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# What Explains Stock Markets' Vulnerability to the 2007–2008 Crisis?

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## Abstract

This paper examines the determinants of stock markets' vulnerability to the 2007–2008 crisis. Given that the United States (US) was the crisis epicenter, the authors analyze the factors driving the co-movement between US returns and stock returns in 83 countries. The analysis distinguishes between the period before and after the collapse of Lehman Brothers. The findings indicate that

the main channel of transmission was financial. There is also evidence of a “wake-up call” or “demonstration effect” in the first stage of the crisis, because countries with vulnerable banking and corporate sectors exhibited higher co-movement with the US market. However, despite a collapse in trade across countries, the analysis does not find support for this channel of transmission.

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This paper—a product of the Office of the Chief Economist, Latin America & the Caribbean Region; and Finance and Private Sector Development Team, Development Research Group—is part of a larger effort in these departments to understand the transmission of the 2007-2008 US financial crisis. Policy Research Working Papers are also posted on the Web at <http://econ.worldbank.org>. The authors may be contacted at [tdidier@worldbank.org](mailto:tdidier@worldbank.org), [ilove@worldbank.org](mailto:ilove@worldbank.org) and [mmartinezperia@worldbank.org](mailto:mmartinezperia@worldbank.org).

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# **What explains stock markets' vulnerability to the 2007-2008 crisis?**

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## 1. Introduction

The 2007-2008 crisis is one of historical dimensions – few would dispute it as one of the broadest, deepest, and most complex crises since the Great Depression.<sup>1</sup> Its origins were in the United States (US) subprime housing finance market, which showed signs of trouble in the first half of 2007. Initially, this seemed to be a crisis of rather limited scope and many thought countries would be able to “decouple” from events in the US.<sup>2</sup> But after Lehman Brothers’ collapsed in September 2008, the crisis spread rapidly across institutions, markets, and borders. There were massive failures of financial institutions and a staggering collapse in asset values in developed and developing countries (see Figure 1). Nonetheless, the transmission of the US crisis was heterogeneous across markets around the globe with some countries showing higher comovement with the US than others (see Figure 2).<sup>3</sup>

This paper empirically investigates the factors that determine stock markets’ vulnerability to the 2007-2008 crisis across 83 countries. We focus on stock markets’ reactions during the crisis because financial markets were the first to feel the effects of the crisis. Also, analyzing the behavior of stock markets is important because equity holdings have become a significant source of wealth for individuals around the world and, hence, a decline in asset values could affect consumption and other real variables. Finally, monthly stock market data over the crisis period is readily available for a significant number of countries, whereas at best annual data could be used for other variables like GDP or employment.

To study the transmission channels behind the current crisis, we explore the factors that drove the comovement between local and US stock market returns.<sup>4</sup> As argued by Claessens, Dornbusch, and Park (2001), an analysis based on correlations of stock returns sheds light on the cross-country transmission of shocks as they reflect cross-market linkages. In particular, we

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<sup>1</sup> The April 2009 Global Stability Report produced by the IMF estimates that write-downs in developed markets could reach US\$4 trillion and those in emerging markets could amount to US\$ 800 billion or 7 percent of banking assets. See <http://www.imf.org/External/Pubs/FT/GFSR/2009/01/pdf/text.pdf>.

<sup>2</sup> The subprime market represented 15 percent of US total residential mortgages in 2006 and the latter accounted for 25 percent of US total debt (see Agarwal and Ho, 2007).

<sup>3</sup> For each country, comovement with the US is measured by the coefficient of a regression of monthly local stock returns (i.e., the percentage change in the stock market index) on US stock returns during the period July 2007 – April 2009.

<sup>4</sup> See Didier, Mauro, and Schmukler (2008) for a discussion of the different channels through which crises can be transmitted.

evaluate the extent to which the comovement in stock market returns was driven by real linkages between economies, financial linkages across markets, or was the consequence of a “wake-up call” (see Goldstein, 1998) or “demonstration effect” (see Masson, 1998) where investors became aware that certain vulnerabilities present in the US context could put other economies at risk.

Real linkages refer to trade effects of which there are two main kinds: competitiveness effect - when changes in relative prices affect a country’s ability to compete abroad – and income effect - when the crisis reduces income and consequently import demand. Financial linkages across markets operate primarily through the financial (or capital flows) account among countries that are connected to the international financial system. Such linkages can be direct or indirect. Direct financial linkages arise due to direct financial exposures between the crisis country and other countries. For example, when foreign investors own assets from the crisis country or vice versa. Indirect financial linkages involve the actions of international investors (“common creditors”), who transmit crises across the various countries where they hold assets either because of margin calls, changes in risk aversion, or herding (due to asymmetric information). Finally, comovement across markets might not be related to any sort of linkages across markets, but might happen as a result of a new interpretation of existing information, which stimulates learning and awareness. In particular, after investors see a certain economy collapse (e.g., U.S.), they might start to question the safety of investments in countries with similar economic vulnerabilities.

Using stock market data for the US and 83 other countries between July 2007 and April 2009, we evaluate the significance of the transmission channels discussed. In order to determine how important these different factors are in explaining cross-country linkages during the 2007-2008 financial crisis, we follow a one-step approach in which each markets’ correlation vis-a-vis the US market is interacted with country-level characteristics representing the channels mentioned above. This methodology allows us to identify and compare the extent to which different channels have an impact on the sensitivity of domestic stock market returns to US market returns.

To capture potential trade linkages, we examine the effect of variables such as exports to the US relative to GDP, total exports to GDP, trade openness (defined as exports plus imports to GDP) and export composition measures (such as the share of fuel and, separately, agricultural exports to total exports). Our estimations also examine the role of financial linkages. We include measures of bilateral financial linkages such as foreign holding of US equity and US holding of foreign equity, as well as broader measures of financial integration such as capital account openness, capital inflows to GDP, stock market size and liquidity. Finally, to account for the possibility of a wake-up call or a demonstration effect from the US crisis that raises investors' awareness of potential risks in other markets, we control for measures of banking, corporate, macro, and sectoral vulnerabilities.

Our estimations reveal some interesting patterns regarding the transmission of the crisis. First, the main channel of transmission appears to have been financial. We find evidence of financial linkages at work both in the periods before and after the collapse of Lehman Brothers. In particular, markets with high ratios of equity holdings by US investors exhibited greater comovement. Also, countries with high levels of portfolio inflows, more liquid and more developed stock markets were more correlated with the US market. Second, to the extent that there was a wake-up call or a demonstration effect from the US crisis that led to comovement across financial markets, it primarily manifested itself during the first stage of the crisis, before the collapse of Lehman. During this early period, we find that in countries with more vulnerable banking and corporate sectors, stock markets were more significantly correlated with the US market. This was not the case during the period after the collapse of Lehman. Third, despite the large contraction in trade flows during the crisis period, we find no support for a real/trade channel of transmission.

Our paper is related to several strands of the literature. First, we contribute to the still relatively small but growing literature on the 2007-2008 financial crisis. Most of the existing papers have focused on the causes and consequences of the crisis and thus, have mostly analyzed its epicenter, the US.<sup>5</sup> However, a few have studied the global transmission of this crisis. Fratzscher (2009) and Obstfeld, Shambaugh, and Taylor (2009) focus on the transmission via

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<sup>5</sup> See Caprio, Demirguc-Kunt, and Kane (2008), Reinhart and Rogoff (2008), Brunnermeier (2009), Calomiris (2009), Cecchetti (2009), and Taylor (2009), among many others.

exchange rates. They report mixed results regarding the effects on exchange rates of worse than average current accounts, of high financial exposure to the US, of large short-term debt levels, and of relatively low international reserves. Alternatively, Dooley and Hutchison (2009) provides evidence that news events from the U.S. have had a large impact on credit default swap spreads in emerging markets, especially in the period after the fall of Lehman Brothers, effectively transmitting the US financial crisis to markets abroad. Rose and Spiegel (2009a and 2009b) conduct an analysis of the international propagation of the crisis based on a measure of crisis incidence and severity which combines four indicators: changes in real GDP, stock markets, credit ratings, and exchange rates. These studies do not find strong evidence that bilateral linkages with the US or domestic fundamentals have been associated with the incidence or severity of the crisis across countries. Lastly and more closely related to our paper, Ehrmann, Fratzscher, and Mehl (2009) studies the crisis transmission through movements in stock markets. This paper focuses on about 450 industry-equity portfolios across 64 countries and finds that macro country risk dwarfed micro, firm-level risk as a global transmission channel. Also, the study finds that equity portfolios with a high degree of integration with the US market before the crisis were more strongly affected than more segregated ones. Although our work is related to these papers, we focus on the factors explaining comovement with the US, as opposed to the incidence of the crisis across countries.

Second, we also expand the vast literature analyzing how shocks propagate across countries around turbulent times more broadly. This literature is deeply intertwined with works on the existence of contagion as there is no consensus on how to clearly distinguish it from other crises transmission channels.<sup>6</sup> A large number of papers analyze the transmission of crises by focusing directly on a particular transmission mechanism such as the role of trade linkages.<sup>7</sup> Alternatively, other papers provide evidence of the relative importance of the different transmission channels.<sup>8</sup> Lastly, many others do not examine propagation mechanisms themselves, but rather focus on whether cross-market linkages, measured mostly through stock

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<sup>6</sup> See for example Claessens and Forbes (2001) and Forbes and Rigobon (2002).

<sup>7</sup> See Kaminsky, Lyons, and Schmukler (2001), Forbes (2002), Kim and Wei (2002), Broner, Gelos, and Reinhart (2006), among many others.

<sup>8</sup> See Glick and Rose (1999), Kaminsky and Reinhart (2000), Van Rijckeghem and Weder (2001), among many others.

market correlations, have increased during turbulent times.<sup>9</sup> However, despite the vast literature on the propagation of shocks across countries, there are relatively few papers evaluating the demonstration effects or the wake-up call hypothesis.<sup>10</sup> Our paper contributes to this literature by analyzing the significance of different channels of crises propagation including real and financial linkages and the demonstration effect or wake-up call hypothesis. In particular, we study the determinants of stock market comovements around the 2007-2008 financial crisis, although we do not focus on whether comovement has been excessive or irrational.

Lastly, we contribute to a third strand of the literature that analyzes the drivers of stock market correlations in order to understand the determinants of international linkages across countries over time.<sup>11</sup> For instance, Quinn and Voth (2008) study the effects of capital account openness and the synchronization of fundamentals on stock market correlations over long-run periods. Similarly, Forbes and Chinn (2004) analyze whether the direct trade flows, competition in third markets, bilateral bank lending, and foreign direct investment affect cross-country linkages in stock and bond markets also over long periods of time. We follow a methodology similar to these papers, but focus on factors affecting stock market comovement during the recent crisis.

The remainder of the paper is organized as follows. Section 2 presents the empirical methodology. Section 3 describes the data. Section 4 analyzes the results. Section 5 concludes.

## **2. Empirical methodology**

To examine stock markets' vulnerability to the 2007-2008 crisis, we estimate a model where monthly local stock market returns (expressed in US dollars) are a function of returns in the US market, the epicenter of the crisis. We explore the determinants of local markets' comovement with the US by interacting US returns with different country-level variables. We also include

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<sup>9</sup> See King and Wadhvani (1990), Calvo and Reinhart (1996), Forbes and Rigobon (2002), Bekaert, Harvey, and Ng (2005), Corsetti, Pericoli, and Sbracia (2005), among many others.

<sup>10</sup> For a theoretical framework, see Shiller (1995), and for empirical studies, see Eichengreen, Rose, and Wyplosz (1998), Sachs, Tornell, and Velasco (1996), Baig and Godfajn (1999), Forbes (1999), and Van Rijckeghem and Weder (2003).

<sup>11</sup> See for example Hamao, Masulis, and Ng (1990), Erb, Harvey, and Viskanta (1994), Longin and Solnik (1995), Ang and Bekaert (2002), Dumas, Harvey, and Ruiz (2003), Goetzmann, Li, and Rouwenhorst (2005), and Kizys and Pierdzioch (2009).



monthly time effects that capture global factors (e.g., changes in commodity prices, an international drop in liquidity, etc.), and country-specific fixed effects that capture the individual country average returns over the time period we consider. We distinguish between two periods: before and after the collapse of Lehman Brothers in September 2008 since that event is considered by many to be a turning point in the crisis (see for example Dooley and Hutchison, 2009, Raddatz, 2009). The empirical model can be summarized by equation (1) below:

$$r_{c,t} = \beta_{pre} D_{pre} r_{US,t} X_c + \beta_{post} D_{post} r_{US,t} X_c + \alpha_c + \mu_t + \varepsilon_{c,t}, \quad (1)$$

where  $r_{c,t}$  is the stock market return in country  $c$  at time  $t$  measured in US dollars and  $r_{US,t}$  is the return on the US stock market index at time  $t$ .  $D_{pre}$  refers to a dummy that equals one for the period before the collapse of Lehman Brothers (July 2007 through August 2008) and  $D_{post}$  refers to a dummy that equals one for the period after Lehman's demise (September of 2008 until April 2009).  $X_c$  is a matrix of pre-crisis country characteristics that could affect the degree of comovement between the US market and the local country  $c$  market. In particular,  $X_c$  includes variables that capture real (trade) and financial linkages between the US market and other markets, as well as variables that capture the possibility that crisis transmission arose from a wake-up call or demonstration effect. Country-level factors included in  $X_c$  are measured at the end of 2006, minimizing concerns about endogeneity.  $\beta_{pre}$  and  $\beta_{post}$  indicate the extent to which different factors explain the comovement between the local and US markets.  $\mu_t$  and  $\alpha_c$  are time and country effects, respectively. Because returns may be correlated over time within country, we estimate the model allowing for clustered standard errors at the country-level.

To compare the impact of country characteristics that can affect comovement in the period before and after the collapse of Lehman, we perform an F-test for the equivalence of coefficients  $\beta_{pre}$  and  $\beta_{post}$ . To make the comparison of economic significance of different variables and transmission channels easier, we standardized all of the independent variables prior to interacting them with US returns (i.e., we transform regressors by subtracting their mean and dividing them by their standard deviation). Hence, the coefficients on the regressors can be interpreted as representing the change in comovement due to a one standard deviation change in a regressor. Because the number of countries drops considerably when we combine different country characteristics, we start by reporting estimations with only one regressor at a time (aside

from the country and time dummies). However, to test the robustness of our results, we also report estimations combining the most significant variables.

Our one-step model described above is equivalent to a two-step procedure in which the local returns for each country are regressed on US returns in the first step, and in the second step, the estimated coefficients on US returns from the first step, which measure each market's comovement with the US, are regressed on the country-level characteristics that proxy for the different transmission channels. The two-step methodology is useful for graphical representation of our results and we show graphs of the comovement against some country characteristics to visually illustrate whether a given factor appears to be explaining the extent of transmission. For inference, however, we use the one-step methodology as it produces more efficient estimates.

### **3. Data**

Local and US returns data for the period July 2007 through April 2009 are calculated from stock market prices obtained from Bloomberg. All country-level variables used to explore the determinants of the degree of comovement between the US and other markets are measured at the end of 2006 or earlier. Table 1 presents a list of these variables along with their definition and data sources. Table 2 shows descriptive statistics for each variable. To deal with outliers, we remove observations that are three standard deviations below and above the mean of each variable.

To measure bilateral trade linkages, we compute the share of exports to the US relative to GDP from data obtained from the IMF Direction of Trade Statistics. We also collect data on broader trade indicators such as exports to GDP, trade openness (defined as the ratio of exports plus imports to GDP), fuel exports to total exports, and agricultural exports to total exports. This data come from the IMF International Financial Statistics and the World Bank World Development Indicators.

To measure financial linkages between the US and other countries we include a number of indicators, collected from multiple sources. First, we construct the ratio of US holdings of foreign equity to local market capitalization and the ratio of foreign holdings of US equity to local market capitalization from data from the Treasury International Capital System database

compiled by the US Treasury. Second, we include a number of broader measures of capital account openness. In particular, we include the Chinn and Ito Index of Financial Openness (Chinn and Ito, 2008) which measures *de jure* openness to capital flows.<sup>12</sup> We also include measures of inflows, namely, foreign direct investment (FDI) inflows, portfolio (equity and debt) inflows and other inflows (mostly bank lending flows). All these variables are scaled by GDP. These data come from the IMF Balance of Payment Statistics. Third, we include measures of stock market size and liquidity. As a measure of stock market size, we include the ratio of stock market capitalization to GDP. Liquidity is measured by the stock market turnover ratio, defined as the value of total shares traded to the stock market capitalization. Data on these variables come from the World Bank Financial Structure Database.<sup>13</sup>

To establish the importance of a wake-up call channel at work in explaining the degree of comovement between the US market and other markets, we compute different measures of banking, corporate, macro, and sectoral vulnerabilities. When it comes to banking, we examine the significance of variables such as the capital-adequacy ratio (measured by the share of equity to assets), the share of liquid assets to total assets, and the ratio of credit to the private sector to GDP. The first two variables are computed with data from Bankscope and the last one comes from the World Bank Financial Structure Database. Finally, we also examine the significance of an index of banking activities restrictions, which incorporates information as to whether banks are allowed to underwrite securities and insurance products, commercialize real estate or own non-financial firms. The index, which comes from the Bank Regulation and Supervision Database collected by the World Bank, takes higher values the more significant the restrictions in place.<sup>14</sup>

A number of variables are included to capture corporate sector vulnerability. First, we compute the ratio of total debt, and separately, short-term debt to total assets. Second, we also examine the significance of return on assets, a measure of firm profitability. Third, we look at a

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<sup>12</sup> The data itself can be found at <http://web.pdx.edu/~ito/>.

<sup>13</sup> This database can be found at <http://econ.worldbank.org/WBSITE/EXTERNAL/EXTDEC/EXTRESEARCH/0,,contentMDK:20696167~pagePK:64214825~piPK:64214943~theSitePK:469382,00.html>.

<sup>14</sup> This data can be found at <http://econ.worldbank.org/WBSITE/EXTERNAL/EXTDEC/EXTRESEARCH/0,,contentMDK:20345037~pagePK:64214825~piPK:64214943~theSitePK:469382,00.html>. An explanation of how the index was constructed can be found at Barth, Caprio and Levine (2001).

measure of liquidity defined as the ratio of cash to assets. Data to compute all these ratios come from Worldscope. Country-level averages, weighted by firm size, are used in our estimations. Finally, using data on interest coverage (the ratio of interest expenses to earnings) from Worldscope, we calculate the percentage of firms with interest coverage below 1. This variable captures the share of firms that are not able to meet their debt obligations with their earnings.

Among the proxies for macroeconomic vulnerability, we include a measure of fiscal imbalance and a number of measures of external imbalances. The fiscal account (budget surplus or deficit) to GDP is computed with data from the World Bank Development Indicators. As measures of external imbalances, we consider the current account balance to GDP, the financial account balance to GDP, and the share of reserves to GDP. All these variables come from the IMF Balance of Payment Statistics.

Finally, because the US crisis started in the real estate sector, we also consider variables related to this sector. In particular, we include the share of mortgage debt to GDP as of 2006, the cumulative growth rate in this share between 2003 and 2006, the average growth rate in the share of mortgage debt to GDP during this period, and the change in real estate prices between 2003 and 2006. These data come from multiple sources including Bank for International Settlements, EMF Hypostat, International Finance Corporation, Market Watch and World Bank.

#### **4. Empirical results**

Following the methodology outlined in Section 3, we conduct different estimations to test for whether trade linkages, financial linkages or a wake-up call/demonstration effect can explain the transmission of the US crisis to other stock markets around the world.

##### **Trade linkages**

Table 3 shows the estimations testing for whether trade linkages explain the comovement between the US and other countries' stock markets. Surprisingly, we find that exports to the US and total exports to GDP have the reverse sign from the expected— countries with larger share of exports show less comovement with the US stock market. However, these results appear to be driven by changes in the exchange rate of the US dollar vis-à-vis other currencies in the midst of

the crisis. If we estimate the same regressions using local returns the coefficient are negative but no longer significant. These results are available upon request.<sup>15</sup> At the same time, we find that overall trade openness is not an important predictor of the country's response to the crisis, as the coefficients on this variable are not significant in either period. This is also somewhat surprising, since trade flows significantly contracted during the crisis period and may reflect the fact that the impact of trade may be observed only on real-side variables. Finally, trade composition does not seem to matter either since neither the ratio of fuel exports to total exports nor the share of agricultural exports to total exports matter.

### **Financial linkages**

Table 4 reports results on the importance of financial linkages in explaining stock market comovement with the US. Most interestingly, we find that a larger share of US investors' holdings of foreign markets is associated with a more pronounced reaction to the US crisis. This is consistent with a "margin calls" story where US investors facing large losses at home withdrew money from their foreign investments, and the countries with the larger share of US investments were the most affected by such withdrawals. The effect of foreign investors' holdings of US securities is not significant, but, if anything, it has the opposite impact – as the foreign investors could have withdrawn money from their US investments and they could have brought that cash home, thus boosting the local market performance.

Even if a country is not directly exposed to the US stock market (i.e., individuals and corporations do not hold US stocks), its market might commove with the US stock market if the economy is very open to financial flows and the stock market is very liquid. This is due to the fact that for investors who are exposed to the US and have to redeem other investments to make up for their US losses it makes sense to exit open and liquid markets. In terms of capital account openness, we find that more open countries have experienced higher comovement with the US in the period after the collapse of Lehman. The coefficient on the Chinn and Ito *de jure* measure for the post-Lehman period is significant at 10%, and it is statistically different from the first period coefficient, also at 10% (according to the F-test). Countries with large portfolio inflows also

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<sup>15</sup> Also, removing countries with large share of trade to the US, such as Singapore, Malaysia or China make the coefficient insignificant even when expressed in US dollars.

exhibit a larger degree of comovement with the US market. The results are significant at 1% and are almost twice as large in magnitude for the first period. The difference between first and second period is statistically significant at 5%. Figure 3 demonstrates that the relationship between the degree of comovement and the share of portfolio inflows to GDP is strong and not driven by the outliers. This result contrasts with what we find for the share of foreign direct investment inflows to GDP. This variable does not seem to significantly influence stock market comovement between the US and other countries. Finally, other inflows (which mostly include bank flows) slightly exacerbated the country's response to the crisis in the second period (significant at 10%).

Regarding the significance of stock market indicators, we find that more liquid markets reacted more to the US crisis. We find that market liquidity is a strong factor in predicting comovement with the US in both periods (significant at 1%), and the effect is stronger in the first period (the difference in coefficients is statistically significant according to the F-test). Figure 4 shows that the effect of liquidity on the degree of comovement is not driven by outliers. The impact of stock market size, measured by the ratio of stock market capitalization to GDP, is weaker than the impact of liquidity, and likely to just capture the fact that the shock was more prominent in more developed countries, which also happen to have larger stock markets. Indeed, when we put two of these factors together, only stock market turnover retains its significance (results not reported).

### **Wake-up call or demonstration effect**

Comovement across markets might not be related to any sort of linkages between markets but might happen as a result of a new interpretation of existing information which stimulates learning and awareness. In other words, the crisis in one country may alert investors to potential dangers in other countries with similar types of vulnerabilities. For example, in the context of the recent US crisis, seeing that high levels of credit (in particular mortgage lending) and indebtedness in the US banking and corporate sectors were at the root of the crisis, investors might have reassessed the value of their portfolios in countries with similar fundamentals. We explore the significance of the wake-up call or demonstration effect hypothesis by examining the

role of variables capturing banking, corporate, macro, and sectoral vulnerabilities that were frequently mentioned as factors contributing to the US debacle.

### *Banking sector vulnerabilities*

Because the 2007-2008 crisis originated in the US banking sector, it is natural to expect that the health of the local banking sector may be related to the extent of country's comovement with the US. Table 5 presents our results for some key banking variables. An important aspect of banking sector health is the capital adequacy ratio since the ability of banks to withstand losses is directly tied to this variable. Our measure of capital adequacy, the equity to assets ratio, shows that countries in which banks were better capitalized have experienced less comovement with the US. However, this result is not very strong - the coefficient is only significant at the 10 percent significance level in the first period and not significant in the second period. The F- test does not reject the hypothesis that both coefficients are the same. Nevertheless, Figure 5 reveals that one country might be an outlier – Brazil, which has the highest equity to assets ratio of over 25, while also suffering a significant response to the crisis. Once Brazil is excluded from the regression, the first period coefficient becomes -0.24 with a t-statistics of -3.07 and it is now significantly different from the second period coefficient. Thus, we find that better capital adequacy reduces countries' comovement with the US market.

Bank liquidity is another important banking characteristic that could reduce the magnitude of comovement. Indeed, we find that bank liquidity is related to the extent of comovement across stock market returns, but only in the first period. The F-test rejects the hypothesis that the coefficients are the same between the two periods. It is possible that by the time the more severe period of the crisis started in September 2008, our liquidity variable, which is measured at the end of 2006, was outdated. This could be because banks that were more liquid at the end of 2006 used up some of this liquidity in the first half of the crisis. Alternatively, in the worst period of the crisis, bank liquidity might not be an important factor anymore as the crisis seemed to have affected the liquid and less liquid banks in similar ways.

The US crisis has been associated with the excessive and poorly regulated use of some sophisticated financial technologies and instruments such as mortgage-backed securities, collateralized debt obligations, collateralized loan obligations, etc (see Caprio, Demirguc-Kunt

and Kane, 2008; Goodhart, 2008; Whalen, 2008). Countries with higher level of financial development are likely to have more prevalent availability and use of these instruments. Hence we explore whether financial development explains the degree of comovement with the US market. For lack of a better proxy, and following an extensive literature on the subject of financial development (see Levine, 2005 for a review), we measure the latter as the share of private credit to GDP. We find that countries with a higher proportion of private credit to GDP experienced greater comovement in both periods, especially in the first. The F-tests rejects the hypothesis of equal coefficients at the 6 percent significance level. The first period coefficient is almost twice the size of the second period coefficient.

The fact that banks could engage in multiple types of activities has also been discussed as a factor contributing to the US crisis (See for example Kotlikoff, 2010). We explore whether countries with greater restrictions on bank activities suffered less comovement by including an index of restrictions on banking activities developed by Barth et al. (2001). This variable is the sum of sub-indexes capturing the extent to which banks can engage in real estate, investment banking, insurance, and non-financial activities. We find that stock markets in countries with more restrictions on bank activities have been less prone to commove with the US market than those with fewer restrictions. The impact of the index on banking activities is similar in both crisis periods, and the difference between the coefficients is not significant.

### *Corporate sector vulnerabilities*

Because our measure of crisis is based on stock price performance, it is natural to expect that countries with firms that had weaker fundamentals prior to the crisis might have been more vulnerable to the crisis. Table 6 shows our regressions with several measures of corporate sector vulnerability described earlier. The interaction between US returns and the corporate debt to assets ratio is positive and significant, indicating that countries with more indebted corporates at the end of 2006 were more likely to commove with the US. This result supports the recent calls for reducing corporate leverage. Another useful indicator is the proportion of firms in the country with interest coverage ratio below one, which indicates the share of firms that have difficulty in meeting their interest payments with their cash flows (and thus are at a higher risk of defaulting on their debt obligations). We find that the larger the share of firms with interest coverage ratios



below one, the higher the comovement of local stock market with the US market. Both measures are only significant in the first period and have significant F-tests. Figures 6 and 7 demonstrate that these effects are not driven by the outliers. Finally, we tried other measures of corporate health, such as the proportion of short-term debt to assets, the return on assets, and the stock of cash (a proxy for liquidity at the firm level), but we have not found them to be significantly related to comovement with the US market.

### *Macroeconomic and sectoral vulnerabilities*

We consider several macroeconomic fundamentals that might affect a country's vulnerability to the current crisis. In particular, we examine the role of the current account balance, the financial account balance, the ratio of total international reserves to GDP, and the budget deficit. Because the crisis was linked to the real estate sector, we also consider the role of several indicators of real estate financing and real estate price appreciation. The results are presented in Tables 7 and 8. We do not find any significant impact of aggregate macro fundamentals on the comovement of stock market returns with the US (see Table 7). Our results on macro factors are similar to those obtained in Rose and Spiegel (2009a), who also do not find any significant impact of the macro factors on the severity of the crisis using a different methodology. On the other hand, Ehrmann et al. (2009) finds that similar macro factors were important in explaining the extent of stock market declines during the crisis. However their methodology looks at overall returns, controlling for comovement with the US (or US betas), while we look at the factors that make comovement with the US stronger during the crisis (i.e. interactions with US betas).

Surprisingly, we do not find any significance for the real estate indicators either (see Table 8). While we find positive coefficients on the extent of real estate price appreciation and the size of the mortgage market, they are not statistically significant. One reason might be the limited data availability, as we have a significantly smaller number of countries for these variables than we have for others.

### **Assessing the relative importance of different transmission channels**

As mentioned in Section 3, to compare the economic significance of different variables and transmission channels, we standardized all of the independent variables prior to interacting them

with US returns. As a result, the interaction coefficient indicates by how much a one standard deviation change in a given variable affects the comovement of local stock market return with the US return. For example, using results discussed in Table 5, a one standard deviation change in the private credit to GDP ratio, increases comovement of the local index with the US market by 0.23. To put this in perspective, we first evaluate the average comovement of local returns and US returns in our sample for both periods. To do so, we regress local returns on US returns, with country dummies, but without time dummies, in a pooled regression with all countries. We find that the average comovement is 0.64 in the first period (with t-statistic of about 9) and 0.93 in the second period (with t-statistic of about 16).<sup>16</sup> This change is in line with the observation that during crisis periods stock market correlations across countries increase. Thus, an impact of one standard deviation of private credit in the first period results in an increase of comovement by about a third of the average value of comovement in the first period, which is quite a large impact.

Comparing all the variables considered, we find that the strongest effects are observed for the measure of stock market liquidity (the turnover ratio), the ratio of US holding of foreign equity, the share of portfolio inflows to GDP, the ratio of private credit to GDP, and the share of firms with interest coverage ratios below 1. All these variables tend to have a much larger impact in the first period. Finally, we pick the strongest factors from each group of variables and run several multivariate regressions. The results are presented in Table 9. Except for the last column, the remaining regressions exclude the interest coverage variable since we have significantly fewer observations for that variable. In general, we find that portfolio inflows, stock market turnover and US holdings of foreign equity remain significant (in at least one of the periods and regressions), while private credit to GDP loses its significance and actually becomes negative.

Once we include the interest coverage ratio we lose a significant portion of the sample – we only have 48 countries now. We find that in the first period of the crisis the interest coverage ratio dominates all other variables – it is the only statistically significant factor in the first period. This suggests that corporate health is a factor investors care about, especially in the early stages of the crisis when they can discriminate between companies with stronger or weaker

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<sup>16</sup> For comparison, in 2 years prior to crisis the average comovement with the US was about 0.4, with the t-statistic of about 5.

fundamentals. In the second period, the strongest significance is obtained for stock market turnover, which suggests that in the worst period of the crisis investors withdrew from liquid markets. Another important factor is the presence of US investors (the share of US holdings of foreign equity), which remains significant at 10% level. While portfolio inflows loses significance at conventional levels, its t-statistic of 1.5 in the first period suggests that it still could be a factor influencing a country's response to crisis. Interestingly, with the addition of interest coverage, we now find that private credit to GDP is significantly negative in the second period, suggesting that financial development might have a mitigating effect, once the other contributing factors are taken into account (such as market liquidity, capital flows and the health of the corporate sector). However, given our relatively small sample and multicollinearity among the variables included in the regression, these results should be treated with caution.

## **5. Conclusions**

This paper examined the determinants of stock markets' vulnerability to the 2007-2008 crisis by analyzing the factors driving the correlation between stock market returns in the US and in 83 other countries. Not surprisingly, given the nature of the crisis and the fact that we are focusing on financial markets, we found that the main channel of transmission was financial. We also found evidence of a wake-up in the first stage of the crisis, when countries with vulnerable banking and corporate sectors exhibited a higher comovement with the US market. On the other hand, despite a collapse in trade across countries, we did not find support for this channel of transmission.

An obvious implication from our findings is the need for countries to contain banking and corporate vulnerabilities to limit the transmission of crises. While macro vulnerabilities did not seem to matter for transmission in the context of the 2007-2008 crisis, this does not mean that they will not play an important role in future crises (as they have in the past). The results also highlight the dark side of financial integration and liquidity since countries that are more integrated and have more liquid markets experienced greater comovement with the US. However, a priori, we believe that countries should not overreact and turn their backs to financial integration and the pursuit of local capital market development. Rather, through adequate

regulation and supervision, countries should try to manage the potential exposures that arise from having financially integrated and liquid markets.

## References

- Agarwal, S. and Ho, C., 2007. Comparing the Prime and Subprime Mortgage Markets. Chicago Fed Letter 241, August.
- Ang, A., and Bekaert, G., 2002. International Asset Allocation with Regime Shifts. *Review of Financial Studies* 15, 1137–1187.
- Baig, T. and Goldfajn, I., 1999. Financial Market Contagion in the Asian Crisis. *IMF Staff Papers* 46, 167-195.
- Barth, J., Gerard, C., and Levine, R., 2001. The Regulation and Supervision of Banks around the World. A New Database. World Bank Policy Research Working Paper 2588
- Bekaert, G., Harvey, C., and Ng, A., 2005. Market Integration and Contagion. *Journal of Business* 78, 39–69.
- Broner, F., Gelos, G., and Reinhart, C., 2006. When in Peril, Retrench: Testing the Portfolio Channel of Contagion. *Journal of International Economics* 69, 203–230.
- Brunnermeier, M. K., 2009. Deciphering the Liquidity and Credit Crunch 2007-2008. *Journal of Economic Perspectives* 23 (1), 77–100.
- Calomiris, C. W., 2009. The Subprime Turmoil: What’s Old, What’s New and What’s Next. *Journal of Structured Finance* 15 (1), 6–52.
- Caprio, G., Demirguc-Kunt, A., and Kane, E., 2008. The 2007 Meltdown in Structured Securitization: Searching for Lessons, Not Scapegoats. World Bank Policy Research Working Paper Series 4745.
- Calvo, S., and Reinhart, C. M., 1996. Capital Flows to Latin America: Is There Evidence of Contagion Effects? in Private Capital Flows to Emerging Markets after the Mexican Crisis, Calvo, G and Goldstein, M. (eds.), Washington: Institute for International Economics.
- Cecchetti, S. G., 2009. Crisis and Responses: The Federal Reserve in the Early Stages of the Financial Crisis. *Journal of Economic Perspectives* 23 (1), 51–75.
- Chinn, M. and Ito, H., 2009. A New Measure of Financial Openness. *Journal of Comparative Policy Analysis* 10(3), 307-320.
- Claessens, S., Dornbusch, R., and Park, Y. C., 2001. Contagion: Why Crises Spread and How This Can Be Stopped, in International Financial Contagion, Claessens, S. and Forbes, K. (eds.), Kluwer Academic Publishers, Norwell, MA.

- Claessens, S., and Forbes, K., 2001. International Financial Contagion: An Overview, in International Financial Contagion, Claessens, S. and Forbes, K. (eds.), Kluwer Academic Publishers, Norwell, MA.
- Corsetti G., Pericoli, M., and Sbracia, M., 2005. Some Contagion, Some Interdependence: More Pitfalls in Tests of Financial Contagion. *Journal of International Money and Finance* 24, 1177–1199.
- Didier, T., Mauro, P., and Schmukler, S., 2008. Vanishing Financial Contagion? *Journal of Policy Modeling* 30, 775-791
- Dooley, M. P. and Hutchison, M., 2009. Transmission of the U.S. Subprime Crisis to Emerging Markets: Evidence on the Decoupling-Recoupling Hypothesis. NBER Working Paper 15120.
- Dumas, B., Harvey, C., and Ruiz, P., 2003. Are Correlations of Stock Returns Justified by Subsequent Changes in National Outputs? *Journal of International Money and Finance* 22, 777–811.
- Ehrmann, M., Fratzscher, M. and Mehl, A., 2009. What Has Made the Current Financial Crisis Truly Global? Mimeo. European Central Bank.
- Eichengreen, B., Rose, A., and Wyplosz, C., 1998. Contagious Currency Crises: First Tests. *Scandinavian Journal of Economics* 98(4), 463-484.
- Erb, C. B., Harvey, C. R., and Viskanta, T. E., 1994. Forecasting International Equity Correlations. *Financial Analysts Journal*, November/December, 32–45.
- Forbes, K., 1999. How Are shocks Propagated Internationally? Firm-level evidence from the Russian and East Asian Crises. In Financial Crises in Emerging Markets, Glick, R., Moreno, R. and Spiegel, M., (eds.), Cambridge University Press.
- Forbes, K., 2002. Are Trade Linkages Important Determinants of Country Vulnerability to Crises? in Preventing Currency Crises in Emerging Markets, Edwards, S. and Frankel, J., (eds.), University of Chicago Press.
- Forbes, K., and Chinn, M., 2004. A Decomposition of Global Linkages in Financial Markets Over Time. *Review of Economics and Statistics* 86 (3), 705–722.
- Forbes, K., and Rigobon, R., 2002. No Contagion, Only Interdependence: Measuring Stock Market Co-Movements. *Journal of Finance* 57, 2223–2261.
- Fratzscher, M., 2009. What Explains Global Exchange Rate Movements During the Financial Crisis? European Central Bank Working Paper 1060.
- Glick, R., and Rose, A. K., 1999. Contagion and Trade: Why Are Currency Crises Regional? *Journal of International Money and Finance* 18 (4), 603–617.

- Goetzmann, W. N., Li, L., and Rouwenhorst, K. G., 2005. Long-Term Global Market Correlations. *Journal of Business* 78 (1), 1–38.
- Goldstein, M., 1998. The Asian Financial Crisis: Causes, Cures, and Systemic Implications. *Policy Analyses in International Economics* 55. Institute for International Economics.
- Goodhart, C.A., 2008. The Background to the 2007 Financial Crisis. *International Economics and Economic Policy* 4, 331-346.
- Hamao, Y., Masulis, R. W., and Ng, V., 1990. Correlations in Price Changes and Volatility Across International Stock Markets. *Review of Financial Studies* 3, 281–308.
- Kaminsky, G. L., Lyons, R., and Schmukler, S., 2001. Mutual Fund Investment in Emerging Markets: An Overview. *World Bank Economic Review* 15(2), 315-340.
- Kaminsky, G. L., and Reinhart, C. M., 2000. On Crises, Contagion, and Confusion. *Journal of International Economics* 51 (1), 145–168.
- Kim, W., and Wei, S. J., 2002. Foreign Portfolio Investors Before and During a Crisis. *Journal of International Economics* 56 (1), 77–96.
- King, M. A., and Wadhvani, S., 1990. Transmission of Volatility between Stock Markets. *Review of Financial Studies* 3 (1), 5–33.
- Kizys, R., and Pierdzioch, C., 2009. Changes in the International Comovement of Stock Returns and Asymmetric Macroeconomic Shocks. *International Financial Markets, Institutions, and Money* 19, 289–305.
- Kotlikoff, L., 2010. *Jimmy Stewart is Dead – Ending the World's Ongoing Financial Plague with Limited Purpose Banking*. John Wiley and Sons.
- Levine, R., 2005. Finance and Growth: Theory and Evidence. In Handbook of Economic Growth vol 1: Aghion, P. and Durlauf, S. (eds.), Elsevier.
- Longin, F., and Solnik, B., 1995. Is the Correlation in International Equity Returns Constant: 1970–1990? *Journal of International Money and Finance* 14, 3–26.
- Masson, P., 1998. Contagion: Monsoonal Effects, Spillovers, and Jumps Between Multiple Equilibria. IMF Working Paper 98/142.
- Obstfeld, M., Shambaugh, J. C., and Taylor, A. M., 2009. Financial Instability, Reserves, and Central Bank Swap Lines in the Panic of 2008. NBER Working Paper 14826.
- Quinn, D., and Voth, H. J. , 2008. A Century of Global Equity Market Correlations. *American Economic Review* 98 (2), 535–540.
- Reinhart, C., and Rogoff, K. , 2008. Is the 2007 US Sub-Prime Financial Crisis So Different? An International Historical Comparison. *American Economic Review* 98 (2), 339–344.

- Rose, A., and Spiegel, M., 2009a. Cross-Country Causes and Consequences of the 2008 Crisis: Early Warning. CEPR Discussion Paper 7354.
- Rose, A., and Spiegel, M., 2009b. Cross-Country Causes and Consequences of the 2008 Crisis: International Linkages and American Exposure. NBER Working Paper 15358.
- Sachs, J., Tornell, A., and Velasco, A., 1996. Financial Crises in Emerging Markets: The Lessons from 1995. *Brookings Papers on Economic Activity* 27(1), 147-199.
- Shiller, R., 1995. Conversation, Information, and Herd Behavior. *American Economic Review* 85(2), 181-185.
- Taylor, J. B., 2009. The Financial Crisis and the Policy Responses: An Empirical Analysis of What Went Wrong. NBER Working Paper 14631.
- Van Rijckeghem, C., and B. Weder, 2001. Sources Of Contagion: Is It Finance or Trade? *Journal of International Economics* 54 (2), 293–308.
- Van Rijckeghem, C. and Weder, B., 2003. Spillovers Through Banking Centers: A Panel Data Analysis of Bank Flows. *Journal of International Money and Finance* 22, 483–509.
- Whalen, R., 2008. The Subprime Crisis: Cause, Effect and Consequences. Networks Financial Institute Policy Brief No. 2008-PB-04.



**Table 1: Variable definitions and sources**

<b>Variable Name</b>	<b>Definition</b>	<b>Source</b>
US Stock Market Returns (%)	Monthly US stock returns between July 2007 and April 2009.	Bloomberg
Local Stock Market Returns in US\$ (%)	Monthly local stock returns expressed in US dollars between July 2007 and April 2009.	Bloomberg
<b>Trade Channel</b>		
Exports to US/GDP (%)	Export FOB (2006) divided by current GDP(2006)	Direction of Trade Statistics (IMF)
Exports/GDP (%)	Total exports (2006) to current GDP (2006)	World Development Indicator
(Export+Import)/GDP (%)	Export FOB & Import CIF (2006) to current GDP (2006)	International Financial Statistics and World Development Indicator
Fuel Exports / Exports (%)	Fuel exports (2006) to total merchandise exports (2006)	World Development Indicator
Agricultural Exports / Exports (%)	Agricultural raw materials exports (2006) to total merchandise exports (2006)	World Development Indicator
<b>Financial Channel</b>		
US Holdings of Foreign Equity /Local Market Capitalization (%)	US investments in foreign equity(Jun. 2007) divided by local market capitalization (Dec. 2006)	Treasury International Capital System (US Treasury Department) and World Development Indicator
Foreign Holdings of US Equity /Local Market Capitalization (%)	Foreign investments in US equity(Jun.2007) divided by local market capitalization (Dec. 2006)	Treasury International Capital System (US Treasury Department) and World Development Indicator
Chin-Ito Index of Financial Openness	A measure of the degree of financial openness of a country where higher value indicates greater de jure financial openness. (2006)	Chin & Ito (September 2008)
FDI Inflows/GDP (%)	Foreign direct investment inflows divided by current GDP (2006)	Balance of Payments & International Investment Position Statistics (IMF) and World Development Indicator
Portfolio Inflows/GDP (%)	Portfolio investment assets inflows divided by current GDP (2006)	Balance of Payments & International Investment Position Statistics (IMF) and World Development Indicator
Other Inflows/GDP (%)	Other assets inflows divided by current GDP (2006)	Balance of Payments & International Investment Position Statistics (IMF) and World Development Indicator
Stock Market Turnover (%)	Ratio of the value of total shares traded to average real market capitalization (2006)	Financial Structure Database (World Bank)
Stock Market Capitalization/GDP (%)	Ratio of the value of listed shares to GDP (2006)	Financial Structure Database (World Bank)

<b>Banking Sector Vulnerabilities</b>		
Capital Adequacy Ratio (%)	Total equity divided by total assets (2006)	BankScope
Liquidity Ratio (%)	Cash and due from banks divided by total assets (2006)	BankScope
Private Credit to GDP Ratio (%)	Credit extended by deposit money banks and other institutions to the private sector measured as a fraction of GDP (2006)	Financial Structure Database 2008 (World Bank)
Banking Activity Composite Index	Index that captures the extent to which banks are restricted from getting involved in securities and insurance underwriting, and real estate and commercial operations. Higher numbers mean larger restrictions.	Banking Regulation & Supervision Survey 2005 (World Bank)
<b>Corporate Sector Vulnerabilities</b>		
Total Debt to Assets Ratio (%)	Weighted average (across all firms in each country) total debt divided by total assets (2006)	World Scope
Short-term Debt to Total Assets Ratio (%)	Weighted average (across all firms in each country) short-term debt divided by total assets (2006)	World Scope
Return on Assets (%)	Weighted average (across all firms in each country) of net income (2006) to total assets(2006)	World Scope
Cash to Total Assets Ratio (%)	Weighted average (across all firms in each country) of cash divided by total assets (2006)	World Scope
Firms with Interest Coverage<1 (%)	% of firms with interest coverage ratio smaller than 1 (2006), where interest coverage ratio is defined as earnings to interest rate expenses.	World Scope
<b>Macroeconomic Vulnerabilities</b>		
Budget Surplus or Deficit/GDP (%)	Government budget surplus or deficit (2006) to current GDP(2006)	World Development Indicator
Current Account Balance/GDP (%)	Current account balance (2006) divided by current GDP (2006), where current account balance is the sum of (i) exports minus imports, (ii) earnings on foreign investments minus payments made to foreign investors, and (iii) net transfers.	Balance of Payments & International Investment Position Statistics (IMF) and World Development Indicator
Financial Account Balance/GDP(%)	Financial account balance (2006) divided by current GDP (2006), where financial account balance is capital inflows-outflows.	Balance of Payments & International Investment Position Statistics (IMF) and World Development Indicator
Total Reserves/GDP (%)	Total reserve assets (including gold, current US\$) divided by current GDP (2006)	Balance of Payments & International Investment Position Statistics (IMF) and World Development Indicator
Mortgage Debt to GDP (%)	Mortgage debt extended by financial institutions divided by current GDP (2006)	World Bank, IFC, BIS, EMF Hypostat, Market Watch, and World Development Indicator
Mortgage Debt to GDP Growth Rate 2003-2006(%)	Percentage change in mortgage debt to current GDP ratio between 2003 and 2006.	World Bank, IFC, BIS, EMF Hypostat, Market Watch, and World Development Indicator
Avg. Annual Mortgage to GDP Growth Rate 2003-2006(%)	The average of annual mortgage debt to current GDP growth rate between 2003 and 2006.	World Bank, IFC, BIS, EMF Hypostat, Market Watch, and World Development Indicator
Change in Real Estate Price 2003-2006(%)	Percentage change in real estate prices between 2003 and 2006.	BIS and Glindro (2008)

**Table 2: Descriptive statistics**

<b>Variable Name</b>	<b>#Obs.</b>	<b>Mean</b>	<b>Median</b>	<b>Standard Deviation</b>	<b>Min.</b>	<b>Max.</b>
Local stock market returns in US\$ (%)	86	-1.57	-1.36	8.85	-25.93	26.18
<b>Trade Channel</b>						
Exports to US/GDP (%)	75	4.52	2.46	4.79	0.05	20.20
Exports/GDP (%)	77	46.95	44.88	22.03	14.37	116.74
(Export+Import)/ GDP (%)	76	73.79	68.45	34.66	21.8	187
Fuel Exports/Total Exports (%)	78	17.21	6.00	24.95	0.053	92.56
Agricultural Exports/Total Exports (%)	75	1.68	1.17	1.59	0.003	6.40
<b>Financial Channel</b>						
US Holdings of Foreign Equity/Local Market Capitalization (%)	74	8.52	6.95	8.15	0	33.96
Foreign Holdings of US Equity/Local Market Capitalization (%)	72	5.18	1.62	7.78	0	39.11
Chin-Ito Index of Financial Openness	80	0.70	0.88	0.31	0.16	1
FDI Inflows/GDP (%)	77	6.02	3.88	6.31	0.07	29.29
Portfolio Inflows/GDP (%)	76	3.60	2.17	4.19	0	19.84
Other Inflows/GDP (%)	75	7.95	4.40	8.70	0.11	35.89
Stock Market Turnover (%)	82	53.48	40.33	49.19	0.35	172.26
Stock Market Capitalization/GDP (%)	79	71.27	49.79	59.92	2.50	285.57
<b>Banking Sector Vulnerabilities</b>						
Capital Adequacy Ratio (%)	83	9.66	9.16	4.81	1.12	25.53
Liquidity Ratio (%)	82	4.25	2.94	3.99	.27	16.26
Private Credit to GDP Ratio (%)	76	71.39	62.48	46.87	11.36	183.84
Banking Activity Composite Index	72	10.11	10	2.46	4	16
<b>Corporate Sector Vulnerabilities</b>						
Total Debt to Assets Ratio (%)	61	25.47	25.56	8.64	2.22	45.68
Short-term Debt to Assets Ratio (%)	61	10.58	9.09	6.26	0.43	24.79
Return on Assets (%)	61	3.54	3.08	1.87	0.97	9.62
Cash to Total Assets Ratio (%)	60	4.30	4.00	2.34	0.81	12.53
Firms with Interest Coverage<1 (%)	61	18.72	18.89	11.00	0	47.51
<b>Macro and Sectoral Vulnerabilities</b>						
Budget Surplus or Deficit/GDP (%)	72	-0.11	-0.29	3.99	-10.78	9.86
Current Account Balance/GDP (%)	76	0.009	-0.48	9.63	-25.45	27.78
Financial Account Balance/GDP (%)	74	2.16	2.38	9.87	-27.53	30.78
Total Reserves/GDP (%)	76	18.30	15.78	14.53	0.38	72.62
Mortgage Debt to GDP (%)	47	32.42	23.50	29.76	0.50	100.8
Mortgage Debt to GDP Growth Rate 2003-2006(%)	39	121.95	29.99	207.41	-9.36	875.00
Avg. Annual Mortgage to GDP Growth Rate 2003-2006(%)	50	20.73	7.62	30.55	-4.45	134.34
Change in Real Estate Price 2003-2006(%)	33	16.08	12.09	22.58	-11.76	87.69

**Table 3: Testing the significance of the trade channel in the transmission of the 2007-2008 crisis**

Table shows results from regressing local market returns expressed in US dollars. Estimations include time dummies and country fixed effects. Robust standard errors, clustered at the country level, are shown in parentheses. \*, \*\*,\*\*\* denote significance at 10, 5 and 1 percent significance level, respectively.

Variables	Returns in US\$				
US Stock Returns*Exports to US/GDP *Pre-Lehman	-0.074				
	(0.089)				
US Stock Returns*Exports to US/GDP *Post-Lehman	-0.166***				
	(0.057)				
US Stock Returns*Total Exports /GDP *Pre-Lehman		-0.157**			
		(0.068)			
US Stock Returns*Total Exports to US/GDP *Post-Lehman		0.0087			
		(0.0510)			
US Stock Returns*(Exports+ Imports)/GDP *Pre-Lehman			-0.119		
			(0.075)		
US Stock Returns*(Exports+ Imports)/GDP *Post-Lehman			0.011		
			(0.050)		
US Stock Returns*Fuel Exports /Exports *Pre-Lehman				0.095	
				(0.006)	
US Stock Returns*Fuel Exports/ Exports*Post-Lehman				0.040	
				(0.063)	
US Stock Returns*Agricultural Exports/Exports *Pre-Lehman					-0.064
					(0.071)
US Stock Returns*Agricultural Exports/Exports *Post-Lehman					0.031
					(0.032)
F-test null Pre-Lehman interaction=Post-Lehman interaction	2.08	6.90	4.26	1.26	0.10
F-test (p-value)	0.154	0.010	0.042	0.264	0.747
Observations	1561	1605	1581	1621	1558
R-squared	0.526	0.515	0.516	0.538	0.533
Number of countries	75	77	76	78	75

**Table 4: Testing the significance of the financial channel in the transmission of the 2007-2008 crisis**

Table shows results from regressing local market returns expressed in US dollars. Estimations include time dummies and country fixed effects. Robust standard errors, clustered at the country level, are shown in parentheses. \*, \*\*, \*\*\* denote significance at 10, 5 and 1 percent significance, respectively.

Variables	Returns in US \$					
US Stock Returns*US Holdings of Foreign Equity*Pre-Lehman	0.278***					
	(0.071)					
US Stock Returns*US Holdings of Foreign Equity*Post-Lehman	0.215***					
	(0.041)					
US Stock Returns*Foreign Holdings of US Equity*Pre-Lehman		-0.019				
		(0.080)				
US Stock Returns*Foreign Holdings of US Equity*Post-Lehman		-0.051				
		(0.046)				
US Stock Returns*Chinn-Ito Index of Financial Openness*Pre-Lehman		-0.037				
		(0.086)				
US Stock Returns*Chinn-Ito Index of Financial Openness*Post-Lehman		0.089*				
		(0.053)				
US Stock Returns*FDI Inflows/GDP*Pre-Lehman				-0.031		
				(0.089)		
US Stock Returns*FDI Inflows/GDP* Post-Lehman				-0.007		
				(0.041)		
US Stock Returns*Portfolio Inflows/GDP*Pre-Lehman					0.257***	
					(0.062)	
US Stock Returns*Portfolio Inflows/GDP*Post-Lehman					0.136***	
					(0.046)	
US Stock Returns*Other Inflows/GDP*Pre-Lehman						0.069
						(0.079)
US Stock Returns*Other Inflows/GDP*Post-Lehman						0.086*
						(0.047)
F-test null Pre-Lehman interaction=Post-Lehman interaction	0.89	0.35	3.26	0.09	4.08	0.05
F-test(p-value)	0.349	0.556	0.075	0.763	0.047	0.823
Observations	1539	1499	1667	1604	1587	1566
R-squared	0.558	0.534	0.519	0.524	0.531	0.522
Number of countries	74	72	80	77	76	75

**Table 4: Testing the significance of the financial channel in the transmission of the 2007-2008 crisis (cont.)**

Table shows results from regressing local market returns expressed in US dollars. Estimations include time dummies and country fixed effects. Robust standard errors, clustered at the country level, are shown in parentheses. \*, \*\*,\*\*\* denote significance at 10, 5 and 1 percent significance, respectively.

Variable	Returns in US\$	
US Stock Returns*Stock Market Turnover*Pre-Lehman	0.324***	
	(0.052)	
US Stock Returns*Stock Market Turnover*Post-Lehman	0.199***	
	(0.040)	
US Stock Returns*Stock Market Capitalization/GDP*Pre-Lehman		0.159*
		(0.087)
US Stock Returns*Stock Market Capitalization/GDP*Post-Lehman		0.077*
		(0.046)
F-test null Pre-Lehman interaction=Post-Lehman interaction	4.72	1.45
F-test(p-value)	0.033	0.232
Observations	1709	1644
R-squared	0.544	0.525
Number of countries	82	79

**Table 5: Testing the significance of banking sector vulnerabilities in the transmission of the 2007-2008 crisis**

Table shows results from regressing local market returns expressed in US dollars. Estimations include time dummies and country fixed effects. Robust standard errors, clustered at the country level, are shown in parentheses. \*, \*\*,\*\*\* denote significance at 10, 5 and 1 percent significance level, respectively.

Variables	Returns in US \$			
US Stock Returns* Bank Capital Adequacy Ratio*Pre-Lehman	-0.171*			
	(0.089)			
US Stock Returns*Bank Capital Adequacy Ratio*Post-Lehman	-0.069			
	(0.054)			
US Stock Returns*Bank Liquidity Ratio*Pre-Lehman		-0.183***		
		(0.068)		
US Stock Returns*Bank Liquidity Ratio* Post-Lehman		-0.042		
		(0.046)		
US Stock Returns*Private Credit to GDP Ratio*Pre-Lehman			0.237***	
			(0.062)	
US Stock Returns*Private Credit to GDP Ratio*Post-Lehman			0.129**	
			(0.049)	
US Stock Returns*Banking Activities Index*Pre-Lehman				-0.161**
				(0.067)
US Stock Returns* Banking Activities Index*Post-Lehman				-0.146***
				(0.046)
F-test null Pre-Lehman interaction=Post-Lehman interaction	1.55	5.35	3.56	0.04
F-test(p-value)	0.217	0.023	0.063	0.850
Observations	1730	1714	1587	1503
R-squared	0.511	0.511	0.545	0.571
Number of countries	83	82	76	72

**Table 6: Testing the significance of corporate sector vulnerabilities in the transmission of the 2007-2008 crisis**

Table shows results from regressing local market returns expressed in US dollars. Estimations include time dummies and country fixed effects. Robust standard errors, clustered at the country level, are shown in parentheses. \*, \*\*,\*\*\* denote significance at 10, 5 and 1 percent significance level, respectively.

Variables	Returns in US\$				
US Stock Returns*Total Debt to Assets Ratio*Pre-Lehman	0.142*				
	(0.080)				
US Stock Returns*Total Debt to Assets Ratio*Post-Lehman	0.0412				
	(0.072)				
US Stock Returns*Firms with Interest Coverage<1*Pre-Lehman		0.184**			
		(0.074)			
US Stock Returns*Firms with Interest Coverage<1* Post-Lehman		0.0003			
		(0.062)			
US Stock Returns*Short-term Debt to Total Assets Ratio*Pre-Lehman			0.084		
			(0.082)		
US Stock Returns*Short-term Debt to Total Assets Ratio* Post-Lehman			0.060		
			(0.061)		
US Stock Returns*Return on Assets*Pre-Lehman				-0.091	
				(0.058)	
US Stock Returns*Return on Assets*Post-Lehman				0.079	
				(0.054)	
US Stock Returns*Cash to Total Assets Ratio*Pre-Lehman					-0.012
					(0.093)
US Stock Returns*Cash to Total Assets Ratio*Post-Lehman					0.063
					(0.054)
F-test null Pre-Lehman interaction=Post-Lehman interaction	3.19	9.56	0.11	9.09	0.96
F-test(p-value)	0.079	0.003	0.745	0.004	0.332
Observations	1287	1285	1284	1284	1265
R-squared	0.573	0.576	0.569	0.576	0.573
Number of countries	61	61	61	61	60



**Table 7: Testing the significance of macroeconomic vulnerabilities in the transmission of the 2007-2008 crisis**

Table shows results from regressing local market returns expressed in US dollars. Estimations include time dummies and country fixed effects. Robust standard errors, clustered at the country level, are shown in parentheses. \*, \*\*,\*\*\* denote significance at 10, 5 and 1 percent significance level, respectively.

Variables	Returns in US\$			
US Stock Returns*Current Account Balance/GDP*Pre-Lehman	0.061 (0.074)			
US Stock Returns*Current Account Balance/GDP*Post-Lehman	-0.031 (0.048)			
US Stock Returns*Financial Account Balance/GDP*Pre-Lehman		-0.107 (0.073)		
US Stock Returns*Financial Account Balance/GDP*Post-Lehman		0.029 (0.054)		
US Stock Returns*Total Reserves/GDP*Pre-Lehman			-0.137 (0.098)	
US Stock Returns*Total Reserves/GDP*Post-Lehman			-0.075 (0.046)	
US Stock Returns*Budget Surplus or Deficit/GDP*Pre-Lehman				0.0002 (0.073)
US Stock Returns*Budget Surplus or Deficit/GDP*Post-Lehman				0.024 (0.069)
F-test null Pre-Lehman interaction=Post-Lehman interaction	1.44	3.02	0.85	0.10
F-test(p-value)	0.235	0.087	0.492	0.754
Observations	1581	1541	1581	1288
R-squared	0.530	0.528	0.522	0.542
Number of countries	76	74	76	62

**Table 8: Testing the significance of sectoral vulnerabilities in the transmission of the 2007-2008 crisis**

Table shows results from regressing local market returns expressed in US dollars. Estimations include time dummies and country fixed effects. Robust standard errors, clustered at the country level, are shown in parentheses. \*, \*\*,\*\*\* denote significance at 10, 5 and 1 percent significance, respectively.

Variables	Returns in US\$			
US Stock Return*Mortgage Debt to GDP *Pre-Lehman	0.090			
	(0.078)			
US Stock Return*Mortgage Debt to GDP *Post-Lehman	0.036			
	(0.049)			
US Stock Return*Mortgage Debt to GDP Growth Rate 2003-2006*Pre-Lehman		-0.089		
		(0.127)		
US Stock Return*Mortgage Debt to GDP Growth Rate 2003-2006*Post-Lehman		-0.037		
		(0.073)		
US Stock Return*Avg. Annual Mortgage to GDP Growth Rate 2003-2006*Pre-Lehman			-0.107	
			(0.100)	
US Stock Return*Avg. Annual Mortgage to GDP Growth Rate 2003-2006*Post-Lehman			-0.020	
			(0.067)	
US Stock Return*Change in Real Estate Price 2003-2006*Pre-Lehman				0.070
				(0.059)
US Stock Return*Change in Real Estate Price 2003-2006*Post-Lehman				0.075
				(0.059)
F-test null Pre-Lehman interaction=Post-Lehman interaction	0.60	0.21	0.72	0.00
F-test(p-value)	0.442	0.653	0.402	0.956
Observations	970	806	1034	693
R-squared	0.598	0.647	0.614	0.719
Number of countries	47	39	50	33

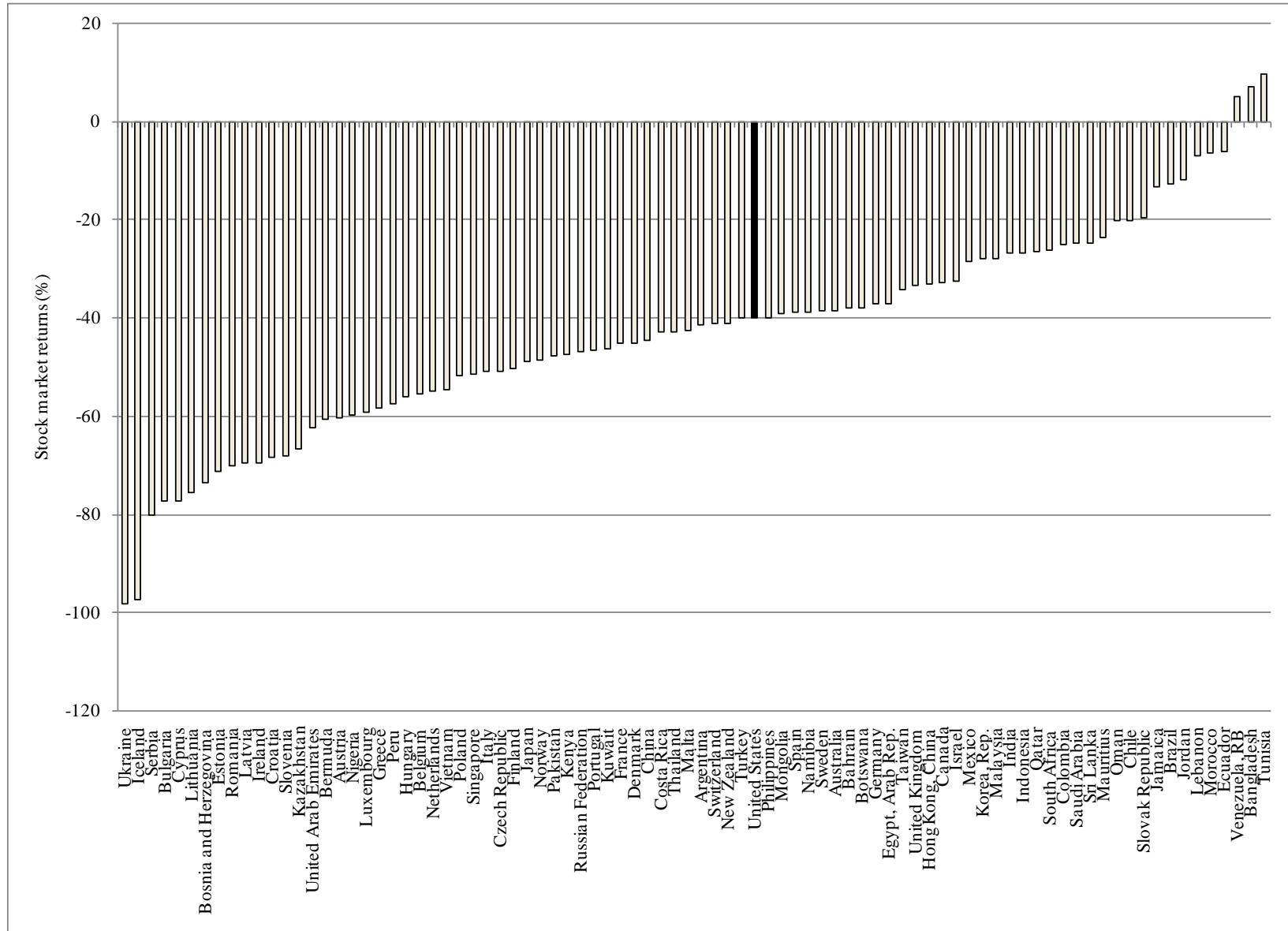
**Table 9: Testing the significance of multiple factors in the transmission of the 2007-2008 crisis**

Table shows results from regressing local market returns expressed in US dollars. Estimations include time dummies and country fixed effects. Robust standard errors, clustered at the country level, are shown in parentheses. \*, \*\*,\*\*\* denote significance at 10, 5 and 1 percent significance level, respectively.

Variables	Returns in US dollars			
US Stock Returns*Portfolio Inflows/GDP*Pre-Lehman	0.115 (0.079)	0.096 (0.069)	0.135** (0.064)	0.092 (0.061)
US Stock Returns*Portfolio Inflows/GDP*Post-Lehman	0.039 (0.069)	0.039 (0.066)	0.042 (0.066)	0.007 (0.055)
US Stock Returns*Stock Market Turnover*Pre-Lehman	0.257*** (0.065)	0.131 (0.081)	0.104 (0.085)	0.108 (0.082)
US Stock Returns*Stock Market Turnover*Post-Lehman	0.188*** (0.058)	0.107 (0.073)	0.143* (0.076)	0.209*** (0.064)
US Stock Returns*US Holdings of Foreign Equity/Local Market Capitalization*Pre-Lehman		0.177* (0.089)	0.216** (0.089)	0.075 (0.081)
US Stock Returns*US Holdings of Foreign Equity/Local Market Capitalization*Post-Lehman		0.120** (0.055)	0.097* (0.054)	0.102* (0.053)
US Stock Returns*Private Credit to GDP Ratio*Pre-Lehman			-0.039 (0.084)	-0.083 (0.076)
US Stock Returns*Private Credit to GDP Ratio*Post-Lehman			-0.041 (0.053)	-0.102* (0.056)
US Stock Returns*Firms with interest coverage<1*Pre-Lehman				0.166** (0.069)
US Stock Returns*Firms with interest coverage<1*Post-Lehman				-0.025 (0.053)
F-test for null that all regressors are jointly zero	35.23	31.44	32.30	54.71
F-test(p-value)	0.000	0.000	0.000	0.000
Observations	1523	1437	1354	1010
R-squared	0.556	0.568	0.586	0.665
Number of countries	73	69	65	48

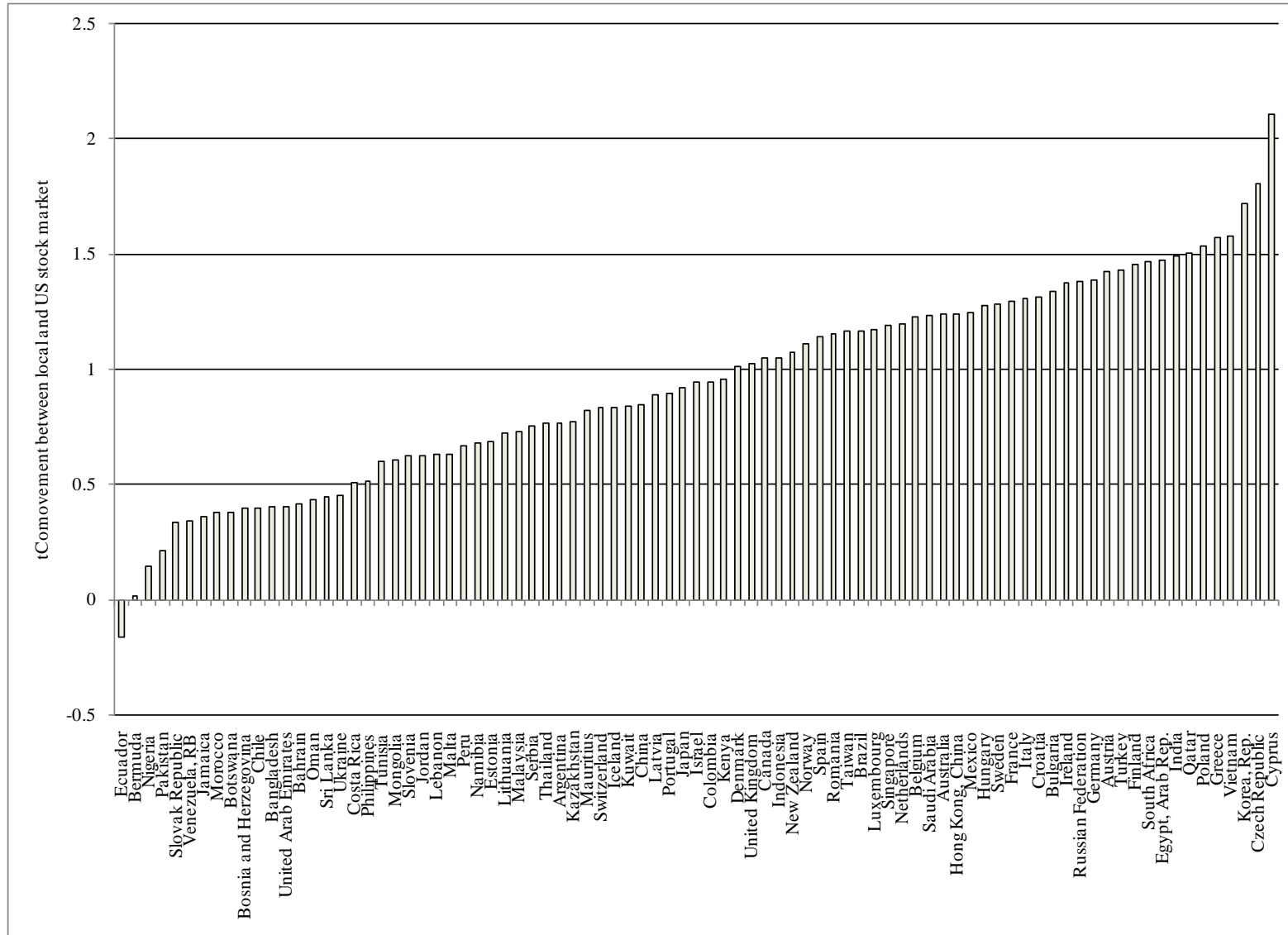
**Figure 1: Stock market returns, July 2007 – April 2009**

Figure shows the percentage change in the stock market index for each country between July 2007 and April 2009. Stock market index data comes from Bloomberg.



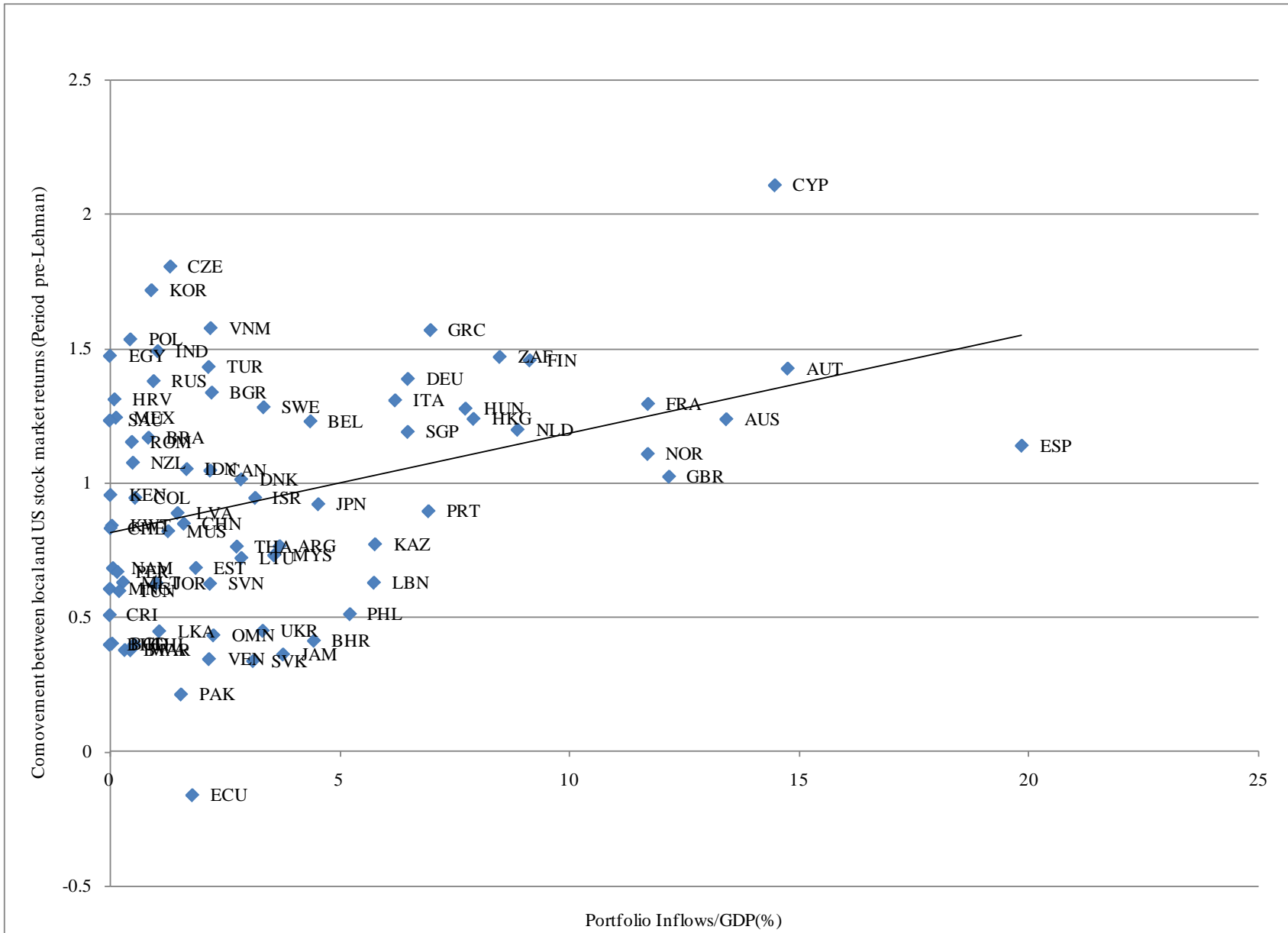
**Figure 2: Comovement with US stock market, July 2007-April 2009**

Figure shows the coefficient from regressing each market's monthly returns against US monthly returns over the period July 2007-April 2009.



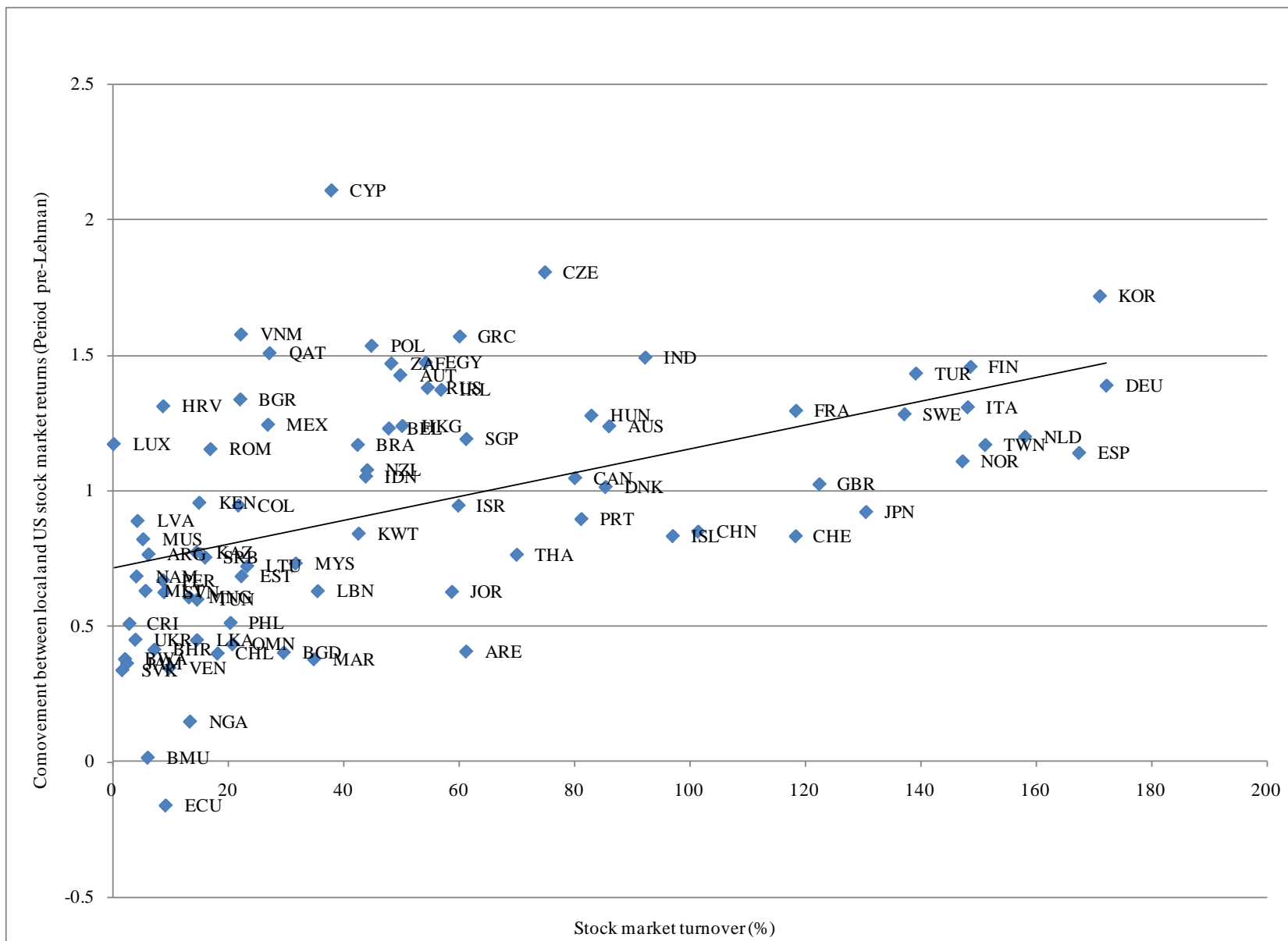
**Figure 3: Impact of portfolio inflows to GDP on the comovement between local and US stock market returns**

Figure shows result from regressing the comovement between local and US stock returns on the share of portfolio inflows to GDP across countries.



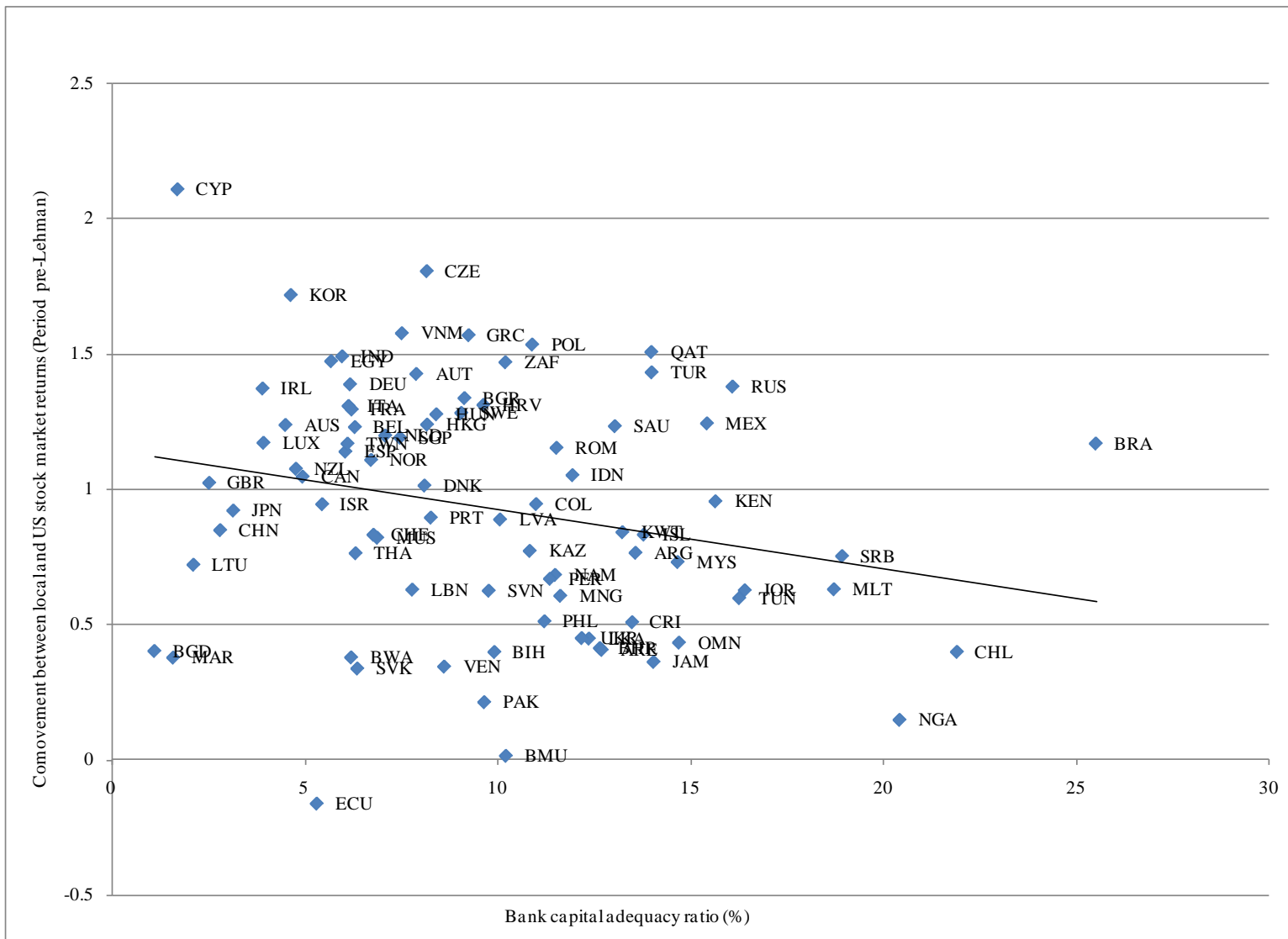
**Figure 4: Impact of stock market liquidity on the comovement between local and US stock market returns**

Figure shows result from regressing the comovement between local and US stock returns on the stock market turnover ratio across countries.



**Figure 5: Impact of bank capital adequacy on the comovement between local and US stock market returns**

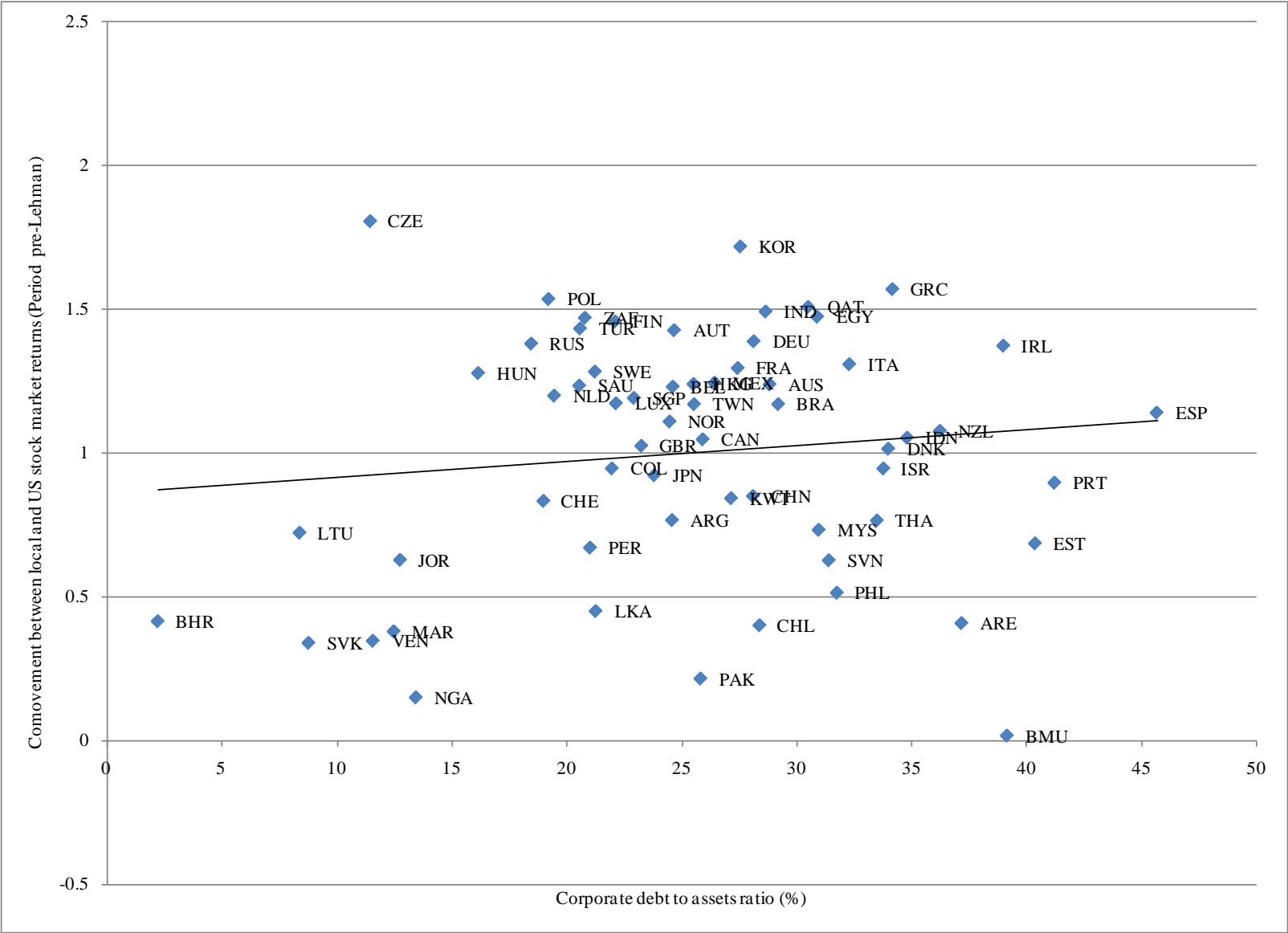
Figure shows result from regressing the comovement between local and US stock returns on bank capital adequacy ratios across countries.





**Figure 6: Impact of corporate leverage (debt to assets) on the comovement between local and US stock market returns**

Figure shows result from regressing the comovement between local and US stock returns on the corporate debt to asset ratios across countries.



**Figure 7: Impact of the share of firms with interest rate coverage <1 on the comovement between local and US stock market returns**

Figure shows result from regressing the comovement between local and US stock returns on the share of firms across countries with interest coverage ratio <1.

