

Contagion within the Global Financial Sector: Sector and Firm Analysis of Banking and Insurance

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Abstract

We take an asset pricing perspective to analyze contagion effects in the global financial sector during the financial crisis of 2007-2009. More specifically, contagion is analyzed at the sector and firm level. We measure cross-industry linkages between the banking and insurance sectors. Using a factor model and banking and insurance sector indices from a large set of countries for the years 1991-2009, we find significant contagion effects in the global financial industry during the financial crisis, both within and across financial sectors. In addition, our results at the firm level indicate that larger banks are more affected by contagion effects. Furthermore, we find that the regulatory environments which restrict banks and insurance firms from competing with each other reduced contagion effects during the financial crisis. Our results are valuable for both investors and regulators, as they reveal increased linkages in the global financial industry during the crisis, which exacerbate portfolio diversification.

Introduction

Recent deregulation and globalization have led to a highly interconnected financial services sector. In particular, the barriers between banking and insurance business have been dismantled in many countries during the last decades, leading to closer linkages between these types of firms and overlaps of their activities (Billio et al., 2012). Moreover, cross-country linkages between financial firms have increased, making firms prone to similar types of shocks (Elyasiani et al., 2015). The financial crisis of 2007-2009 exposed these linkages by identifying a high exposure of the global financial industry to similar types of shocks (e.g., Bekaert et al., 2014; Baur, 2012). As a result, the co-movement of financial sector stocks strongly increased during the crisis, thereby affecting the portfolios of investors of both banking and insurance firms alike. Such excess co-movements are particularly undesirable during financial crises, as they reduce the effectiveness of portfolio diversification in times it is needed most.

This study takes an asset pricing perspective to analyze contagion¹ effects in the global financial sector. In contrast to previous studies, we particularly disentangle the banking and the insurance sectors from the overall financial services sector. We develop a factor model and measure cross-industry linkages between the banking and insurance sectors around the world during the financial crisis of 2007-2009. Moreover, we use our framework to analyze contagion effects at the firm level. Previous papers (e.g., Bekaert et al., 2014; Baur, 2012) indicate that sectors' performances moved more closely together in times of crisis leading to contagion effects at the sector level. However, measuring contagion at the sector level may ignore the heterogeneous exposures of individual firms. We therefore analyze the heterogeneity in firm

¹ We follow related papers (e.g., Bekaert, Harvey and Ng, 2005; Bekaert et al., 2014) and define contagion as the co-movement of stock prices during crises in excess of what is implied by economic fundamentals.

level responses by identifying firm and country level determinants of a firm's measure of contagion. By doing this we can determine whether contagion is fundamentals-based or not.

Our research builds on a large literature dealing with the interconnectedness between the banking and insurance industry. Historically, banks and insurers were restricted from doing business in the other sector, and banks and insurers were strictly separated in most countries (Baluch, Mutenga and Parsons, 2011).² However, the ongoing process of financial deregulation increased the linkages between both types of firms by dismantling the obstacles between operating in the banking and insurance sectors.³ Hence, previous studies indicate strong linkages between banks and insurers which have been growing in recent years (Billio et al., 2012; Chen et al., 2013; Baluch, Mutenga and Parsons, 2011). Moreover, the recent trend of globalization and diversification of financial firms' activities across regional borders increased international linkages between financial firms from formerly separated markets. For example, international mergers and acquisitions within and across financial sectors and the expansion of business to other countries increase international linkages within the global financial service industry (Staikouras, 2009; Elyasiani et al., 2015; Trapp and Wewel, 2010). Such linkages have been shown to be particularly deleterious during the recent financial crisis and increase firms' exposures to common shocks (Billio et al., 2012; Chen et al., 2013).

The literature on contagion effects during crises is vast and growing, but it is mostly focused on aggregate stock market indices (e.g., Forbes and Rigobon, 2002; Bekaert, Harvey and Ng, 2005; Bekaert et al., 2014) or on different economic sectors (Baur, 2012; Phylaktis and Xia,

² Several prior studies analyze the benefits and drawbacks of bancassurance systems (e.g. Artikis, Mutenga and Staikouras, 2008; Carow, 2001).

³ For example, in Europe, the Second Banking Directive (1989) removed barriers between the banking and insurance sector, leading to the establishment of strong bancassurance systems within Europe (Artikis, Mutenga and Staikouras, 2008). In the U.S., the Gramm-Leach-Bliley Act (1999) deregulated the financial industry and paved the way for bancassurance. In other parts of the world, deregulation is under way, and this increases the links between both sectors in most countries (Artikis, Mutenga and Staikouras, 2008).

2009). Several studies measuring financial sector contagion from an asset pricing perspective (e.g., Bekaert et al., 2014; Baur, 2012) show an increased co-movement of country financial sectors with the global financial sector. However, these studies do not distinguish between banks and insurance firms. Analyzing the stock price reaction of banking and insurance sectors separately is important for investors, as it provides evidence on the interlinkages between the two sectors and opportunities to diversify from an investor's perspective.

Moreover, analyzing contagion effects at the aggregate stock market level or sector level may ignore heterogeneous exposures of individual firms, which may respond differently to a crisis. Therefore, knowledge of contagion effects at the firm level is important for investors because knowing whether single firms respond differently to a crisis should affect the composition of their investment portfolio. Thus, in contrast to existing studies on contagion, we focus on a single sector (the global financial sector) and its components (banks and insurers) and add an analysis of factors that are linked to contagion at the firm level.⁴ This allows us to investigate if contagion effects are fundamentals-based or non-fundamentals-based (Baur, 2012). In case of fundamentals-based contagion, firms are affected by the crisis differently, so that particular firms would provide an opportunity for at least some diversification in times of crisis. To the best of our knowledge this is the first paper to analyze contagion effects within the global financial sector during the recent financial crisis and factors that affect contagion at the firm level.⁵

⁴ Our sample of banks includes firms with Industrial Classification Benchmark (ICB) 8355, while Asset Managers (8771), Consumer Finance (8773), Specialty Finance (8775), Investment Services (8777) and Mortgage Finance (8779) are excluded from the sample. The sample of insurance firms includes Non-life Insurance (8530) and Life Insurance (8570), but excludes Insurance Brokers (8534) and Reinsurance (8538).

⁵ De Bruyckere et al. (2013) analyze contagion between banks and sovereign default risk in Europe over the period 2007–2012. However, their analysis is not based on a factor model and does not analyze contagion from the overall market or other sectors of the global financial industry.

Data from DataStream are used in the study, including banking and insurance sector indices from a large set of countries for the years 1991-2009. For our analysis of firm level contagion, we use stock price and accounting data of publicly listed banks and insurers. The sample contains 509 banks and 141 insurance firms. We use a factor model that includes a domestic and a world market factor for all financial institutions; in addition, domestic and global insurance and banking sector factors are included to analyze contagion effects stemming from these sectors. A firm level measure of contagion is analyzed by regression analysis. The period used in the regression is the period of the financial crisis. The regressions can be used to determine whether contagion is fundamentals-based or not; that is, with fundamentals-based contagion, the extent of contagion would be significantly related to firms' characteristics. Moreover, country level factors which capture the countries' regulatory environments are included in the regression to analyze if such factors influence financial firms' stock price reaction to the financial crisis.

By way of preview, our results indicate significant contagion effects in the global financial industry during the financial crisis of 2007-2009. We find that both banking and insurance sectors around the world increased their linkages with their domestic stock market as well as with the global market. Similarly, we find evidence of increased linkages within and across financial sectors: Both banks and insurance firms increased their co-movement with the domestic and global banking and insurance sectors. However, our firm level analysis reveals evidence of fundamentals-based contagion in the banking industry: We find that larger banks were more significantly affected by the crisis. For insurance firms, our results do not provide evidence of fundamentals-based contagion. Our analysis of country level factors shows that

banks in regulatory environments which restrict banks and insurance firms from competing with each other were less affected by contagion effects during the financial crisis.

The findings contribute to the literature in several ways. To the best of our knowledge, this is the first paper which uses an asset pricing perspective to analyze contagion effects in the global financial industry while particularly disentangling the banking from the insurance sector. In addition, our study is the first study to examine contagion effects during the crisis at the firm level. Our results provide valuable implications for both investors and policymakers. For investors, we show increased linkages across and within financial sectors and with the overall stock market. This reduces the effectiveness of diversification in times when it is needed most (Baur, 2012; Phylaktis and Xia, 2009). However, at the firm level, our results indicate a heterogeneous response in the banking sector, consistent with fundamentals-based contagion. Moreover, our results indicate that the regulatory environment strongly affects the degree of contagion during a financial crisis: regulations which restrict banks and insurers from competing with each other lower the vulnerability of financial firms in times of crisis. This provides valuable knowledge regarding the design of macroprudential regulatory frameworks.

The remainder of this paper is organized as follows: The next section provides the hypotheses development. This is followed by the Data and Methodology sections, respectively. The Results appear in the succeeding section, and the Conclusion follows.

Hypotheses development

In this section we derive testable hypotheses based on the results of prior studies. Our aim is to reveal increases in interlinkages between banks and insurers across and within countries and

sectors from an asset pricing perspective. Contagion effects are particularly harmful from an investor's perspective: Portfolio theory states that investors hold diversified stock portfolios to reduce risk and return volatility. Hence, the risk of an individual firm or sector can be at least partly diversified away in theory by holding shares of many sectors and firms. However, in case of high co-movements of stock prices during crises, investors are unable to offset unfavorable developments in one sector with stocks from another sector (Campbell et al., 2001; Phylaktis and Xia, 2009) which reduces the positive effect of portfolio diversification. Previous papers indicate that contagion effects occurred with respect to aggregate stock market indices (e.g., Forbes and Rigobon, 2002; Bekaert, Harvey and Ng, 2005; Bekaert et al., 2014) or with respect to different economic sectors (Baur, 2012; Phylaktis and Xia, 2009) during recent crises.

In contrast to previous studies analyzing contagion in the financial sector (Baur, 2012; Bekaert et al., 2014), we particularly disentangle the banking sector from the insurance sector to take into consideration the different business models of these sectors.⁶ Following related studies, we examine three categories of contagion: *Market contagion*, *Local financial sector contagion* and *Global financial sector contagion*. We test for the existence of these types of contagion by first introducing a benchmark asset pricing model and then extending this model by additional factors. Our methodological approach is similar to the one used by Baur (2012). All models are tested separately for banking and insurance sectors.

Market contagion

⁶ See Cummins and Weiss (2014) for a comprehensive analysis of the differences in banks' and insurers' business models.

We start our analysis by testing for different types of market contagion. Previous studies indicate that individual financial and non-financial sectors increased their co-movement with the aggregate, domestic market in times of crisis. Bekaert et al. (2014) finds strong evidence of “domestic contagion” at the sector level during the recent crisis. Increases in co-movements between financial firms and the overall market can be explained by real economic effects: During a crisis, consumers’ demand for bank loans decreases and existing loans lose value, which erodes banks’ equity. Moreover, the demand for insurance decreases during a crisis, and insurers experience significant write-downs of financial assets (Baluch, Mutenga and Parsons, 2011). Hence, our first hypothesis states:

H1: *Local market contagion*: The co-movement of stock prices for the banking and the insurance sectors’ stock indices increased with respect to their *local market* stock index during the financial crisis.

Next, we analyze contagion between the banking and insurance sectors and the world market (*Global market contagion*). Due to recent trends in globalization and liberalization, both banks and insurers are linked to the global markets via numerous ways such as investments in global asset classes or international business relationships. Hence, our second hypothesis states:

H2: *Global market contagion*: The co-movement of stock prices between the banking and the insurance sectors’ stock indices increased with respect to the *Global market* stock index during the financial crisis.

Local financial sector contagion

Next, we analyze linkages *within* the financial industry during the financial crisis of 2007-2009. We begin by focusing on increased co-movement between domestic banking and insurance indices. Previous papers (e.g. Artikis, Mutenga and Staikouras, 2008; Carow, 2001; Billio et al., 2012) indicate growing links between banks and insurance sectors around the world, mainly due to recent trends in deregulation. Examples of this deregulation are the Second Banking Directive (1989) in Europe and the Gramm-Leach-Bliley Act (1999) in the U.S. which removed barriers between operating in the banking *and* insurance sectors. This led to the establishment of strong bancassurance systems, resulting in closer linkages between banks and insurers and making them more prone to the same types of shocks during crises. For example, Billio et al. (2012) and Chen et al. (2013) show increased interlinkages between U.S. banks and insurers during the recent crisis, with banking linkages more of a driver for insurers' performance than vice versa. Hence, we state that:

H3: Local financial sector contagion: The co-movement of local insurance (banking) sectors' stock indices increased with respect to the local banking (insurance) sectors' stock indices during the financial crisis.

Global financial sector contagion

Apart from increased co-movement between the banking and insurance sectors within the same country, linkages with the global banking and insurance industries are expected to arise during the crisis. Recent globalization has led to increased linkages of financial firms across borders, leading to a highly interconnected financial services sector. For example, previous research indicates that international mergers and acquisitions within and across financial sectors

and the expansion of business to other countries (Staikouras, 2009; Trapp and Wewel, 2010) has occurred. The latter leads to similar risk exposures among financial firms, which makes financial firms around the world prone to similar shocks. Not surprisingly, several studies (e.g., Bekaert et al., 2014; Baur, 2012) show an increased co-movement of countries' financial sectors with the global financial sector. Hence, we extend these studies by analyzing whether these findings hold for both banking and insurance sectors individually. Thus,

H4: *Global banking sector contagion*: The co-movement of stock prices between the banking and the insurance sectors' stock indices increased with respect to the *global banking sector* stock index during the financial crisis.

H5: *Global insurance sector contagion*: The co-movement of stock prices between the banking and insurance sectors' stock indices increased with respect to the *global insurance sector* stock index during the financial crisis.

Firm level contagion

Considerable literature exists on contagion effects with respect to aggregate stock market indices (e.g., Forbes and Rigobon, 2002; Bekaert, Harvey and Ng, 2005; Bekaert et al., 2014) and on difference economic sectors (Baur, 2012; Phylaktis and Xia, 2009). However, analyzing contagion effects at the aggregate or sector level may ignore heterogeneity in exposures of individual firms, i.e., different firms in the same country and sector may be affected differently by a crisis. Therefore, the degree of contagion for single firms is important for investors because knowing whether single firms respond differently to a crisis should affect the composition of their investment portfolio.

In particular, contagion might be affected by firm-specific characteristics (fundamentals). If contagion is fundamentals-based, investors do not view all stocks from a sector and country identically during a crisis (Baur, 2012; De Bruyckere et al., 2013). Rather they discriminate among firms so that, for example, stock prices of relatively strong financial firms are not affected as severely as the stock prices of firms more prone to default. Altunbas, Manganeli and Marqués-Ibañez (2011) show that financial institutions' business models strongly affected their risk exposure during the financial crisis. Tong and Wei (2010) show that the decline in stock prices of industrial firms depended on firm level factors. Thus,

H6: Fundamentals-Based Contagion: Contagion at the firm level is fundamentals-based.

Alternatively, contagion may occur without investors discriminating among firms in a sector. That is, investor reactions may be driven by herding behavior (Bekaert et al., 2014). In this case, the effectiveness of investors' portfolio diversification would be reduced compared to the case of fundamentals-based contagion.

In addition, previous papers (e.g. Bekaert et al., 2014; De Bruyckere et al., 2013) show that country level factors such as the regulatory environment affects contagion at the sector level. We extend their analysis by examining if country level factors are significantly related to measures of contagion at the firm level. More precisely, we focus on country variables that capture financial sector regulation.⁷

H7: Regulatory Environment and Contagion: The degree of contagion is affected negatively by the quality of a country's financial sector regulation.

⁷ All variables are further described in the methodology section. An overview is provided in Table 1.

Data and Methodology

Data

For our analysis at the sector level, we use weekly changes in all banking and insurance sector indices included in Datastream for which data are available during our observation period. Weekly aggregate domestic indices, insurance sector indices, banking sector indices and global sector indices are also obtained from Datastream so that contagion effects can be measured at the sector level. Our observation period covers the years 1991 – 2009. We use the period from 1991 until July 2007 to set a benchmark of co-movements of financial sectors with the different factors in non-crises times. We then follow Baur (2012) and Bekaert et al. (2014) and analyze contagion effects during the financial crisis between August 2007 and March 2009.⁸

For our analysis at the firm level we use weekly stock price and accounting data for all banks and insurance firms included in Datastream.⁹ We drop firms with negative or missing total assets, equity, and revenue. Furthermore, the data is winsorized at the 1 and 99 percentiles to deal with extreme outliers. Moreover, we drop firms if stock prices are not available during our sample period, as the estimation of the factor models requires weekly stock returns for each sector and firm individually. Furthermore, we drop firms if their return on equity is above 1 or below -1 (Leaven and Levine, 2009) and if their annual growth rate is above 50% or below -50%.¹⁰ In addition, we drop reinsurers and insurance brokers from our sample of insurance firms due to their different business models.

Methodology

⁸ See Baur (2012) for a discussion about the exact starting point and the end of the crisis.

⁹ Tables indicating firm observations for each country are provided in the appendix.

¹⁰ Our results remain robust if we include these firms.

We start our analysis at the sector level and use a benchmark factor model to analyze contagion between the local banking and insurance sectors and the aggregate domestic stock market. We then extend this model by including additional factors to capture contagion effects from international financial sectors so that we can test each of our hypotheses. For our analysis at the firm level, we first re-estimate each factor model individually for each bank and each insurance firm. Second, we use regression analysis to determine if the contagion effects which we estimate are related to firm and country specific characteristics. More details are provided below.

Market contagion

We start our analysis by introducing the following benchmark model to analyze *Local market contagion* (H1):¹¹

$$R_{i,t} = \alpha + \beta^{MKT} R_t^{MKT} + \gamma^{MKT} R_t^{MKT} D_t + e_{i,t} \quad (1)$$

where $R_{i,t}$ are the daily (t) stock market returns of banking (insurance) sector i . R_t^{MKT} are the daily stock market returns from the domestic aggregate stock market index. β^{MKT} denotes the co-movement of banking returns and insurance returns with their own domestic aggregate stock

¹¹ Due to collinearity between the indices used in our analysis, we estimate contagion effects separately for each measure of contagion by using separate regression models for each type of contagion. Furthermore, to allow an intuitive interpretation of the beta factors and to further avoid the problem of multicollinearity in our analyses, factors are orthogonalized (e.g. Bekaert et al., 2014; Beekaert, Hodrick and Zhang, 2009). Local banking and insurance sectors are orthogonalized with respect to the local market return, that is, we regress the return of the respective index on the local market return and use the residuals from that regression ($e_{i,t}$) as the banking (insurance) sector return:

$$R_t^{BNK(L)} = \beta^{MKT} R_t^{MKT} + e_{i,t}$$

All local market and global banking (insurance) returns are orthogonalized with respect to the global market return, that is, we regress the return of the respective index on the global market return and use the residuals from that regression ($e_{i,t}$) as the local index and global banking (insurance) sector return. For example, for the local market index, we conduct the following regression:

$$R_t^{MKT} = \beta^{GLB} R_t^{GLB} + e_{i,t}$$

market in non-crises times. D_t is a crisis dummy equal to one if the week is between August 2007 and March 2009 (Baur, 2012).¹² Hence, *local market contagion* (the increase of a financial sector's stock price in relation to its domestic aggregate stock market) is captured in the coefficient γ^{MKT} .¹³

To test for *Global market contagion* (H2), we extend equation (1) by a global market factor denoted by R_t^{GLB} , proxied by the MSCI Global index:

$$R_{i,t} = \alpha + \beta^{MKT} R_t^{MKT} + \beta^{GLB} R_t^{GLB} + \gamma^{GLB} R_t^{GLB} D_t + e_{i,t} \quad (2)$$

Global market contagion (the increase of a financial sector's returns in relation to the aggregate global market stock index) is captured in the coefficient γ^{GLB} .

Local financial sector contagion

Next, we develop factor models to analyze *Local financial sector contagion*. To test for *Local financial sector contagion* (H3) in the banking sector, we extend the model in the following way:

$$R_{i,t} = \alpha + \beta^{MKT} R_t^{MKT} + \beta^{GLB} R_t^{GLB} + \beta^{INS(L)} R_t^{INS(L)} + \gamma^{INS(L)} R_t^{INS(L)} D_t + e_{i,t} \quad (3)$$

¹² The exact starting and ending points of the financial crisis are difficult to determine and subject to discussion within the literature. To make our research directly comparable to previous papers, we follow Bekaert et al. (2014), Baur (2012) and the Bank for International Settlements (BIS, 2009), and use a timeframe that includes all of the major financial and economic events during the crisis. This includes the phase of "initial financial turmoil" (Q3 2007 until mid-September 2008), "sharp financial market deterioration" (until late 2008) and the phase of "macroeconomic deterioration" (until Q1 2009). This is followed by a period of "stabilization and tentative signs of recovery," which is not considered as part of the crisis period here.

¹³ Note that alternative measures of contagion, as for example used by Bekaert, Harvey and Ng (2005) or Phylaktis and Xia (2009), measure contagion via residual correlation. However, given that we aim to analyze changes in co-movement, focusing on changes in the systematic co-movement in crisis times (Baur, 2012), we follow the approaches used by Bekaert et al. (2014) and Baur (2012), which take into consideration changes in the factor exposures during crises. This approach distinguishes "systematic contagion" from "idiosyncratic contagion".

where $R_t^{INS(L)}$ denotes the local insurance sector index. *Local financial contagion* (the increase of in the banking sector returns with the local insurance sector stock index) is captured in the coefficient $\gamma^{INS(L)}$.

Similarly, we test for *Local financial sector contagion* (H3b) for banks as follows:

$$R_{i,t} = \alpha + \beta^{MKT} R_t^{MKT} + \beta^{GLB} R_t^{GLB} + \beta^{BNK(L)} R_t^{BNK(L)} + \gamma^{BNK(L)} R_t^{BNK(L)} D_t + e_{i,t} \quad (4)$$

where $R_t^{BNK(L)}$ denotes the local banking sector index. *Local financial contagion* (the increase of an insurance sector's returns with the local banking sector stock index) is captured in the coefficient $\gamma^{BNK(L)}$.

Global financial sector contagion

Next, we include $R_t^{BNK(G)}$ (a global banking sector index) to test for *Global banking sector contagion* (H4):

$$R_{i,t} = \alpha + \beta^{MKT} R_t^{MKT} + \beta^{GLB} R_t^{GLB} + \beta^{BNK(G)} R_t^{BNK(G)} + \gamma^{BNK(G)} R_t^{BNK(G)} D_t + e_{i,t} \quad (5)$$

Global banking sector contagion (the increase of a financial sector's stock returns in relation to the global banking sector stock index) is captured in the coefficient $\gamma^{BNK(G)}$.

To test for *Global insurance sector contagion* (H5) we use the following factor model:

$$R_{i,t} = \alpha + \beta^{MKT} R_t^{MKT} + \beta^{GLB} R_t^{GLB} + \beta^{INS(G)} R_t^{INS(G)} + \gamma^{INS(G)} R_t^{INS(G)} D_t + e_{i,t} \quad (6)$$

where $R_t^{INS(G)}$ denotes the global insurance sector index. *Global insurance sector contagion* (the increase of a financial sector's stock returns with the global insurance sector stock index) is captured in the coefficient $\gamma^{INS(G)}$.¹⁴

Firm Level Contagion

To test for heterogeneity in firm level responses (that is, whether contagion effects depend on firm and country level characteristics) we use the following regression model for each measure of contagion (γ_j^n) separately.

$$\gamma_j^n = \alpha + \vartheta' FIRM_j + \theta' COUNTRY_c + \varepsilon_j \quad (7)$$

where γ_j^n is the measure of contagion stemming from different sources (n: MKT; GLB; BNK(L); INS(L); BNK(G); INS(G)) from equations (1)-(6). To obtain measures of firm level contagion, Equations (1)-(6) are estimated for each bank and insurer j in our sample separately to obtain an individual measure of contagion for each firm.¹⁵

$$R_{j,t} = \alpha + \beta^{MKT} R_t^{MKT} + \gamma_j^{MKT} R_t^{MKT} D_t + e_{j,t} \quad (8)$$

$$R_{j,t} = \alpha + \beta^{MKT} R_t^{MKT} + \beta^{GLB} R_t^{GLB} + \gamma_j^{GLB} R_t^{GLB} D_t + e_{j,t} \quad (9)$$

$$R_{j,t} = \alpha + \beta^{MKT} R_t^{MKT} + \beta^{GLB} R_t^{GLB} + \beta^{INS(L)} R_t^{INS(L)} + \gamma_j^{INS(L)} R_t^{INS(L)} D_t + e_{j,t} \quad (10)$$

$$R_{j,t} = \alpha + \beta^{MKT} R_t^{MKT} + \beta^{GLB} R_t^{GLB} + \beta^{BNK(L)} R_t^{BNK(L)} + \gamma_j^{BNK(L)} R_t^{BNK(L)} D_t + e_{j,t} \quad (11)$$

$$R_{j,t} = \alpha + \beta^{MKT} R_t^{MKT} + \beta^{GLB} R_t^{GLB} + \beta^{BNK(G)} R_t^{BNK(G)} + \gamma_j^{BNK(G)} R_t^{BNK(G)} D_t + e_{j,t} \quad (12)$$

¹⁴ All factor models are estimated within a GARCH framework because equity returns exhibit conditional heteroscedasticity (Baur, 2012).

¹⁵ Robust standard errors are used for all regression analyses.

$$R_{j,t} = \alpha + \beta^{MKT} R_t^{MKT} + \beta^{GLB} R_t^{GLB} + \beta^{INS(G)} R_t^{INS(G)} + \gamma_j^{INS(G)} R_t^{INS(G)} D_t + e_{j,t} \quad (13)$$

FIRM denotes a vector of firm level control variables that can be expected to be related to a firms' degree of contagion (*Size, Leverage, Growth, Liability diversification and Z-Score*).¹⁶ COUNTRY denotes a vector of country level control variables (*GDP per capita, Non-bank financial firms owning banks, Insurance activities, Regulatory quality, and External governance index*). We regress firm-specific contagion measures (that is the increase in co-movement during the crisis for each firm (j)) on a set of firm-specific factors from the year 2006 (their pre-crisis exposure). This is consistent with Tong and Wei (2010) who use a cross-sectional regression to analyze the impact of pre-crisis firm level factors on the stock price developments of manufacturing firms in emerging countries during the financial crisis. Table 1 provides a description of all variables used in our analysis.

Firm Level Factors

Our vector of firm level control variables includes a measure of *Size* (the natural logarithm of total assets). Large financial institutions are assumed to be more strongly connected to other financial firms and the overall economy and therefore more prone to shocks from aggregate markets and other financial sectors. Altunbas, Manganelli and Marqués-Ibañez (2011) show that larger banks were more severely affected by the recent financial crisis than smaller banks. In addition, Bhagat and Bolton (2015) show that larger banks engaged in more risk-taking than smaller banks. This makes them more prone to shocks during a crisis. Hence, we expect higher levels of contagion for larger financial institutions. Moreover, we include a measure of

¹⁶ For insurance firms, a dummy variable indicating if the firm is a life insurer (*Life*) is also included.

Leverage (total equity divided by total assets). Higher capital ratios indicate there is a stronger buffer to withstand losses in times of crisis, making firms less prone to shocks. Moreover, lower levels of the capital ratio increase risk-shifting incentives from shareholders towards excessively risky projects at the expense of debt holders (Altunbas, Manganelli and Marqués-Ibañez, 2011). De Bruyckere et al. (2013) show that banks with low capital ratios were particularly vulnerable to sovereign risk spillovers during the crisis. Similarly, Beltratti and Stulz (2012) and Altunbas, Manganelli and Marqués-Ibañez (2011) show that more levered banks were affected by the recent financial crisis more severely than less levered banks. Hence, we expect that financial firms with lower capital ratios are more prone to contagion effects.

We add a measure of *Growth* (defined as the yearly growth rate of total assets).¹⁷ Chen and Wong (2004) suggest an aggressive growth strategy can threaten insurers' stability, in particular during times of economic downturn. Growing insurers tend to under-serve which threatens their financial health in case of market turmoil. This makes them more prone to contagion effects during a financial crisis. Similarly, Houston et al. (2010) show that growth strategies induce banks to engage in more risk taking. This is particularly troublesome in times of crisis. Hence, we expect that financial firms with higher growth rates are more prone to contagion effects.

In addition, we take into consideration financial institutions' business models by accounting for their liability diversification (Fiordelisi and Marqués-Ibañez, 2013). For banks, we use the deposit to total liabilities ratio; and for insurance firms, we use insurance reserves to total liabilities (*Liability diversification*). Both measures indicate the proportion of traditional activities compared to non-core activities of their respective sector. Given that non-core activities

¹⁷ For robustness, we use the yearly growth rate of total revenue to measure firm growth. Our results remain consistent.

strongly affected insurance firms' (Berdin and Sottocornola, 2015) and banks' (de Bruyckere et al., 2013) reactions to the financial crisis, we expect a negative relationship between these measures and contagion. Moreover, we include an indicator of default risk, measured by the firm's *Z-Score*.¹⁸ Fiordelisi and Marqués-Ibañez (2013) show that financial firms with higher default risk show higher levels of systematic risk and hence a higher co-movement with the aggregate stock market. Hence, these firms are more prone to contagion. Finally, we include a dummy variable equal to one if the firm is a life insurance firm (*Life*) in our set of insurance firms to take into account the heterogeneous business models of life and non-life insurance firms.¹⁹

Country Level Factors

Regarding country level factors, we control for the countries' per capita wealth (measured by *GDP per capita*), given the heterogeneous effect of the financial crisis on developed and developing countries (Bekaert et al., 2014). Moreover, we control for the quality of the countries' regulation and governance by including a measure of *Regulatory quality*. This measure, developed by the *Worldbank* (*Worldwide Governance Indicators*), captures "perceptions of the ability of the government to formulate and implement sound policies and regulations that permit and promote private sector development."²⁰ We expect that higher degrees of *Regulatory quality* led to a better and more effective regulatory response to mitigate

¹⁸ The Z-Score has been used in various papers to measure a financial institution's default risk (see e.g., Fiordelisi and Marqués-Ibañez, 2013; Boyd et al., 2006; Berger, Klapper and Turk-Ariss, 2009; Uhde and Heimeshoff, 2009). The Z-Score is defined as (the firm's return on assets plus its capital ratio) divided by the standard deviation of its return on assets for the previous 5 years.

¹⁹ We test for multicollinearity among the independent variables using variance inflation factors (VIFs). In all models, the mean VIF is well below the benchmark of 10, indicating that multicollinearity appears to be of no concern in our analysis (Belsley et al., 2005; Chatterjee et al., 2013).

²⁰ See <http://info.worldbank.org/governance/wgi/index.aspx#home> for additional information.

the consequences of the financial crisis. Effective countermeasures such as bailout packages, fiscal stimuli and deposit guarantees require capable governments and administrative systems in order to mitigate contagion effects.

Moreover, we control for the countries' financial sector regulation, as the regulations which determine the linkages between financial institutions are expected to be strong determinants of the degree of contagion in times of crisis. In particular, regulations which restrict banks and insurance firms from being active in the other sector should decrease the links between the two types of financial institutions and therefore mitigate contagion effects stemming from other sectors. We include three measures of financial sector regulation. We include *Insurance activities*, which measure the extent to which banks are allowed to engage in insurance activities, and *Non-bank financial firms owning banks*, which measures the extent to which nonbank financial firms (e.g., insurance firms) may own and control banks. Both indices are based on the *Bank Regulation and Supervision* survey by the *World Bank*²¹(Barth et al., 2001; Barth et al., 2004; Barth et al., 2012), where higher scores indicate higher levels of restrictiveness.²² Baluch, Mutenga and Parsons (2011) state that insurance sectors in countries where the linkages with the banking sector were more pronounced were affected more severely by the financial crisis. In particular, they show that insurance firms with close affiliations to the banking sector were more severely affected by the financial crisis. For example, several insurance groups suffered from severe problems arising from their banking affiliates rather than

²¹ See the following website for additional information: <http://econ.worldbank.org/WBSITE/EXTERNAL/EXTDEC/EXTRESEARCH/0,,contentMDK:20345037~pagePK:64214825~piPK:64214943~theSitePK:469382,00.html>.

²² In particular, the scale is denoted as follows: Unrestricted = 1: full range of activities can be conducted directly in the bank; Permitted = 2: full range of activities can be conducted, but some or all must be conducted in subsidiaries; Restricted = 3: less than full range of activities can be conducted in the bank or subsidiaries; and Prohibited = 4: the activity cannot be conducted in either the bank or subsidiaries (Barth et al. 2004).

from their core insurance activities; this indicates that there is a threat of being closely connected to the banking sector during financial turmoil. Similarly, Billio et al. (2012) find increased linkages between the banking and insurance sectors during recent years which increased the level of systemic risk in the financial services sector. This increased the channels through which shocks can propagate between banks and insurers. Hence, such close linkages are expected to explain contagion effects during times of crisis.

Third, we control for the quality of governance in the country's banking sector (*External Governance Index*). The index is based on the *Bank Regulation and Supervision* survey by the *World Bank*²³ (Barth et al., 2001; Barth et al., 2004; Barth et al., 2012). Higher values indicate better corporate governance.²⁴ Inadequate corporate governance in the banking sector has been widely recognized as a major cause for the financial crisis (e.g., off-balance sheets activities which endangered the financial systems proved difficult to detect by regulators and investors). Similarly, Bhagat and Bolton (2015) show that banks with better corporate governance engaged in less risk-taking during the period of the financial crisis. Hence, we expect that environments which promote better corporate governance negatively affect contagion effects during the crisis.

Results

Summary Statistics

Table 2 shows summary statistics for all firm and country level variables used throughout our analyses. The results are reported separately for banks (Panel A and B) and insurance firms

²³ See the following website for additional information: <http://econ.worldbank.org/WBSITE/EXTERNAL/EXTDEC/EXTRESEARCH/0,,contentMDK:20345037~pagePK:64214825~piPK:64214943~theSitePK:469382,00.html>.

²⁴ In particular, the index comprises information on the country's Strength of External Audit, Financial Statement Transparency, Accounting Practices and External Ratings and Creditor Monitoring.

(Panel C and D). The table shows that the average size of banks and insurance firms in our sample is comparable, as indicated by *Size*. Moreover, the table indicates a similar level of pre-crisis *Growth* in banking (7%) and insurance (6%). Finally, our results indicate that insurers are on average better capitalized than banks, as indicated by *Leverage* (29% and 18%, respectively).

Sector Level Contagion

Hypotheses 1 and 2 state that we expect *Market contagion* stemming from the domestic stock market and the global stock market. Table 3 (Panel A) presents the result of equations (1)-(2) for all banking sectors (BNK) and insurance sectors (INS). Columns (1) and (2) indicate that both banking and insurance sectors experienced strong degrees of *Market contagion*, indicated by the coefficient of γ^{MKT} from equation (1). For both types of financial institutions, the coefficient is positive and highly significant, indicating an increased co-movement of the banking and insurance sectors with their domestic aggregate stock market. This is consistent with Bekaert et al. (2014), who find evidence of “domestic contagion” at the sector level during the recent crisis for various types of industries.²⁵ Similarly, the coefficient of γ^{GLB} is positive and significant for banking (BNK) and insurance (INS) sectors, providing evidence of *Global market contagion* and therefore for hypothesis 2 (Columns 3 and 4). Hence, the co-movement with the global stock market increased during the crisis, potentially because of recent trends of globalization and liberalization. This increased the links between banks, insurers and the world market due to investments in global asset classes or international business relationships.

²⁵ These industries include Basic materials, Communications, Consumer, cyclical, Consumer, noncyclical, Diversified, Energy, Financial, Industrial, Technology and Utilities.

Hypothesis 3 states that we expect Local *financial sector contagion* stemming from the domestic banking and insurance sector. Table 3 (Panel B) presents the results for equation (3) for all banking sectors (BNK) and insurance sectors (INS). Columns (5) and (6) indicate significant contagion effects at the country (local) level: Our results indicate that banking and insurance sectors increased their co-movement with each other during the crisis, indicated by positive and significant coefficients of $\gamma^{INS(L)}$ and $\gamma^{BNK(L)}$. Hence, we find support for Hypothesis 3. Such linkages during crises can be the result of deregulation in the banking and insurance sectors around the world, which increased the links between both sectors (Artikis, Mutenga and Staikouras, 2008; Carow, 2001; Billio et al., 2012). Hence, during crises, they are prone to similar types of shocks (Billio et al., 2012; Chen et al., 2013).

Moreover, we find evidence in favor of for Hypotheses 4 and 5 (*Global financial sector contagion*): the coefficients of $\gamma^{BNK(G)}$ and $\gamma^{INS(G)}$, are positive and significant for both banking and insurance sectors, indicating contagion effects between these sectors and the global banking / insurance sector. This is consistent with previous research (e.g., Bekaert et al., 2014; Baur, 2012) which indicates an increased co-movement of financial sectors with the global financial sector. Such increases in co-movements can be explained by international M&A activities within and across financial sectors and the expansion of business to other countries (Staikouras, 2009; Elyasiani et al., 2015; Trapp and Wewel, 2010). Overall, our results indicate strong linkages in the global financial services sector: All sectors showed increased co-movements within and across financial sectors and across national boundaries during the financial crisis. Hence, from an asset pricing perspective, financial firms reacted similarly to shocks during the financial crisis. Our results provide unfavorable news for investors, because such contagion effects reduce the possibility to diversify their investments in times of crises.

Firm Level Contagion

Table 4 presents the results of equation (7) for all banks in our sample. Columns (1)-(5) provide the results for the measures of contagion separately. The results indicate that several firm level factors are, indeed, significantly related to the measures of contagion at the firm level: In particular, we find that larger banks experience higher levels of contagion, as indicated by significantly positive coefficients for *Size*. Hence, consistent with our prediction, we find that large banks are particularly prone to shocks from the aggregate stock market and other financial sectors, probably due to their strong connections to other financial firms and the overall economy. In addition, our results are consistent with Altunbas, Manganelli and Marqués-Ibañez (2011) who find that larger banks were affected by the recent financial crisis more severely than smaller banks. Moreover, our measure of *Growth* is significantly positive for our measure of *Local market contagion*. Hence, our results provide some support that high growth strategies in the banking sector are associated with contagion in times of crisis. Overall, Hypothesis 6 is supported for banks.

Table 5 presents the results of equation (7) for all insurers in our sample. Columns (1)-(5) provide the results for the measures of contagion separately. In contrast to the findings for banks, our results indicate that almost no firm level factors are significantly related to the measures of contagion at the firm level. Hence, the results indicate that all insurance firms were affected by the financial crisis alike from an investor's perspective. That is, we find no evidence of fundamentals-based contagion in our analysis.

With respect to country level factors, our results for banks (Table 4) indicate that measures of *Insurance activities* and *Non-bank financial firms owning banks* are significant and negative in several regressions (*Local market contagion*; *Local insurance contagion*; *Global*

insurance contagion). This result supports Hypothesis 7. It also provides valuable findings from a policymaker's perspective: banks in countries where the regulatory framework restricts banks and insurers from being active in the other sectors experience significantly lower levels of contagion. This finding can be explained by the lower connections between these types of firms. Hence, the removal of barriers between both sectors makes banks and insurers prone to similar shocks during financial crises. For insurance firms, however, the results are less pronounced, as indicated by Table 5. Our results indicate that only *Global market contagion* was mitigated by the regulation concerning *Non-bank financial firms owing banks*. Thus the results are mostly inconsistent with Hypothesis 7.

In summary, our regression analysis provides evidence of fundamentals-based contagion in the banking sector (Bekeart et al., 2014; Baur, 2012), given that investors take into consideration firm specific characteristics when evaluating their stock value during crises. This provides favorable news from an asset pricing perspective: Though our results from equations (1)-(6) indicate that contagion effects occurred throughout the banking and insurance sectors, our results indicate that individual banking stocks responded differently during the crisis, indicating the possibility to diversify investments in times when it is needed most. Moreover, the results indicate the importance of the regulatory environment in the financial sector: Our results indicate that regulations which restrict banks and insurers from being active in the other sector strongly decrease the degree of contagion in the banking sector. From a regulator's perspective, these findings should be considered when designing macroprudential frameworks in the financial industry, as regulations which separate banks and insurance strongly decrease their interlinkages during financial crises.

Conclusion

We take an asset pricing perspective to analyze contagion effects in the global financial industry at the sector and firm level. In contrast to previous studies analyzing contagion effects during the financial crisis of 2007-2009, we particularly disentangle the banking from the insurance sector. We develop a factor model and measure cross-industry linkages between the banking and insurance sectors around the world during the recent financial crisis. In addition, we analyze the heterogeneity in firm level responses by identifying firm and country level determinants of the firm's degree of contagion.

Using a factor model and banking and insurance sector indices from a large set of countries for the years 1991-2009, our results indicate significant contagion effects in the global financial industry during the financial crisis of 2007-2009. We find that both banking and insurance sectors around the world increased their linkages with their domestic market and with the global stock market. Similarly, we find evidence of increased linkages within and across financial sectors. Moreover, using a sample of 509 banks and 141 insurance firms, we find evidence of fundamentals-based contagion in the banking sector: larger banks experience higher levels of contagion. Finally, we find that the country level regulations which restrict banks and insurance firms from competing with each other reduce contagion effects during the financial crisis in the banking sector.

We make several contributions to the literature. First, we contribute by performing a comprehensive study of contagion effects in the global financial services sector while particularly disentangling the banking sector from the insurance sector. In addition, while previous papers focus on contagion effects at the aggregate (e.g., Forbes and Rigobon, 2002; Bekaert, Harvey and Ng, 2005; Bekaert et al., 2014) or sector level (Baur, 2012; Phylaktis and

Xia, 2009), we analyze contagion effects during the crisis at the firm level. From an investors' perspective, our results show increased linkages across and within financial sectors and with the overall stock market, which reduces the effectiveness of diversification during crises. However, our results at the firm level show that contagion effects in the banking sector are driven to some extent by firm specific characteristics, which provides opportunities for diversification at the firm level. For policymakers, our results indicate that the regulatory environment strongly affects the degree of contagion during a financial crisis: Regulatory frameworks which restrict banks and insurers from competing with each other lead to lower contagion effects during the crisis. This provides valuable knowledge regarding the design of macro-prudential regulatory frameworks.

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Table 1: Variable Description

Panel A: Firm level factors		
Variable	Definition	Exp.
Size	The natural logarithm of total assets.	+
Leverage	The ratio of equity to total assets.	-
Growth	The annual growth rate of total assets.	+
Liability diversification	The ratio of non-deposit liabilities to total deposits (Banks); The ratio of insurance reserves to total liability (Insurers).	+
Z-Score	Ratio of the sum of each insurer's return on assets (ROA) and its capital ratio (E/TA) divided by the standard deviation of the return on assets (σ_{ROA}).	-
Life	Indicator variable if the insurance firm is a life insurer.	+/-
Panel B: Country level factors		
Variable	Definition	Exp.
GDP per Capita	Gross domestic product divided by midyear population. GDP is the sum of gross value added by all resident producers in the economy plus any product taxes and minus any subsidies not included in the value of the products. It is calculated without making deductions for depreciation of fabricated assets or for depletion and degradation of natural resources. Data are in current U.S. dollars.	+/-
Insurance activities	The ability of banks to engage in insurance underwriting and selling. The degree of regulatory restrictiveness for each aggregate or composite activity is rated on a scale from 1 to 4, with larger numbers representing greater restrictiveness. The definitions of the 1 through 4 designations are as follows: (1) Unrestricted – A full range of activities in the given category can be conducted directly in the bank; (2) Permitted – A full range of activities can be conducted, but all or some must be conducted in subsidiaries. (3) Restricted – Less than a full range of activities can be conducted in the bank or subsidiaries. (4) Prohibited – The activity cannot be conducted in either the bank or subsidiaries.	-
Non-bank financial firms owning banks	Restrictions on the ability of Non-bank financial firms to own and control banks. The degree of regulatory restrictiveness for each aggregate or composite activity is rated on a scale from 1 to 4, with larger numbers representing greater restrictiveness. The definitions of the 1 through 4 designations are as follows: (1)Unrestricted; Nonbank financial firms may own 100% of the equity in a commercial bank, (2)Permitted; Nonbank financial firms may own 100% of the equity in a commercial bank; but prior authorization or approval is required, (3) Restricted;Limits are placed on how much equity can be owned by Nonbank firms; (4)Nonbank firms absolutely restricted from owning equity in a commercial bank.	-
Regulatory quality	Captures perceptions of the ability of the government to formulate and implement sound policies and regulations that permit and promote private sector development.The scale ranges from -2.5 to 2.5, with higher values corresponding to better governance.	-
External Governance Index	Country's quality of corporate governance in the financial sector. This measure ranges from 0—19, where higher values indicate better corporate governance. The index is the sum of individual country level measures of corporate governance (Strength of External Audit, Financial Statement Transparency, Accounting Practices, External Ratings and Creditor Monitoring).	-

Notes: The table provides a description of firm level factors (Panel A) and country level factors (Panel B) for all banks and insurers used in the regression analyses. All firm level factors are provided by *Worldscope*, and all country level factors by the *Worldbank*. Exp. denotes the expected direction of the variables' empirical effects.

Table 2: Summary Statistics

Panel A: Firm level factors (Banks)					
Variable	Obs	Mean	Std. Dev.	Min	Max
Size	509	14.62	2.17	10.84	21.15
Leverage	509	0.18	0.10	0.04	0.71
Growth	509	0.07	0.11	-0.25	0.50
Liability diversification	509	0.79	0.18	0.10	1.00
Z-Score	509	4.61	0.99	0.63	6.92

Panel B: Country level factors (Banks)					
Variable	Obs	Mean	Std. Dev.	Min	Max
GDP per Capita	509	40.05	14.78	0.82	57.35
Nonfinancial Firms Owning Banks	509	2.12	0.44	1	3
Insurance Activities	509	2.25	0.52	2	4
Regulatory Quality	509	1.40	0.53	-0.24	1.77
External Governance Index	509	2.45	5.50	0	17

Panel C: Firm level factors (Insurers)					
Variable	Obs	Mean	Std. Dev.	Min	Max
Size	141	15.25	2.81	8.26	20.34
Leverage	141	0.29	0.20	0.02	0.96
Growth	141	0.06	0.13	-0.27	0.49
Liability diversification	141	0.72	0.22	0.02	1.00
Z-Score	141	3.47	1.00	-0.12	5.45
Life Indicator (=1 if life insurer)	141	0.31	0.46	0.00	1.00

Panel D: Country level factors (Insurers)					
Variable	Obs	Mean	Std. Dev.	Min	Max
GDP per Capita	141	35.50	17.30	3.35	57.35
Nonfinancial Firms Owning Banks	141	2.43	0.58	2	4
Insurance Activities	141	2.24	0.45	1	3
Regulatory Quality	141	1.32	0.51	0.25	1.77
External Governance Index	141	4.60	6.88	0	17

Note: This table shows the summary statistics for firm level factors (Panel A) and country level factors (Panel B) for all banks used in the regression analyses. Panel C and D show the summary statistics for firm level factors (Panel C) and country level factors (Panel D) for all insurers used in the regression analyses. All variables are defined in Table 1. All variable values are reported for the year 2006.

Table 3: Sector Contagion Effects

	Panel A: Market Contagion				Panel B: Local Financial Sector Contagion		Panel C: Global Financial Sector Contagion			
	(1) (INS)	(2) (BNK)	(3) (INS)	(4) (BNK)	(5) (INS)	(6) (BNK)	(7) (INS)	(8) (BNK)	(9) (INS)	(10) (BNK)
γ^{MKT}	0.115*** (0.024)	0.229*** (0.017)								
γ^{GLB}			0.033** (0.015)	0.037*** (0.012)						
$\gamma^{BNK(L)}$					0.060*** (0.012)					
$\gamma^{INS(L)}$						0.128*** (0.009)				
$\gamma^{BNK(G)}$							0.247*** (0.025)	0.257*** (0.021)		
$\gamma^{INS(G)}$									0.217*** (0.029)	0.393*** (0.026)

Notes: The table shows the results for all sector level measures of contagion during the financial crisis of 2007-2009 for banks and insurance firms. Results for the banking sectors are denoted by (BNK). Results for the insurance sectors are denoted by (INS). Panel A shows our measures of Market Contagion. Panel B shows our measures of Local financial sector contagion. Panel C shows our measures of Global financial sector contagion.***, ** and * denotes significance at the 1%, 5% and 10% levels.

Table 4: Firm Level Contagion – Results for Banks

	(1) (γ^{MKT})	(2) (γ^{GLB})	(3) ($\gamma^{INS(L)}$)	(4) ($\gamma^{BNK(G)}$)	(5) ($\gamma^{INS(G)}$)
Size	0.069*** (0.013)	0.011 (0.012)	0.095*** (0.020)	0.066*** (0.025)	0.085*** (0.025)
Leverage	0.061 (0.253)	0.098 (0.208)	-0.100 (0.337)	-0.615 (0.500)	-0.612 (0.533)
Growth	0.397** (0.179)	0.265 (0.166)	-0.182 (0.216)	0.259 (0.341)	0.525 (0.357)
Liability diversification	-0.059 (0.162)	-0.182 (0.158)	0.260 (0.284)	-0.140 (0.363)	-0.371 (0.352)
Z-Score	-0.014 (0.019)	0.013 (0.018)	-0.005 (0.026)	0.050 (0.035)	0.033 (0.039)
GDP per Capita	0.014*** (0.004)	0.003 (0.003)	0.000 (0.004)	0.001 (0.006)	-0.005 (0.008)
Non-bank Financial Firms Owning Banks	-0.069 (0.062)	-0.057 (0.057)	-0.149** (0.066)	0.011 (0.103)	-0.347*** (0.111)
Insurance Activities	-0.180*** (0.065)	-0.092 (0.062)	-0.248*** (0.060)	-0.001 (0.116)	-0.404*** (0.116)
Regulatory Quality	-0.163* (0.092)	0.118 (0.085)	0.119 (0.085)	0.186 (0.151)	0.132 (0.182)
External Governance Index	-0.002 (0.005)	0.001 (0.005)	0.004 (0.004)	-0.008 (0.009)	0.023** (0.009)
Constant	-0.503 (0.398)	0.077 (0.362)	-0.713 (0.537)	-1.200 (0.774)	0.765 (0.871)
R2	0.156	0.119	0.082	0.059	0.061
Adj. R2	0.139	0.102	0.064	0.040	0.043
Observations	509	509	509	509	509

Notes: The table shows the results of regression analyses from equation (7) for banks. The results are reported for all measures of contagion separately in columns (1)-(5). All independent variables are from the year 2006. Firm level and country level factors are described in Table 1. ***, ** and * denotes significance at the 1%, 5% and 10% levels.

Table 5: Firm Level Contagion – Results for Insurers

	(1) (γ^{MKT})	(2) (γ^{GLB})	(3) ($\gamma^{INS(L)}$)	(4) ($\gamma^{BNK(G)}$)	(5) ($\gamma^{INS(G)}$)
Size	0.030 (0.037)	-0.011 (0.026)	0.025 (0.022)	-0.032 (0.044)	-0.037 (0.068)
Leverage	0.394 (0.512)	0.298 (0.303)	0.099 (0.256)	-0.066 (0.499)	0.194 (0.816)
Growth	-0.324 (0.628)	0.584 (0.383)	-0.802* (0.426)	-0.786 (0.694)	-0.770 (1.270)
Liability diversification	-0.444 (0.328)	0.021 (0.234)	0.213 (0.218)	-0.182 (0.404)	0.080 (0.540)
Z-Score	-0.023 (0.073)	0.036 (0.043)	0.044 (0.052)	-0.089 (0.097)	-0.013 (0.142)
Life	-0.020 (0.151)	0.052 (0.094)	-0.039 (0.093)	0.032 (0.166)	0.215 (0.263)
GDP per Capita	0.014 (0.011)	0.011 (0.008)	-0.004 (0.006)	-0.007 (0.010)	-0.018 (0.017)
Insurance Activities	-0.221 (0.147)	-0.214 (0.142)	-0.109 (0.115)	0.038 (0.179)	0.318 (0.420)
Non-bank Financial Firms Owning Banks	-0.068 (0.121)	-0.249** (0.125)	0.032 (0.117)	-0.079 (0.156)	-0.109 (0.389)
Regulatory Quality	-0.355 (0.287)	-0.194 (0.253)	0.039 (0.235)	0.300 (0.322)	0.767 (0.681)
External Governance Index	-0.015 (0.014)	0.013 (0.010)	0.007 (0.010)	-0.002 (0.014)	-0.003 (0.033)
Constant	0.990 (0.872)	1.113 (0.777)	-0.364 (0.778)	0.957 (1.325)	-0.345 (2.483)
R2	0.180	0.174	0.087	0.062	0.044
Adj. R2	0.110	0.104	0.009	-0.018	-0.038
Observations	141	141	141	141	141

Notes: The table shows the results of regression analyses from equation (7) for insurance firms. The results are reported for all measures of contagion separately in columns (1)-(5). All independent variables are from the year 2006. Firm level and country level factors are described in Table 1. ***, ** and * denotes significance at the 1%, 5% and 10% levels.

Appendix

Table A.1: Firm Level Factors by Country (Banks)

Country	Obs	Size	Leverage	Growth	Liability diversification	Z-Score
Australia	6	18.35	0.21	0.13	0.62	5.41
Belgium	2	19.08	0.15	-0.04	0.32	4.40
Bulgaria	3	13.49	0.31	0.15	0.62	4.84
Canada	9	18.05	0.08	0.17	0.75	3.81
Croatia	7	13.46	0.18	0.09	0.84	5.44
France	18	17.12	0.35	0.01	0.37	5.45
Germany	9	16.90	0.27	-0.01	0.53	4.75
India	32	16.07	0.12	0.12	0.87	3.76
Italy	17	17.24	0.30	-0.04	0.45	4.73
Malaysia	9	16.86	0.11	0.17	0.72	4.36
Singapore	3	18.44	0.14	0.10	0.64	4.17
South Africa	5	17.11	0.17	0.17	0.71	3.57
Switzerland	22	16.81	0.22	-0.06	0.57	4.64
Thailand	10	16.21	0.14	0.03	0.82	2.98
United States	357	13.73	0.18	0.08	0.84	4.69
Sum / Mean	509	16.60	0.19	0.07	0.64	4.47

Table A.2: Country Level Factors by Country (Banks)

Country	Obs	GDP per Capita	Insurance Activities	Non-bank Financial Firms Owning Banks	Regulatory Quality	External Governance Index
Australia	6	36.08	3	3	1.62	15
Belgium	2	38.85	3	1	1.32	14
Bulgaria	3	4.46	3	2	0.57	15
Canada	9	40.24	2	3	1.55	0
Croatia	7	11.36	2	2	0.39	15
France	18	36.54	3	2	1.23	0
Germany	9	36.45	3	2	1.57	16
India	32	0.82	2	3	-0.24	0
Italy	17	33.43	3	2	0.95	15
Malaysia	9	6.19	3	3	0.55	17
Singapore	3	33.58	3	2	1.77	0
South Africa	5	5.66	3	2	0.71	0
Switzerland	22	57.35	4	2	1.50	13
Thailand	10	3.35	3	3	0.25	14
United States	357	46.44	2	2	1.65	0
Sum / Mean	509	26.05	2.80	2.27	1.03	8.93

Table A.3: Firm Level Factors by Country (Insurers)

Country	Obs	Size	Leverage	Growth	Liability diversification	Z-Score	Life
Australia	3	15.35	0.31	0.11	0.50	1.75	0.33
Belgium	1	20.34	0.15	-0.07	0.08	4.38	1.00
Bulgaria	2	10.98	0.30	0.19	0.71	3.24	0.50
Canada	11	17.02	0.21	0.16	0.72	3.87	0.55
Croatia	2	12.33	0.38	0.24	0.87	4.30	0.00
France	3	18.44	0.23	-0.01	0.57	4.03	0.33
Germany	4	17.22	0.07	-0.08	0.69	3.69	0.25
Italy	5	17.37	0.14	-0.07	0.67	3.98	0.20
Malaysia	6	13.16	0.22	0.11	0.88	3.37	0.17
Singapore	3	13.23	0.33	0.10	0.82	3.70	0.33
South Africa	7	13.81	0.45	-0.03	0.44	2.69	0.57
Switzerland	6	17.37	0.09	-0.07	0.73	2.32	0.17
Thailand	15	11.17	0.51	0.03	0.72	3.70	0.07
United States	73	15.77	0.29	0.08	0.76	3.51	0.33
Sum / Mean	141	15.25	0.26	0.05	0.65	3.47	0.34

Table A.4: Country Level Factors by Country (Insurers)

Country	Obs	GDP per Capita	Insurance Activities	Non-bank Financial Firms Owning Banks	Regulatory Quality	External Governance Index
Australia	3	36.08	3	3	1.62	15
Belgium	1	38.85	3	1	1.32	14
Bulgaria	2	4.46	3	2	0.57	15
Canada	11	40.24	2	3	1.55	0
Croatia	2	11.36	2	2	0.39	15
France	3	36.54	3	2	1.23	0
Germany	4	36.45	3	2	1.57	16
Italy	5	33.43	3	2	0.95	15
Malaysia	6	6.19	3	3	0.55	17
Singapore	3	33.58	3	2	1.77	0
South Africa	7	5.66	3	2	0.71	0
Switzerland	6	57.35	4	2	1.50	13
Thailand	15	3.35	3	3	0.25	14
United States	73	46.44	2	2	1.65	0
Sum / Mean	141	27.86	2.86	2.21	1.12	9.57