	0.042 (0.81)	-0.003 (0.24)	-0.011 (0.64)
Corruption			0.002 (1.35)	0.001 (0.24)	0.001 (0.98)	-0.000 (0.27)	0.003 (0.39)	0.002 (2.28)**	0.002 (0.58)
Constant	0.108 (11.39)**	-0.137 (3.95)**	-0.162 (3.04)***	-0.095 (0.84)	-0.160 (2.53)**	-0.009 (0.10)	-0.127 (0.42)	-0.051 (1.31)	-0.254 (1.82)
R ²	0.55	0.68	0.63	0.72	0.62	0.71	0.60	0.40	0.82
Observations	540	474	318	74	244	56	54	81	53
Country Fixed Effect	Y	Y	Y	Y	Y	Y	Y	Y	Y
Year Fixed Effect	Y	Y	Y	Y	Y	Y	Y	Y	Y
F-stat	196.36***	146.04***	45.18***	13.28***	33.17***	9.72***	5.73***	4.07***	16.71***

Appendix: Descriptive Statistics

By following a conventional approach, we calculate stock returns as the first difference of the natural log of each stock-price index, and the returns are expressed as percentages. Appendix Table A1 presents the descriptive statistics of the daily returns in three panels (A–C)¹³. Panel A reports the **descriptive** statistics for the full sample period, Panel B reports the descriptive statistics for the GFC, and Panel C reports the descriptive statistics for the EZC. The mean return of the MSCI indices for the full period is 0.04%, whereas the mean return for the GFC declines to -0.05% and declines to -0.01% for the EZC. The standard deviations for these periods are 1.69%, 2.42%, and 1.52% that indicate the GFC is more volatile than the EZC. The table also reports excess kurtosis for the stock return series for all three panels that indicates that big shocks in either sign (+/-) are more likely to be present and that the stock-return series might not be normally distributed. The Jarque-Bera (JB) statistics are significant in all three periods that indicates abnormality in the distribution and that series autocorrelation exist, which is usual for time-series data. However, almost all of the stock-return series in the full sample (53 out of 55 indices: Panel A) have autocorrelations (LB) in lag 16 for the daily data, which gradually decreases in the GFC (35 out of 55 indices: Panel B) and in the EZC (17 out of 55 indices: Panel C). These decreases how nonsynchronous trading in the stocks that make up the index. It could also be due to price limitations imposed on the index or other types of market friction that produce a partial adjustment process.

¹³We use the daily returns instead of the rolling average of the two-day returns because neither Forbes and Rigobon (2002) nor Chiang et al. (2007) find any difference between the daily and two-day returns. However, Chiang et al. (2007) notes that using two-day returns tends to generate serial autocorrelation and hence, this type of returns is not compatible for examining announcement effects.

Appendix Table A1
Descriptive statistics

This table reports the descriptive statistics for our data. Panel A presents the descriptive statistics for the full sample (2003–2013), Panels B and C present the descriptive statistics for the global financial crisis (GFC) and the Eurozone crisis (EZC) respectively.

Panel A: Full Sample									Panel B: Global Crisis							Panel C: Eurozone Crisis						
Country	Category	Mean (%)	Std. Dev. (%)	Skewn ess	Kurtos is	Jarque-Bera	Q-stat (16)	Observ ations	Mean (%)	Std. Dev. (%)	Skewn ess	Kurtos is	Jarque-Bera	Q-stat (16)	Observ ations	Mean (%)	Std. Dev. (%)	Skewn ess	Kurtos is	Jarque-Bera	Q-stat (16)	Observ ations
Canada	Developed America	0.040	1.492	-0.829	13.789	14249.720***	107.300***	2870	-0.021	2.492	-0.649	7.470	565.0672***	45.870***	626	-0.003	1.255	-0.314	5.111	163.7537***	37.980***	810
US	Developed America	0.027	1.247	-0.332	14.166	14962.770***	81.454***	2870	-0.046	2.028	-0.146	8.133	689.5817***	37.416***	626	0.040	1.124	-0.438	7.292	647.6579***	42.124***	810
Australia	Developed Asia	0.037	1.656	-0.871	12.194	10471.740***	27.474***	2870	-0.025	2.678	-0.740	7.241	526.198***	18.441	626	0.000	1.508	-0.255	4.797	117.7869***	22.720	810
Japan	Developed Asia	0.019	1.419	-0.211	7.994	3003.524***	46.202***	2870	-0.060	1.986	-0.006	6.533	325.6191***	43.584***	626	0.004	1.237	-0.493	8.366	1004.437***	17.597	810
New Zealand	Developed Asia	0.021	1.398	-0.487	8.083	3202.817***	30.779***	2870	-0.080	2.142	-0.357	5.586	187.7936***	17.180	626	0.031	1.257	-0.333	3.914	43.13307***	14.692	810
Singapore	Developed Asia	0.039	1.366	-0.270	8.467	3609.054***	51.996***	2870	-0.018	2.121	-0.090	5.488	162.2634***	26.433**	626	0.014	1.153	-0.384	5.099	168.5805***	15.847	810
Austria	Developed Europe	0.019	1.965	-0.189	9.791	5531.284***	36.404***	2870	-0.142	3.050	-0.032	5.960	228.7045***	17.148	626	-0.022	2.064	0.017	5.671	240.78***	14.077	810
Belgium	Developed Europe	0.020	1.585	-0.569	11.662	9128.254***	31.759***	2870	-0.121	2.394	-0.671	7.870	665.5594***	27.775***	626	0.036	1.583	0.100	6.157	337.6815***	22.337	810
Denmark	Developed Europe	0.054	1.513	-0.340	10.719	7179.814***	56.497***	2870	-0.053	2.297	-0.195	7.508	534.1077***	44.025***	626	0.028	1.529	-0.152	5.330	186.3041***	15.791	810
Finland	Developed Europe	0.009	1.908	-0.205	7.696	2656.960***	33.816***	2870	-0.103	2.628	0.120	5.494	163.7165***	19.676	626	-0.027	1.950	-0.062	4.559	82.5187***	19.922	810
France	Developed Europe	0.023	1.663	-0.014	9.678	5333.755***	58.119***	2870	-0.052	2.342	0.132	7.883	623.7654***	52.528***	626	0.005	1.880	0.013	5.440	200.992***	15.254	810
Germany	Developed Europe	0.039	1.659	-0.066	8.523	3650.199***	27.141**	2870	-0.054	2.291	0.154	7.565	546.1538***	21.184	626	0.023	1.796	-0.151	4.939	129.95***	19.002	810
Greece	Developed Europe	-0.024	2.267	0.074	7.162	2074.339***	46.394***	2870	-0.123	2.715	-0.052	5.622	179.6606***	25.382*	626	-0.157	2.925	0.369	5.226	185.6156***	13.263	810
Ireland	Developed Europe	-0.008	1.989	-0.681	11.891	9674.503***	52.990***	2870	-0.229	3.154	-0.505	7.116	468.5783***	23.176*	626	-0.004	1.983	-0.139	5.321	184.3672***	18.836	810
Italy	Developed Europe	0.001	1.761	-0.066	9.104	4456.948***	63.653***	2870	-0.083	2.378	0.150	7.496	529.4768***	67.142***	626	-0.033	2.200	-0.061	5.033	139.9502***	17.273	810
Netherlands	Developed Europe	0.024	1.561	-0.126	9.831	5588.066***	53.728***	2870	-0.056	2.256	-0.028	7.783	596.7446***	42.460***	626	0.012	1.625	-0.036	5.403	195.0282***	13.381	810
Norway	Developed Europe	0.042	2.089	-0.449	9.686	5441.829***	32.311***	2870	-0.060	3.357	-0.288	5.689	197.1896***	19.482	626	0.014	1.876	-0.247	4.905	130.7695***	11.091	810
Spain	Developed Europe	0.025	1.799	0.073	10.135	6089.866***	39.051***	2870	-0.028	2.370	0.013	7.762	591.4057***	45.416***	626	-0.036	2.237	0.360	6.974	550.4629***	19.715	810
Sweden	Developed Europe	0.048	1.920	0.039	8.249	3296.041***	41.084***	2870	-0.059	2.885	0.260	5.473	166.5744***	26.063*	626	0.026	1.982	-0.126	5.508	214.4626***	16.288	810
Switzerland	Developed Europe	0.035	1.255	-0.014	8.553	3688.102***	56.169***	2870	-0.028	1.810	0.215	6.939	409.5674***	54.064***	626	0.036	1.222	-0.277	4.529	123.3493***	18.452	810
UK	Developed Europe	0.019	1.449	-0.125	12.657	11159.840***	74.117***	2870	-0.065	2.317	0.025	7.837	610.2655***	47.707***	626	0.019	1.357	-0.143	5.186	164.1202***	11.379	810
Egypt	Emerging Africa & Middle East	0.078	1.813	-0.593	10.330	6594.205***	47.985***	2870	-0.034	2.206	-1.134	10.706	1682.885***	31.575**	626	-0.069	1.650	-0.592	11.032	2224.38***	19.172	810
Jordan	Emerging Africa & Middle East	0.009	1.228	-0.526	11.335	8439.822***	40.968***	2870	-0.047	1.594	-0.749	10.084	1367.42***	43.523***	626	-0.047	0.865	-0.078	8.164	900.8295***	24.851*	810
Kenya	Emerging Africa & Middle East	0.070	1.405	-0.056	12.774	11424.300***	356.550***	2870	-0.062	1.802	0.425	10.985	1681.921***	119.870***	626	0.058	1.025	-0.691	7.594	776.7318***	94.508***	810
Lebanon	Emerging Africa & Middle East	0.027	1.515	-0.438	20.084	34995.110***	72.080***	2870	0.065	1.874	0.882	9.766	1275.278***	43.809***	626	-0.054	0.821	0.214	10.559	1934.438***	24.745*	810
Mauritius	Emerging Africa & Middle East	0.066	1.207	0.272	16.596	22141.530***	83.289***	2870	0.018	1.856	0.056	8.928	916.9779***	37.543***	626	0.019	0.787	0.047	6.500	413.7623***	24.696*	810
Morocco	Emerging Africa & Middle East	0.030	1.128	-0.245	6.461	1461.089***	99.145***	2870	-0.024	1.360	-0.302	6.634	354.0379***	43.369***	626	-0.056	1.102	-0.254	5.579	233.095***	23.795*	810
Nigeria	Emerging Africa & Middle East	0.045	1.473	-0.028	8.699	3884.463***	486.090***	2870	-0.165	1.844	-0.236	5.491	167.7306***	265.630***	626	0.055	1.199	0.237	4.898	129.2457***	53.182***	810
South Africa	Emerging Africa & Middle East	0.043	1.870	-0.330	7.854	2869.515***	41.782***	2870	-0.003	2.698	-0.235	6.160	266.2008***	19.390	626	-0.003	1.667	-0.015	4.947	127.9341***	18.322	810
Turkey	Emerging Africa & Middle East	0.051	2.499	-0.373	8.259	3373.873***	40.576***	2870	-0.035	3.140	-0.069	6.147	258.8609***	25.237*	626	0.003	1.873	-0.502	6.661	486.3405***	17.954	810
Argentina	Emerging America	0.051	2.184	-0.673	9.735	5640.865***	27.850**	2870	-0.067	2.972	-0.684	8.953	973.0384***	28.020**	626	-0.060	2.128	-0.647	7.735	813.3132***	15.602	810
Brazil	Emerging America	0.060	2.213	-0.401	11.562	8843.483***	44.993***	2870	0.030	3.446	-0.291	7.990	658.4194***	22.332	626	-0.047	1.630	-0.293	5.489	220.7686***	26.102*	810
Chile	Emerging America	0.050	1.417	-0.301	16.158	20747.850***	78.126***	2870	0.018	2.088	-0.076	12.830	2520.987***	31.337**	626	0.003	1.299	-0.604	11.028	2224.586***	61.812***	810
Colombia	Emerging America	0.095	1.697	-0.371	13.813	14046.510***	75.478***	2870	0.033	2.187	-0.528	8.940	949.4315***	26.309**	626	0.031	1.175	-0.242	5.021	145.8398***	25.312*	810
Mexico	Emerging America	0.055	1.685	-0.132	10.598	6912.151***	53.740***	2870	-0.031	2.566	0.109	7.421	510.9734***	13.626	626	0.024	1.367	-0.423	6.607	463.3565***	36.671***	810
Peru	Emerging America	0.063	1.994	-0.452	10.077	6086.839***	22.080	2870	0.002	2.991	-0.155	6.117	255.8639***	17.229	626	0.024	1.673	-1.336	16.122	6052.093***	20.105	810
China	Emerging Asia	0.052	1.822	-0.047	9.671	5322.397***	41.924***	2870	-0.002	2.890	0.081	6.035	240.9004***	19.655	626	-0.012	1.404	-0.147	5.670	243.5117***	25.099*	810
Hong Kong	Emerging Asia	0.036	1.345	-0.182	10.962	7596.217***	27.823**	2870	-0.012	2.146	-0.055	6.742	365.5124***	20.182	626	0.023	1.112	-0.317	6.086	334.942***	21.950	810
India	Emerging Asia	0.051	1.816	-0.038	11.388	8415.237***	78.183***	2870	-0.001	2.747	0.256	7.946	644.9697***	33.048***	626	-0.024	1.407	-0.009	4.151	44.70835***	12.426	810
Indonesia	Emerging Asia	0.068	1.925	-0.298	9.326	4827.626***	57.688***	2870	0.029	2.686	-0.178	7.692	577.4251***	42.587***	626	0.027	1.512	-0.489	8.354	999.7232***	33.028***	810
Korea	Emerging Asia	0.045	1.961	-0.194	20.043	34753.600***	28.801**	2870	-0.046	2.979	-0.024	15.913	4349.619***	17.209	626	0.012	1.704	-0.296	5.111	162.1932***	23.790*	810
Malaysia	Emerging Asia	0.040	0.980	-0.540	12.158	10169.200***	56.379***	2870	-0.005	1.392	-0.666	10.557	1535.895***	14.786	626	0.036	0.886	-0.056	6.897	512.983***	25.931*	810

Pakistan	Emerging Asia	0.024	1.630	-0.460	6.604	1654.835***	76.352***	2870	-0,131	2,180	-0,450	5,422	174.1384***	79.528***	626	0,046	1,080	-0,159	4,827	116.0523***	28.112**	810
Philippine	Emerging Asia	0.061	1.563	-0.500	8.649	3935.681***	59.425***	2870	-0,030	2,079	-0,530	8,370	781.6284***	30.389**	626	0,077	1,263	-0,301	4,778	118.9511***	19.645	810
Sri Lanka	Emerging Asia	0.044	1.488	-0.025	26.800	67736.350***	150.500***	2870	0,019	1,796	2,208	22,264	10188.06***	89.282***	626	0,045	1,027	0,485	6,775	512.6859***	83.590***	810
Taiwan	Emerging Asia	0.022	1.480	-0.218	5.839	986.261***	65.833***	2870	-0,023	2,024	-0,074	4,453	55.6369***	29.934**	626	0,008	1,261	-0,235	4,684	103.1569***	41.543***	810
Thailand	Emerging Asia	0.054	1.699	-0.653	12.564	11142.820***	45.337***	2870	-0,016	2,195	-0,583	8,558	841.1436***	23.950*	626	0,069	1,427	-0,045	5,419	197.7131***	24.283*	810
Croatia	Emerging Europe	0.010	1.533	-0.161	10.411	6580.201***	64.734***	2870	-0,082	2,014	-0,141	6,936	406.2087***	61.361***	626	-0,013	1,029	0,013	8,381	977.4239***	12.128	810
Czech Republic	Emerging Europe	0.043	1.842	-0.223	16.097	20557.430***	64.268***	2870	-0,031	2,814	-0,069	12,158	2188.234***	38.920***	626	-0,047	1,574	-0,260	4,876	127.9124***	17.245	810
Estonia	Emerging Europe	0.033	1.720	0.113	8.390	3479.700***	34.745***	2870	-0,168	2,408	0,150	6,427	308.7593***	15.163	626	0,020	1,700	-0,014	5,378	190.9109***	14.765	810
Hungary	Emerging Europe	0.019	2.393	-0.046	10.765	7210.422***	82.476***	2870	-0,078	3,482	0,038	8,390	757.9481***	78.891***	626	-0,051	2,477	0,133	6,544	426.2025***	7.628	810
Poland	Emerging Europe	0.032	2.088	-0.256	7.513	2466.659***	19.990	2870	-0,075	2,999	-0,114	5,645	183.8313***	17.674	626	-0,010	2,004	-0,286	6,368	393.9654***	6.667	810
Portugal	Emerging Europe	0.006	1.461	-0.134	10.967	7599.435***	61.729***	2870	-0,076	1,959	-0,028	9,877	1233.726***	58.161***	626	-0,028	1,723	0,067	6,288	365.4769***	17.229	810
Russia	Emerging Europe	0.037	2.413	-0.503	18.576	29132.250***	109.500***	2870	-0,073	3,814	-0,308	12,274	2253.12***	69.964***	626	-0,021	1,816	-0,472	5,715	278.9234***	25.007*	810
Slovenia	Emerging Europe	0.019	1.464	-0.218	9.034	4376.834***	78.195***	2870	-0,130	2,057	-0,268	6,964	417.3356***	41.408***	626	-0,050	1,283	-0,183	4,546	85.2272***	22.871	810