Stock Market Risk in the Financial Crisis

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Abstract

The aim of the paper is to investigate composition effects arising from the financial crisis. A composition effect is a change in the market risk of a sector that is caused not by a direct change in that sector but by a change in another sector that affects the composition of the stock market. In the paper we investigate the pre and during crisis market risk of the industrial, banking and utilities sectors. Amongst other results, we find, across the G12 countries, a positive relationship between the increase in the market risk of industrials during the crisis and both the pre-crisis market risk of the banking sector and the scale of the systemic crisis in a country. The six G12 countries that experienced a major systematic banking crisis are amongst the seven countries with the largest increases in the market risk for industrials. Results drawn from our detailed analysis using US data are consistent with these findings. Finally, we consider how the results add to our understanding of the linkages between the financial and real sector and conclude that composition effects of the financial crisis could have a significant chilling effect on industrials, in addition to the effect of other linkages arising through more sophisticated economic channels.

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1. Introduction

The financial crisis of 2007 began in the US, rapidly took the form of a full blown systemic crisis in the US and almost immediately became a global phenomenon (Covitz et al., 2013; Lane, 2012; Mishkin, 2010; Shiller, 2012). By 2008 there were major systemic banking crises in a large number of economies, e.g., Austria, Belgium, Denmark, Germany, Iceland, the Netherlands, Nigeria, Spain and the UK, and 'borderline' systemic crises in many others such as France, Italy, Portugal, Russia, Sweden and Switzerland. The financial crisis has had enormous impact on the financial sector of many developed countries, decimating values of financial companies and leading some of the biggest world names in banking to be dependent on state financial support to avoid collapse or, in some cases, to be nationalised. Although the financial sector has been hardest hit by the crisis, its effect has been felt across the economies around the world. In the US, for example, GDP in 2012 was only 4% higher in real terms than at the end of 2007. This situation is common, e.g., Canada, German, Swiss and the UK GDPs are only 5.3%, 3.78%, 6.1%, and -3.2%, respectively, higher in real terms than in 2007. This significant collapse of the financial sector has affected the composition of the stock market and the aim of this paper is to investigate whether this change in composition has impacted on the market based risk measures of other sectors and to consider what implications this may have for the non-financial sector.

There is some evidence suggesting that we might find such a 'composition effect'. For example, Grout and Zalewska (2006) document that during the dotcom bubble the Kalman filter daily betas of old economy stocks fell, both in the UK and in the US, for a short period during the dotcom bubble. The dot-com bubble is minor when compared to the financial crisis, which suggests that, given the duration, scale of impact and global reach of the financial crisis, it may be possible to find significant market risk changes induced by the composition changes associated with the financial crisis.

The underlying premise is simple. Assume, for example, that the proportion of a comparatively risky sector falls (rises). Other things being equal, since the market weighted sum of betas of the market portfolio must sum to one, other sectors must have higher (lower) market risk measures if the overall constraint is to be achieved. We refer to the change in market risk measures in a particular sector that arise not from fundamental changes in that sector but as a result of another sector growing, declining or having major risk change as a composition effect. That is, over and above any other changes that may be going on, there will be a simple spill over from changes in one sector on the stock market risk of other sectors. Hence, the collapse of the financial sector as a proportion of the stock market may have impact on the stock market based risk measures of other sectors simply because the composition of the stock market has changed.

In the paper we focus on the risk of industrials, utilities and banking sectors before and during the crisis. Whilst utilities are traditionally seen as defensive stocks, the sector appears to have been thought of as particularly low risk and safe havens for investment during the financial crisis. Berkshire-Hathaway's utility focused strategy and its expansion in the financial crisis is one of the better known examples of this. Unlike utilities, however, industrials have not had a favoured 'halo effect' during the crisis. We look at the differences in the changes in risk of industrials and utilities in the G12 countries and relate this to the impact of the financial crisis on banking to identify composition effects.

The analysis is initially performed on US daily data on sector indices provided by Professor Kenneth French using Fama-French three factors CAPM specification and using S&P1500 daily observations sourced from DataStream using a single factor CAPM. We then undertake a comparative investigation of G12 countries (the sample also includes the US) using DataStream calculated sector indices. The sample covers 1 January 1996 – 31 July 2014 period. An interesting feature of the crisis for the purposes of the paper is that the scale of the crisis was not uniform even across G12 countries. For example, according to Laeven and Valencia's Systemic Crisis Data Bank (Laeven and Valencia, 2013), amongst the G12 countries the financial crisis developed into a major systemic banking crisis in Belgium, Germany, the Netherlands, Spain, the UK, and the US, whilst France, Italy, Sweden, and Switzerland faced a marginal systemic crisis, and Australia, Canada, Japan, had no systemic crisis at all. Utilising these differences we are able to compare the risk changes across countries that have well developed banking systems but suffered different severity of the crisis, with the expectation that composition effects would be greatest in countries that experienced major systemic crisis.

We find that the market risk of industrials is higher during the crisis than pre-crisis in the US and for most of the G12 countries. To the extent that this increase is caused by composition effects arising from the financial crisis one would expect the increase in market risk for industrials to be larger the higher the pre-crisis market risk of the banking sector and also larger the more severe the systemic banking crisis in a country. Across the G12 countries we find such a positive relationship between the increase in the market risk of industrials relative to pre-crisis levels and the pre-crisis market risk of the banking sector. Indeed, with the exception of Sweden, we find that all countries with pre-crisis market risk of the banking sector above one experienced increases in market risk of industrials during the crisis and that all countries with pre-crisis market risk of the banking sector below one experienced declines in market risk of industrials. Furthermore, the six G12 countries that experienced a severe systematic banking crisis are amongst the seven countries with the largest increases in the market risk for industrials (again Sweden is the exception). Although the market risk of the banking sectors changed during the crisis, there is no systematic relationship between the scale of the systemic crisis in a country and the change in risk of the banking sector in that country.

The position of utilities is more nuanced. If, as we argue, utilities were seen as particularly low risk during the crisis then in the absence of any composition effect we would expect the market risk to fall. However, the evidence of changes in the risk of industrials suggests that if a composition effect is present we would expect a less clear picture with the possibility of risk increases. This is exactly the case, i.e., we find that the risk of the utility sector falls in some countries and rises in others with increases in risk outnumbering the declines.

Finally, we also conjecture that such composition effects could potentially be an addition to the traditional transmission routes from the financial sector to the non-financial sector. If it is found that market based measures of risk of industrials increase in part because of a composition effect this could suggest that increases in stock market based measures of the cost of capital for these sectors 'overestimate' the underlying changes in the sector leading to additional difficulties in raising finance.

The format of the paper is as follows. The following section, Section 2, outlines the justification for the sample selection. Section 3 presents the data and methodology while Sections 4 and 5 present the results for the US and the G12 countries respectively. Section 6 concludes and discusses the implications. Appendix provides tables with the GARCH effects estimated for the regression specifications used in the paper as well as tables with an alternative definition of the financial crisis dummy.

2. Countries and sectors

In this section we discuss in more detail the justification for the choice of the countries used in the analysis, and the focus on the industrials and utilities sectors.

2.1. The countries

The global financial crisis of 2007 initially developed in the US, although it has had enormous impact on the financial sector of almost all developed countries (Baur, 2012). Given the central role of the US in the financial crisis and wide range of available data, we begin our analysis by focusing on potential composition effects in the US, using daily returns of the utility, industrials and banking sector indices constructed using data from AMEX, NASDAY and NYSE. However, given that the impacts of the financial crisis are not uniform across countries, we seek to utilize this fact by comparing the effects across a series of countries with different severities of the crisis. A good measure of the extent of the differences can be gauged by looking at the group of 12 countries, G12 (actually 13 as a result of Switzerland's membership), since this is a group of industrially advanced countries whose central banks co-operate to regulate international finance. As indicated in the introduction, the scale of the impact of the financial crisis in these countries is classified in the Systemic Crisis Data Bank as a major systemic banking crisis in Belgium, Germany, the Netherlands, Spain, the UK, and the US, as 'marginal' in France, Italy, Sweden and Switzerland, and absent, in Australia, Canada, Japan, (Laeven and Valencia, 2013). We use this exogenous metric (i.e., classification of the countries into these with (i) major systemic crisis, (ii) marginal and (iii) no systemic crisis) as an indicator of the scale of impact of the financial crisis in a country. The basic conjecture is that the greater the scale of the crisis, then the greater should be the composition effects. Within the G12 group, there were also significant differences in government responses. For example, the US, the UK and the Netherlands engaged in significant nationalisation whereas this was often comparatively or sometimes totally absent in other countries, and by 2012 within the G12, the average cost of asset purchases and guarantees was 12% of GDP in the countries with major systemic crisis (Belgium 7.7%, Germany 17.2%, Netherlands 3.3%, Spain 1.8%, UK 30.8%, and US 13%) and 1.75% of GDP for the countries categorised as marginal (France 0.3%, Italy 0%, Sweden 0%, and Switzerland 6.7%).

2.2. The sectors

The banking sector was at the heart of the financial crisis and is at the centre of our analysis. We have argued that the dramatic changes in the banking, and broader financial sectors, could lead to spill over effects onto other sectors, and given that we utilise differences in the scale of systemic crisis across the countries, we begin with a brief discussion of the banking sector in our sample. The notion of, what we call, a composition effect is that changes in market share of one part of the market are very likely to spill over to the betas of other sectors, as a result of the overall constraint, and thus we may observe a relationship between the severity of the systemic crisis and the betas of other sectors. Figure 1 provides data on how the banking sector's shares of the stock markets have differed during the crisis relative to the pre-crisis period. For each country we calculate the average market share of the banking sector during the crisis to the equivalent average share over the period of the same length before the crisis (monthly observations are used). We adopt two alternative dates as the relevant markers for the start of the crisis. These are August 2007 and September 2008 (see below, Section 3.3, for discussion). Thus, for each country, the left hand bar shows the ratios using August 2007 as the start of the financial crisis and the right hand bar relates to September 2008 as the start of the financial crisis.

********************** insert Figure 1 here **********************

There is significant disparity across countries. The Netherlands provides the most dramatic change with the banking sector's share of the stock market during the crisis averaging about only 3.9% of the pre-crisis figure. This dramatic effect was heavily due to the nationalisation programme that made the government owner of ABN AMRO, ASR, and SNS REALL, although the government has a stated commitment to return the companies to the market. At the other extreme, Australia and Canada, both having avoided a systemic crisis, have seen noticeable increases in the share of the banking sector rather than falls. The countries in Figure 1 are grouped according to the three categories of systemic crisis, the first three countries having no systemic crisis, the next having marginal systemic crisis and the final six are those countries which had a major systemic crisis. There is a clear relationship between the categories and the changes in market share. Australia, Canada and Japan have an average ratio of 1.03, those countries with marginal systemic crisis have an average of 0.82 and those with major systemic crisis the average market share of the banking sector during the crisis is half of the pre-crisis share, 50.8 (for these numbers August 2007 is used as the start of the financial crisis).

Spain and Sweden are slight anomalies. The mean market share of Spain's banking sector during the crisis is almost as high as its pre-crisis level. This may be a reflection of several factors (the shock to the Spanish financial sector was relatively late (Royo, 2013), the fact that the pre-crisis Spanish debt to income ratio was favourable, there has been no nationalisation of the Spanish banks, Spain received enormous EU support, and the non-banking sector in Spain has been hit comparatively harder than the other countries that have experienced a major systemic crisis). Similarly, Sweden has an unexpectedly high ratio. The reason probably lies in the fact that Sweden went through a banking crisis in 1991-1992 that was similar in many respects to the subprime crisis that precipitated the global financial crisis (Drees and Pazarbasioglu, 1998; Sandal, 2004). Hence there was significant intervention and restructuring in Sweden before the current crisis. Indeed Sweden's response to the 1991-1992 crisis has been held as a model for the current crisis (See Krugman, 2008; Jonung, 2009). Thus in many regards Sweden is an outlier with regard to the position of its banking sector both pre- and during crisis.

In the paper we analyse the change in risk of the industrial sector and the utility sector. We address the utility sector because there is strong anecdotal evidence that this sector have been particularly attractive in the crisis. Utility infrastructure companies are typically considered defensive stocks but there is evidence that utilities have been perceived as even safer homes for investment during the period of heightened uncertainty arising from the recent financial crisis. There are obvious reasons why this may be the case. For example, the prices and/or the returns for a large proportion of the companies are regulated and hence revenues are somewhat protected during periods of high business risk. Furthermore, the outputs are more essential to consumers and the economy than other sectors so demand is far less volatile even for those companies that are not directly regulated.

Utility industries around the world have been for several years the focus of major investment programmes. The most obvious example is probably the energy sector where in most western economies traditional, carbon heavy generation capacity is being replaced with renewable generation (wind, solar, nuclear, biomass) on a large scale. This new generation is typically sited away from traditional generation hence, in addition to cost of the new generation, the transmission systems require billions of dollars of additional investment to upgrade and extend national transmission systems. IT developments in modern smart networks also call for large-scale upgrades to network systems. Other sectors, such as transport, similarly require massive infrastructure inputs. Despite the financial crisis, these sectors have found it relatively easy to find funding. For instance, across different sectors Afonja (2012), Cambridge Economic Policy Associates (2014), Hansen (2010), Ofgem (2013) and PWC (2013) emphasise that funding has been robust at attractive rates. Moreover, Maung and Mehrota (2010) show that utilities credit ratings have been more robust than other sectors during the crisis.

The attraction of utilities during the financial crisis also appears to hold when one looks at private equity. The strategy of Berkshire Hathaway through the crisis is a classic example of this point. Berkshire Hathaway (2008) emphasised the importance of utility businesses to the company's strategy looking forward. Between 2009 and 2013, Berkshire Hathaway's revenue from railroad, utilities and energy business increased from \$11,434bn to \$73,757bn (Berkshire Hathaway, 2013), mostly funded by acquisitions. Recently, Charles Munger, Berkshire Hathaway's Vice Chairman, suggested that Berkshire Hathaway will soon be the biggest utilities business in the US (Wall Street Journal, 2014). The perception of utilities as being particularly low risk in the financial crisis should indicate that a fall in market risk relative to the pre-crisis level should be observed, unless some other factor acts to offset this. Hence failure to observe a relatively uniform decline in market risk for utilities could be taken as providing some evidence of an offsetting composition effect.

As indicated in the introduction, industrials have not had a favoured 'halo effect', and we therefore assume that general industrial stocks are far more likely to experience a stock market composition effect rather than be seen as a safe haven in the crisis. So when the financial market declines as a share of the stock market we conjecture that industrials will face a composition effect leading to upward pressure on its stock market risk measure. Furthermore, we conjecture that those countries that suffered the greater systemic crisis are more likely to observe an increase in the risk measures of industrials compared to their pre-crisis levels.

3. Data

As discussed above, testing for our hypotheses is conducted at two levels. First, the case of the US market is studied, and then the analysis of international markets is performed. Below we describe the samples created for the US and the G12 countries.

3.1 The US sample

To analyse the US market we use time series collected from the webpages of Professor Kenneth French[2] and DataStream, to which we refer to as KF-Data and DS-Data respectively.

The KF-Data provide time series of daily returns on a wide range of industry indices, excess return on the market, risk free rate of return and returns on the SML and HML factors. The industry indices based on 49 Compustat SIC classifications are selected for the study because this is the most detailed classification that is available. It provides returns for the utilities and the banking sectors which we refer to as R_{U49} and R_{B49} respectively. However, the industrials index needs to be calculated. [3] Following the specification of the DS Industrials Index (ICB Code 2000) we calculate the returns on the KF industrials index using returns on the following indices: Construction materials, Machinery, Electrical Equipment, Automobile and trucks, Aircraft, Shipbuilding and railroad equipment, Defense, Business services, Measuring and control equipment, Business supplies, Shipping containers, and Transportation. We equally weight these returns and refer to the returns of this newly created industrials index as R_{I49}.

However, given that the industrials sector index we created may be biased towards particular sectors (e.g., it may overweigh components with small weights) we also construct an alternative control sample. Grout and Zalewska (2006), when analysing the effect of proposed changes in regulation of utilities on the market risk of UK utilities, constructed a sample of 'old-economy' stocks that could be expected to respond in a similar way to changes in general market conditions save for the proposed changes in regulation. Following this approach, a comparator index is calculated as the equally weighted index of the Agriculture, Food products, Candy and soda, Beer and liquor, Tobacco products, Apparel, Textiles, Wholesale, Retail, Restaurants, hotels and motels indices and the indices included in

[2] http://mba.tuck.dartmouth.edu/pages/faculty/ken.french/data_library.html#Research

[3] There are 5, 10, 12, 17, 30, 38, 48, and 49 industry classifications available.

the construction of the industrials index. The returns on this control index are referred to as R_{C49}.

Using the KF-Data has two advantages. First, it provides indices representative for the whole US economy, as the stocks used to construct indices are traded on NYSE, AMEX, or NASDAQ. Second, the SML and HML factors are constructed using the same methodology as the other indices. There are however, two disadvantages. First, it does not provide an industrial index for the economy and construction of the equally weighted index may create a bias towards components with small weights. Second, there are no indices for other counties constructed using the same methodology.

To deal with these potential caveats we also use US industry indices provided by DataStream. To check the robustness of our findings we collected S&P1500 indices and DS-calculated indices. The S&P1500 indices are collected because, (i) there is a 'ready-calculated' industrials index, and (ii) in addition to the returns on the utilities index, returns on four sub-indices are also available. In particular, there are indices for electricity utilities, gas utilities, water utilities and multi-utilities. The DS calculated indices, on the other hand, do not have detailed sub-indices for the utilities sector but they are calculated for many countries providing a comparable sample for the G12 analysis. Both sources provide indices for the banking sector which we also collected and use in the analysis. For all these indices we calculate log-returns and denote as R_{SP} with an additional superscript to indicate a sector (B for banking, I for industrials, etc.).

The sample starts on 1 January 1996 and ends on 31 July 2014. The beginning of the sample is dictated by the data availability. The KF-Data series go back to July 1926 and end on 31 July 2014 (at the time of the sample collection), but the other time series are much shorter. The S&P1500 time series start on 3 February 2004, and some DS-calculated time series start at various points through 1995.

To keep the sample as long and as representative as possible we start the KF-Data and DS-calculated time series on 1 January 1996 and end on 31 July 2014. The S&P1500 time series start on 3 February 2004 and end on 31 July 2014. We do not truncate all the time series to 2004 to maintain the sample long enough to have a good overview of the changes that occurred after 2007.

Basic summary statistics of the returns on the KF and S&P1500 indices are presented in Table 1. The statistics for the log-returns on the DS-calculated indices are presented in the next section, i.e., together with the statistics for the other G12 countries.

******************** insert Table 1 here ************************

3.2. The G12 sample

To further understand the analysed phenomena we provide an international comparison of the changes in the market risk of the utilities, the industrials and the banking sectors over the period 1 January 1996 – 31 July 2014. The choice of countries was partly dictated by data availability, i.e., information about stock market returns of the industrials and the utilities sector was available for long enough, but also a range of countries' experiences since 2007. Ideally, we targeted to construct a sample of countries that experienced severe economic and stock market repercussions during the financial crisis, and countries that did not seem to be affected by the collapse of the sub-prime mortgage market in the US.

The attention has been focused on the G12, a group of 13 highly industrial countries whose central banks co-operate to regulate international finance. As mentioned in Section 2.2, according to Laeven and Valencia (2013) the G12 countries can be divided into three groups depending on the severity of the systemic problems in their banking sectors, those which experienced a major systemic banking crisis (Belgium, Germany, the Netherlands, Spain, the UK, and the US), those with a 'marginal' systemic banking crisis (France, Italy, Sweden and Switzerland), and those without it (Australia, Canada, Japan).

We collected the DS-calculated stock market and the banking sector indices for all the 13 countries. However, the utilities index was not available for Sweden and the Dutch one stopped being calculated on 24 February 2004. Therefore, changes in the market risk of the utilities sectors are analysed for 11 countries only. Moreover, there are also some issues with the DS General Industries indices. The French index is available from 29 January 1999 and there are no General Industrials indices for Spain and Sweden. In the case of these two countries the DS-calculated Industrials indices use used. These indices are much broader, and may not be directly comparable with the General Industrials index, but this is the best proxy that we have. All the time series (except those for France) are collected for the 1 January 1996 – 31 July 2014 period. The summary statistics of the log-returns on market, banking, industrials and utilities indices are presented in Table 2.

******************** insert Table 2 here ********************

3.3 Methodology

To test for the existence of the composition effect time dummies are needed to observe the potential impact of the financial crisis on market risk across sectors and across countries. Although it is common to treat 2007 as the starting year of the financial crisis, it is not altogether clear which exact date is to be singled out. Moreover, the financial crisis did not start in all countries at the same time. While in the US and the UK the financial crisis started in 2007, other countries started to experience it in 2008 (Laeven and Valencia, 2013). We tie the start of the financial crisis dummies to specific market events. In particular, we pick two specific dates to define two time dummies. The first date is 9 August 2007, i.e., the day when BNP Paribas announced that it was ceasing activities in three large hedge funds specialising in US mortgage market. This was probably the first point in time that it was stated openly that many trillions of dollars of derivatives were likely to be worth far less than was assumed at the time. The second date is 15 September 2008, i.e., the day Lehman Brothers went bankrupt.

We use two dummies to capture the time change in risk measures. Dummy D_{07} is defined as 1 from 9 August 2007 till 31 July 2014 (the end of the sample) and zero otherwise, and Dummy D_{08} is defined as 1 from 15 September 2008 till 31 July 2014, and zero otherwise.

When testing for the composition effect on US data (Section 4) we only use D_{07}. This is because the financial crisis started in the US in 2007 (Laeven and Valencia, 2013). In the regressions for the G12 countries both dummies are used. This is because in all these countries, but the US and the UK, the financial crisis started in 2008. As the month of the beginning of the financial crisis for the individual countries are hard to be determined we use both D_{07} and D_{08} to test the robustness of our findings. The regressions with the D_{08} dummy are presented in the Appendix.

The Fama-French 3-Factor CAPM specification

$$\begin{aligned} R_t &= \alpha + \alpha_D D_{07} + \beta(R_{M,t} - R_{free,t}) + \beta_D D_{07}(R_{M,t} - R_{free,t}) \\ &+ \gamma SMB_t + \gamma_D D_{07} SMB + \delta HML_r + \delta_D D_{07} HML_t + \varepsilon_t \end{aligned} \tag{1}$$

as well as a simple market CAPM specification

$$R_t = \alpha + \alpha_D D_{07} + \beta R_{M,t} + \beta_D D_{07} R_{M,t} + \varepsilon_t \tag{2}$$

are used with R_t denoting daily excess returns (Equation (1)) or returns (Equation (2)) on individual indices (utilities, industrials, banking and control index) or differences between returns on indices of utilities sector and returns on indices of industrials or of the control sample. For the G12 countries we used Equation (2) specification only.[4]

Tables 1 and 2 clearly show that time series of returns are far from normally distributed. To deal with the potential bias in the estimated coefficients and standard errors a GARCH (p,q) specification of the variance is applied. The magnitude of p and q is determined for each individual regression based on the correlation tests of squared standardised residuals, Durbin-Watson statistics and Schwartz criterion. As the GARCH effects are not of main interest they are presented in the Appendix.

4. US results

Table 3 shows regression results for the Fama-French 3 Factor CAPM specification as discussed in Section 3.3. The first column shows that the beta coefficients estimated for the industrials index increased during the financial crisis. The increase is statistically significant at 1%. Moreover the statistically significant increase is observed for the SMB factor and statistically significant decrease is obtained for the HML factor. The increase of the beta coefficient is consistent with our hypothesis. In addition, the same effects (in the size of statistical significance and direction of change) are observed for the control index constructed to mimic old-economy stocks. This supports the expectation that the control index has similar

[4] We also controlled for potential changes in market risk during the dotcom bubble but this had no impact on the results and is not reported.

properties to the industrials index although consists of a much broader asset class. The next two columns show the coefficients estimated for the banking sector ($R_{B49} - R_{free}$) and the utilities sector ($R_{U49} - R_{free}$). They show that the risk of the banking sector increased during the financial crisis and the risk of utilities declined during the financial crisis.

The last two columns of Table 3 confirm our expectations that the utilities sector, in general, is less risky than the industrials and the old-economy stocks, and that the difference in the market risk of the industrials index and of the control index increased statistically significantly during the financial crisis.

********************** insert Table 3 here *********************

The results obtained for S&P1500 indices confirm these findings. Tables 4 and 5 show the regression results obtained for the level and differences specifications, respectively, obtained for S&P1500 indices. Table 4 confirms that the market risk of the banking and of the industrials sectors increased statistically significantly during the financial crisis. It is also clear that the risk of utilities decreased. A statistically significant decline is obtained for the S&P1500 utilities index and all its sub-indices except for the gas utilities which does not show a statistically significant change in the beta coefficient.

********************** insert Table 4 here *********************

Table 5 documents the relative changes in the market risk of the utility companies. It shows the estimates of the coefficients when the returns on the utilities index, or its sub-indices, minus returns on the industrials index are used as the dependent variable. All the interactive effects of the slope coefficient are statistically significantly negative at 1% and 5%. The decline in the coefficient is also substantial. Except for the gas utilities, the gap between the market risk of the utilities and of the industrials, at least, doubled during the financial crisis.

********************** insert Table 5 here *********************

All in all the above results show that during the financial crisis the market risk of the industrials sector increased, while it decreased for the utilities sector. This resulted in a statistically significantly wider gap between the market risks of these two sectors.

5. G12 sample

The primary objective of this section is to undertake an international comparison of the change in the pattern of the industrials and utilities beta coefficients across the G12 countries.

Table 6 shows the results of regressions across the 13 countries for industrials (Panel A) and banks (Panel B) using D_{07} to capture the change in beta during the crisis period. Looking at industrials first, the change in the beta within the crisis period from the pre-crisis level, the coefficient estimates for $R_m x D_{07}$ are statistically significant at 1% for all of the countries with the exception of Switzerland, significant at 5%, and Canada, where the coefficient is not significant. For most countries there is an increase in the beta of industrials during the crisis but Australia, Canada and Italy show a decline in the beta of industrials during the crisis.

********************** insert Table 6 here *********************

Before discussing the differences in the betas of industrials across the countries, it is helpful first to look at the beta of the banking sector in these countries. Panel B shows the beta of the banking sector before 2007, the column marked R_M, and the change in the beta during the crisis, the column marked $R_M x D_{07}$. This shows that before the crisis the betas of the banking sector were greater than one in most countries, with Australia, Canada and Italy, again being the exception. The betas of the banking sector increased during the crisis compared to the pre-crisis levels for all countries except Canada (the coefficient is positive although not statistically significant) and the Netherlands for which the beta halved during the financial crisis (the estimates are statistically significant at 1%).

If the change in the beta of industrials can in part be explained by the composition effects arising from the decline of the banking sector during the financial crisis then on average we would expect that the effect would be more pronounced the more severe the country's banking crisis and the higher the beta of the country's banking index. Figure 2 helps to see whether the regressions shown in Table 6 suggest that there is any evidence of such a relationship. The vertical axis in Figure 2 measures the increase in risk of industrials compared to the pre-crisis levels. The horizontal axis measures the beta of the banking sector before the crisis, and the vertical axis is drawn through one. All 13 countries are plotted in this space.

********************* insert Figure 2 here ******************

The first point to note is that there are no countries except Sweden in either the upper left or lower right quadrant. Put another way, save for Sweden there are no countries with pre-crisis beta of the banking sector above one that did not have an increase in the beta of industrials during the crisis and no country that had a fall in the beta of industrials which did not have the pre-crisis level of risk of the banking index less than one. Furthermore, there is a clear positive correlation in the graph. In Figure 2 the countries with major systemic banking crisis are marked by triangles, those with marginal systemic banking crisis are marked by diamonds and those with no systemic banking crisis are marked by circles. The figure shows clearly that the six countries that experienced a major systemic banking crisis are amongst the seven countries with the biggest increase in betas of industrials (Sweden again be the exception). Two of the four countries that had a marginal systemic banking crisis have small but positive increases in the beta of industrials and two of the three where there was no systemic banking crisis experienced small falls in the beta of industrials.[5]

[5] It is interesting to note that in recent years it is being claimed that both Australia and Canada engaged in secretive bailouts, well hidden from the public eye. McDonald (2012) argues that secretive bailouts took place in Canada and similar stories have been leaked in Australia (http://www.moneymorning.com.au/20101203/nab-and-westpacs-secret-bailout-revealed.html)

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The presence of a composition effect will be somewhat mitigated by a large increase in risk of the banking sector. However, as Table 6 shows, although in general there is an increase in risk in the banking sector there is no systematic relationship between increases in risk and the severity of the banking crisis. For example, the two largest increases in risk of the banking sector occur in countries with only marginal systemic banking crisis (France and Italy). Furthermore, the biggest fall in the risk of the banking sector occurred in a country classified as having a major systemic crisis (Netherlands). The large decline in risk in the Netherlands banking sector may in part be caused by the large-scale nationalization that took place. Note that the Netherlands also experienced the biggest increase in risk of industrials and one might conjecture that part of the impact arose because of the fall in the risk of the banking sector.

********************* insert Figure 3 here ******************

Overall, not only do we observe the increase in the beta of industrials as anticipated but in general the scale of change seems to fit the underlying notion that the composition effect will be greatest where the crisis has been most severe and where pre-crisis banking index betas were highest.

********************** insert Table 7 here *********************

Table 7 shows the results of regressions across the eleven countries for utilities (Panel A) and utilities minus industrials (Panel B), using D_{07} to capture the change in beta during the crisis period. Looking at utilities first, the change in the beta within the crisis period from the pre-crisis level, $R_M x D_{07}$, is mixed across the countries. There are four countries where this fell, two of which had coefficients that are not significant. Furthermore, the fact that utilities have proved popular during the crisis and yet many display increases in betas during the crisis period lends weight to the presence of a composition effect. A far clearer picture emerges when one looks at the change in beta for utilities minus industrials. Here the coefficient on $R_M x D_{07}$ is significant at 1% in every country. This is strong evidence that utilities were comparatively favoured. Figure 3 gives a histogram of the coefficients on $R_M x D_{07}$ in Panel B of Table 7 with the countries allocated into groups: major systemic banking crisis, which is placed first, marginal systemic banking crisis, placed next, or no systemic banking crisis, placed last (countries are placed alphabetically within group). The five countries with a major systemic banking crisis appear fairly consistent with every country having a negative coefficient. In contrast, the marginal systemic banking crisis and no systemic banking crisis appear far more randomly allocated, with both groups having positive and negative coefficients.

6. Conclusions

The aim of the paper is to investigate what we call composition effects, in particular, the impact of composition effects arising from the financial crisis. A composition effect is a change in the market risk of a sector that is caused not by a direct change in that sector but by a change in another sector that affects the composition of the stock market. For example, assume that the proportion of a comparatively risky sector falls (rises). Other things being equal, since the market weighted sum of betas of the market portfolio has to be one, other sectors must have higher (lower) market risk measures if the overall constraint is to be achieved.

In the paper we investigate, in the US in detail and across G12 countries, the pre and during crisis market risk of industrials and utilities. We find that the market risk of industrials is higher during the crisis than pre-crisis in the US and for most of the G12 countries. Furthermore, to the extent that this increase is caused by composition effects arising from the financial crisis, one would expect the increase in market risk for industrials larger the more severe the systemic banking crisis in a country. Across the G12 countries we find such a positive relationship between the increase in the market risk of industrials relative to pre-crisis levels and the pre-crisis market risk of the banking sector. The six G12 countries that experienced a severe systematic banking crisis are amongst the seven countries with the largest increases in the market risk for industrials (the exception is Sweden). We also find that, with the exception of Sweden, all countries with pre-crisis market risk of the banking sector above one experienced increases in market risk of industrials during the crisis and all countries with pre-crisis market risk of the banking sector below one experienced declines in market risk of industrials. Note that, although the market risk of banks changed during the crisis, there is no such systematic relationship between the scale of the systemic crisis and the change in risk of the banking sector.

Turning to utilities, if, as we argue, utilities were seen as particularly low risk during the crisis then in the absence of any composition effect we would expect the market risk to fall. However, we find that the risk of the utility sector falls in some countries and rises in others with increases in risk outnumbering the declines, which we interpret as additional support for a composition effect.

Finally, we conjecture on whether such composition effects may add to our understanding of the linkages between the financial and real sector (see, e.g., Allen et al., 2009; Cerra and Saxena, 2008; Laeven and Valencia, 2010; Reinhart and Rogoff, 2008; Reinhart and Rogoff, 2009, and see also Antony and Broer, 2010, for a survey). In the paper we suggest that the collapse of the banking sector contributed to an increase in the market risk of industrials purely because of the composition effect, which would be in addition to any direct real impacts on the sector. If the ensuing rise in market risk is fed directly into estimates of the required cost of capital, then this may lead to an 'overestimate' of the true cost of capital in the sector. For example, the average increase in beta for the five G12 countries in our study that had a major systemic banking crisis is 0.225. If this is due to composition effects then, with a 5% equity risk premium, the cost of capital for industrials would be perceived as having increased by 1.125% from this effect alone. Such an impact could have a chilling effect on industrials in addition to the effect of other linkages arising through more sophisticated economic channels.

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Figure 1. Ratios of the average of market capitalisation of the banking sector as a fraction of the market capitalisation of the corresponding stock market during the financial crisis to the equivalent average over the same length period before the crisis. The start of the financial crisis is defined as August 2007 (darker bars) or September 2008 (lighter bars). The G20 countries are grouped into those without systemic banking crisis (green bars), marginal banking crisis (blue bars) and with the systemic banking crisis (red bars).

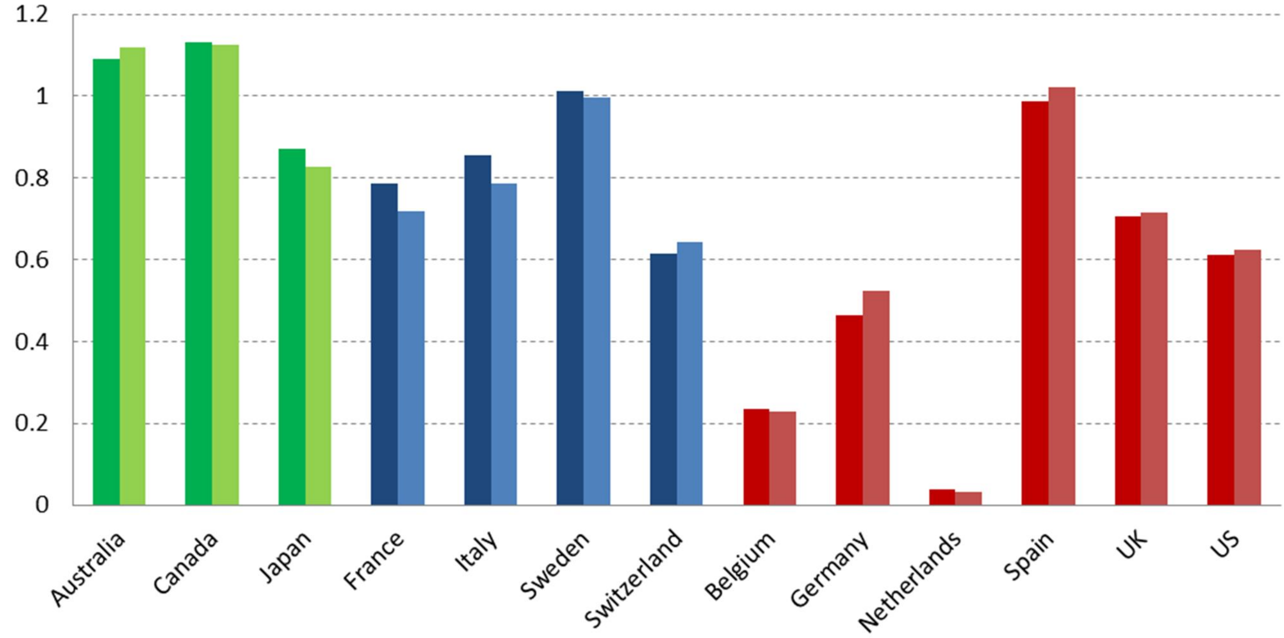

Figure 2. The pre-crisis market risk of the banking sector versus the change in the market risk of the industrials sector for 13 G12 countries. The triangles denote countries classified by Laeven and Valencia (2013) as those which major systemic banking crisis, the diamonds denote 'marginal' cases of the systemic banking crisis and the circles denote countries that did not experienced the systemic banking crisis in the period 2008-2013.

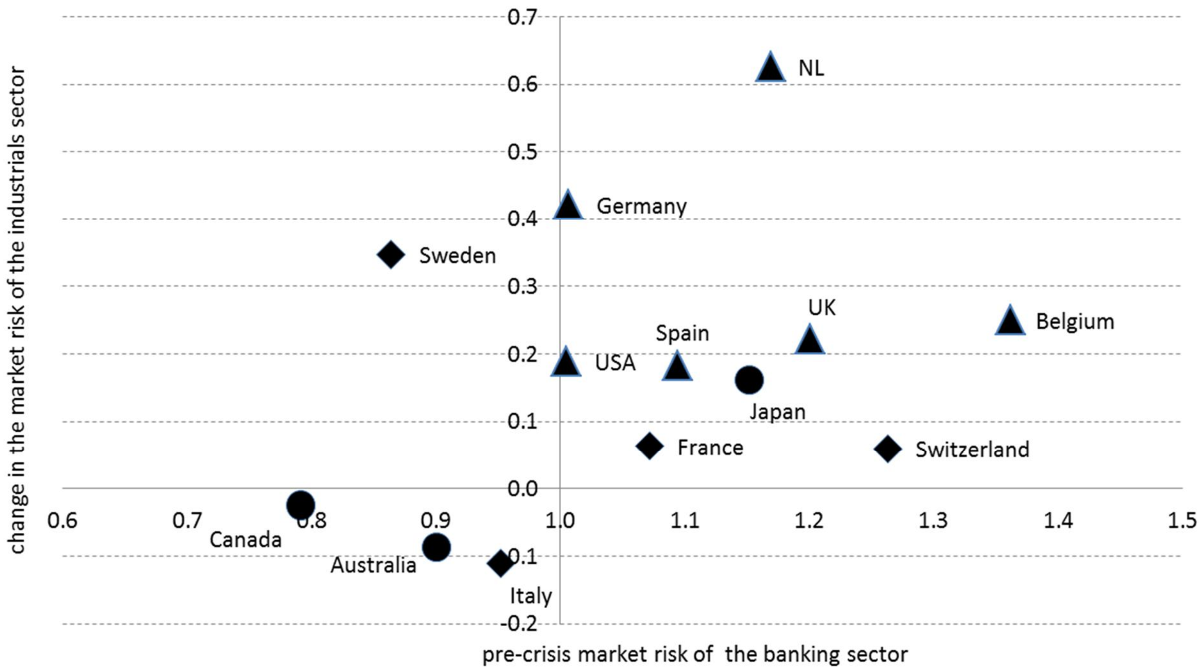

Figure 3. Change in the difference of the market risk of the utilities and the industrials for 11 G12 countries. The blue bars denote countries classified by Laeven and Valencia (2013) as those which major systemic banking crisis, the red bars denote ‘marginal’ cases of the systemic banking crisis and the green bars denote countries that did not experienced the systemic banking crisis in the period 2008-2013.

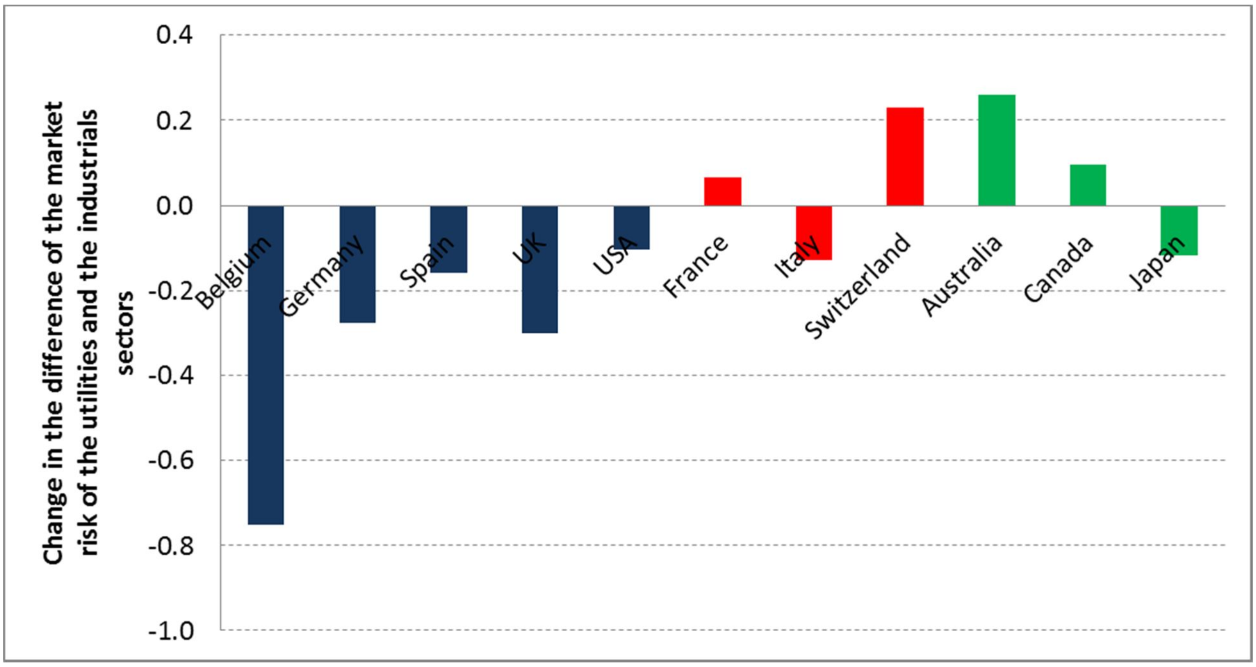

Table 1. Summary statistics of daily stock market -returns for indices based on Kevin French data (panel A) and for daily log-returns (x100) of S&P1500 indices provided by DataStream (Panel B). Panel A is based on 4677 observations (1 January 1996 – 31 July 2014) and Panel B is based on 2641 observations (3 February 2004 – 31 July 2014).

	Mean	Median	Min	Max	St. dev	Skewness	Kurtosis
Panel A							
R_{U49}	0.041	0.080	-8.920	14.430	1.136	0.235	16.821
R_{I49}	0.049	0.090	-9.480	10.020	1.301	-0.222	8.463
R_{C49}	0.051	0.090	-7.820	9.960	1.173	-0.144	9.047
R_{B49}	0.044	0.050	-16.98	16.960	1.946	0.426	16.805
$R_M – R_{free}$	0.030	0.080	-8.950	11.350	1.253	-0.105	9.999
SMB	0.006	0.020	-4.620	4.290	0.606	-0.274	6.963
HML	0.014	0.010	-4.860	3.950	0.634	0.083	8.712
R_{free}	0.010	0.010	0.000	0.030	0.009	0.047	1.500
Panel B							
R_{SPU}	0.032	0.080	-8.500	12.469	1.137	0.047	1.500
$R_{SPUelectricity}$	0.038	0.079	-8.623	12.865	1.140	0.384	16.582
R_{SPUgas}	0.048	0.079	-10.942	14.973	1.365	-0.062	18.750
$R_{SPUwater}$	0.038	0.001	-8.876	11.664	1.474	0.222	10.222
$R_{SPUmulti}$	0.043	0.098	-7.761	11.046	1.111	0.283	15.010
R_{SPI}	0.035	0.067	-9.458	9.190	1.361	-0.356	8.368
R_{SPB}	0.013	0.009	-24.101	25.385	2.702	0.500	19.917
R_{SPM}	0.032	0.072	-9.459	10.958	1.249	-0.233	10.679

Table 2. Summary statistics of daily stock market log-returns (x100) for the DS calculated stock market indices (R_M), banking indices(R_B), industrials indices (R_I) and utilities indices (R_U) for G12 countries (except for the Netherlands and Sweden for which R_U are not available) over 1 January 1996 - 31 July 2014 (4848 observations).

	Mean	Median	Min	Max	St. dev	Skewness	Kurtosis
Australia							
R_M	0.036	0.032	-8.658	5.778	0.970	-0.486	6.541
R_B	0.054	0.034	-8.494	9.686	1.240	0.035	5.591
R_I	0.035	0.019	-10.298	5.053	1.108	-0.553	5.283
R_U	0.050	0.019	-10.436	8.140	1.230	-0.180	4.538
Belgium							
R_M	0.034	0.051	-8.125	8.240	1.127	-0.158	5.874
R_B	0.005	0.030	-25.407	18.604	2.335	-0.331	11.120
R_I	0.040	0.020	-10.719	11.427	1.649	-0.052	5.032
R_U	0.046	0.015	-9.928	16.656	1.096	0.813	16.332
Canada							
R_M	0.038	0.068	-9.563	8.979	1.060	-0.687	9.530
R_B	0.056	0.024	-14.050	12.168	1.345	0.135	9.762
R_I	0.052	0.006	-12.055	12.403	1.708	0.088	5.578
R_U	0.054	0.032	-6.782	7.975	0.871	-0.196	7.398
France							
R_M	0.035	0.049	-8.411	9.938	1.294	-0.089	4.666
R_B	0.032	0.026	-13.418	18.326	2.157	0.208	6.892
R_I	0.031	0.007	-21.767	25.072	1.825	0.350	20.946
R_U	0.023	0.013	-12.325	21.352	1.853	0.293	8.386
Germany							
R_M	0.029	0.067	-7.787	16.062	1.265	0.084	9.149
R_B	0.000	0.014	-16.458	15.869	1.904	-0.073	9.552
R_I	0.041	0.024	-11.733	14.697	1.686	-0.113	5.731
R_U	0.022	0.023	-10.738	14.748	1.511	0.028	7.605
Italy							
R_M	0.025	0.034	-8.611	10.509	1.370	-0.136	4.432
R_B	0.018	0.022	-11.940	15.802	1.886	-0.114	5.334
R_I	0.013	0.005	-10.038	11.975	1.666	0.106	2.857
R_U	0.038	0.019	-10.258	12.211	1.422	0.234	7.595
Japan							
R_M	0.003	0.005	-9.838	12.304	1.313	-0.333	6.030
R_B	-0.022	0.002	-12.822	14.119	1.859	0.201	4.592
R_I	0.010	0.004	-19.469	13.071	1.815	-0.349	5.613
R_U	0.014	0.007	-12.344	9.079	1.312	-0.098	5.229
Netherlands							
R_M	0.025	0.057	-9.199	9.323	1.301	-0.286	5.597
R_B	-0.017	0.008	-127.00	15.176	2.324	-6.919	210.265
R_I	0.040	0.023	-13.143	13.355	1.742	-0.175	6.055
Spain							
R_M	0.038	0.075	-8.469	11.772	1.330	-0.059	4.717
R_B	0.038	0.033	-14.251	19.080	1.853	0.283	8.517
R_I	0.041	0.020	-10.913	10.126	1.607	-0.025	3.044
R_U	0.047	0.080	-8.032	8.054	1.293	-0.464	4.063
Sweden							
R_M	0.043	0.041	-8.488	10.872	1.500	0.012	3.929
R_B	0.050	0.015	-10.746	14.673	1.858	0.354	6.007
R_I	0.048	0.029	-8.793	10.904	1.613	0.079	3.922
Switzerland							
R_M	0.028	0.034	-7.248	9.826	1.090	-0.218	5.850
R_B	0.013	0.009	-11.432	17.782	1.870	0.142	7.565
R_I	0.042	0.025	-17.015	17.350	1.431	-0.162	13.179
R_U	0.019	0.008	-7.252	10.470	1.025	0.044	7.678
UK							
R_M	0.028	0.041	-8.692	8.885	1.127	-0.216	6.133
R_B	0.017	0.015	-19.428	18.829	1.858	-0.069	11.522

R_I	0.022	0.026	-10.347	9.664	1.459	-0.192	4.026
R_U	0.045	0.039	-9.223	11.858	1.104	-0.028	7.850
US							
R_M	0.032	0.049	-9.396	10.913	1.232	-0.258	7.749
R_B	0.021	0.011	-21.641	19.351	2.120	0.115	17.106
R_I	0.016	0.016	-9.673	12.079	1.547	-0.293	6.453
R_U	0.030	0.046	-9.267	14.188	1.284	-0.282	10.356

Table 3. Regression results for Equation (1) specification using KF-data for the 1 January 1996 – 31 July 2014 period (4677 daily observations). D_{07} is equal to 1 from 9 August 2007 till 31 July 2014 and zero otherwise. Standard errors are in parentheses. ***: 1% significance; **: 5% significance and *: 10% significance.

	$R_{I4\ 9}$- R_{free}	R_{C49} - R_{free}	R_{B49} - R_{free}	R_{U49}- R_{free}	R_{U49} - R_{I49}	R_{U49}- R_{C49}
Constant	-0.001	-0.001	0.000***	-0.014	-0.014	-0.015
	(0.006)	(0.005)	(0.009)	(0.010)	(0.012)	(0.011)
D_{07}	0.012	0.015**	-0.019***	0.032**	0.015	0.014
	(0.009)	(0.007)	(0.015)	(0.016)	(0.019)	(0.017)
R_M-R_{free}	1.012***	0.933***	1.063***	0.777***	-0.228***	-0.154***
	(0.007)	(0.005)	(0.011)	(0.012)	(0.014)	(0.013)
$(R_M$-$R_{free})$xD_{07}	0.066***	0.066***	0.124***	-0.100***	-0.167***	-0.179***
	(0.009)	(0.007)	(0.017)	(0.017)	(0.020)	(0.019)
SMB	0.212***	0.186***	-0.289***	0.045***	-0.223***	-0.188***
	(0.011)	(0.009)	(0.016)	(0.017)	(0.020)	(0.019)
SMBxD_{07}	0.088***	0.044***	0.355***	-0.149***	-0.278***	-0.237***
	(0.017)	(0.013)	(0.030)	(0.030)	(0.037)	(0.033)
HML	0.314***	0.284***	0.276***	0.906***	0.566***	0.564***
	(0.012)	(0.010)	(0.022)	(0.023)	(0.024)	(0.024)
HMLxD_{07}	-0.274***	-0.310***	0.784***	-0.782***	-0.497***	-0.394***
	(0.019)	(0.015)	(0.039)	(0.034)	(0.036)	(0.036)
R^2 adj.	0.904	0.920	0.800	0.585	0.321	0.253

Table 4. Regression results for Equation (2) specification using S&P1500 data collected from DataStream for the 3 February 2004 – 31 July 2014 period (2641 daily observations). D_{07} is equal to 1 from 9 August 2007 till 31 July 2014 and zero otherwise. Standard errors are in parentheses. ***: 1% significance; **: 5% significance and *: 10% significance.

	R_{SPI}	R_{SPB}	R_{SPU}	$R_{SPUelectricity}$	R_{SPUgas}	$R_{SPUwater}$	$R_{SPUmulti}$
Constant	0.000	0.000	0.000	0.001***	0.000	0.000	0.000**
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
D_{07}	0.000	0.000	0.000	0.000*	0.000	0.000	0.000
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
R_M - R_{free}	1.038***	0.864***	0.779***	0.749***	0.848***	1.043***	0.788***
	(0.016)	(0.024)	(0.028)	(0.030)	(0.025)	(0.045)	(0.028)
$(R_M - R_{free})xD_{07}$	0.090***	0.428***	-0.144***	-0.180***	0.012	-0.355***	-0.168***
	(0.017)	(0.030)	(0.030)	(0.033)	(0.028)	(0.048)	(0.030)
R^2 adj.	0.899	0.527	0.617	0.542	0.692	0.392	0.594

Table 5. Regression results for Equation (2) specification using S&P1500 data collected from DataStream for the 3 February 2004 – 31 July 2014 period (2641 daily observations). D_{07} is equal to 1 from 9 August 2007 till 31 July 2014 and zero otherwise. Standard errors are in parentheses. ***: 1% significance; **: 5% significance and *: 10% significance.

	$R_{SPU} - R_{SPi}$	$R_{SPUelectricity} - R_{SPI}$	$R_{SPUgas} - R_{SPI}$	$R_{SPUwater} - R_{SPI}$	$R_{SPUmulti} - R_{SPI}$
Constant	0.000	0.000*	0.000	0.000	0.000
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
D_{07}	0.000	0.000	0.000	0.000	0.000
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
R_M	-0.264***	-0.298***	-0.200***	-0.008	-0.240***
	(0.033)	(0.036)	(0.030)	(0.048)	(0.034)
$R_M x D_{07}$	-0.229***	-0.260***	-0.073**	-0.425***	-0.262***
	(0.036)	(0.039)	(0.034)	(0.052)	(0.036)
R^2 adj.	0.186	0.191	0.022	0.113	0.217

Table 6. Regression results for Equation (2) specification using DS-data for the G12 countries for the 1 January 1996 – 31 July 2014 period (4848 daily observations). D_{07} is equal to 1 from 9 August 2007 till 31 July 2014 and zero otherwise. Standard errors are in parentheses. ***: 1% significance; **: 5% significance and *: 10% significance.

	Panel A: R_I					Panel B: R_B				
	Const.	D_{07}	R_M	R_M xD_{07}	R^2 adj.	Const.	D_{07}	R_M	R_M xD_{07}	R^2 adj
Australia	0.000	0.000	0.795***	-0.086***	0.384	0.000	0.000	0.901***	0.166***	0.652
	(0.000)	(0.000)	(0.013)	(0.021)		(0.000)	(0.000)	(0.009)	(0.015)	
Belgium	0.000**	0.000	0.622***	0.251***	0.290	0.000***	0.000	1.362***	0.230***	0.627
	(0.000)	(0.000)	(0.017)	(0.024)		(0.000)	(0.000)	(0.009)	(0.019)	
Canada	0.000	0.000	0.687***	-0.025	0.533	0.000*	0.000	0.791***	0.022	0.485
	(0.000)	(0.000)	(0.024)	(0.033)		(0.000)	(0.000)	(0.013)	(0.020)	
France	0.000**	0.000	0.969***	0.064***	0.810	0.000	-0.001*	1.072***	0.582***	0.648
	(0.000)	(0.000)	(0.009)	(0.012)		(0.000)	(0.000)	(0.012)	(0.015)	
Germany	0.000**	-0.001**	0.723***	0.421***	0.459	0.000	-0.001***	1.007***	0.272***	0.579
	(0.000)	(0.000)	(0.014)	(0.021)		(0.000)	(0.000)	(0.011)	(0.021)	
Italy	0.000	0.000	0.871***	-0.111***	0.434	0.000	0.000**	0.952***	0.468***	0.796
	(0.000)	(0.000)	(0.015)	(0.022)		(0.000)	(0.000)	(0.008)	(0.014)	
Japan	0.000**	-0.001**	1.020***	0.162***	0.606	0.000*	0.000	1.152***	-0.014	0.674
	(0.000)	(0.000)	(0.014)	(0.019)		(0.000)	(0.000)	(0.012)	(0.016)	
Netherlands	0.001***	0.000	0.455***	0.626***	0.344	0.000	-0.001***	1.169***	-0.687***	0.340
	(0.000)	(0.000)	(0.015)	(0.025)		(0.000)	(0.000)	(0.012)	(0.022)	
Spain	0.000***	0.000*	0.673***	0.183***	0.626	0.000	0.000	1.094***	0.295***	0.865
	(0.000)	(0.000)	(0.010)	(0.013)		(0.000)	(0.000)	(0.007)	(0.010)	
Sweden	0.000**	0.000*	0.845***	0.347***	0.751	0.000	0.000	0.864***	0.308***	0.639
	(0.000)	(0.000)	(0.009)	(0.013)		(0.000)	(0.000)	(0.011)	(0.017)	
Switzerland	0.001***	0.000	0.577***	0.059**	0.235	0.000***	-0.001	1.263***	0.151***	0.696
	(0.000)	(0.000)	(0.014)	(0.027)		(0.000)	(0.000)	(0.012)	(0.023)	
UK	0.000	0.000	0.794***	0.221***	0.450	0.000	0.000	1.201***	0.144***	0.676
	(0.000)	(0.000)	(0.017)	(0.023)		(0.000)**	(0.000)	(0.012)	(0.019)	
US	0.000	0.000	0.924***	0.189***	0.674	0.000**	0.000	1.005***	0.368***	0.635
	(0.000)	(0.000)	(0.012)	(0.015)		(0.000)	(0.000)	(0.010)	(0.020)	

Table 7. Regression results for Equation (2) specification using DS-data for 11 of the G12 countries for the 1 January 1996 – 31 July 2014 period (4848 daily observations). D_{07} is equal to 1 from 9 August 2007 till 31 July 2014 and zero otherwise.***: 1% significance; **: 5% significance and *: 10% significance.

	Panel A: R_U					Panel B: R_U - R_I				
	Const.	D_{07}	R_M	R_M xD_{07}	R^2 adj.	Const.	D_{07}	R_M	R_M xD_{07}	R^2 adj.
Australia	0.000**	0.000*	0.501***	0.247***	0.238	0.001**	-0.001**	-0.227***	0.260***	0.008
	(0.000)	(0.000)	(0.021)	(0.026)		(0.000)	(0.000)	(0.026)	(0.034)	
Belgium	0.000	0.000*	0.622***	-0.459***	0.229	0.000	0.000	0.016	-0.752***	0.116
	(0.000)	(0.000)	(0.013)	(0.015)		(0.000)	(0.000)	(0.024)	(0.032)	
Canada	0.000***	0.000	0.414***	0.049***	0.256	0.000	0.000	-0.259***	0.094***	0.043
	(0.000)	(0.000)	(0.011)	(0.016)		(0.000)	(0.000)	(0.027)	(0.037)	
France	0.000	0.000	0.909***	0.102***	0.485	0.000	0.000	0.723***	-0.116***	0.158
	(0.000)	(0.000)	(0.014)	(0.022)		(0.000)	(0.001	(0.024)	(0.034)	
Germany	0.000**	-0.001**	0.724***	0.104***	0.384	0.000	-0.001	-0.083***	-0.276***	0.029
	(0.000)	(0.000)	(0.014)	(0.019)		(0.000)	(0.000)	(0.004)	(0.018)	
Italy	0.000	0.000	0.627***	-0.148***	0.375	0.000	0.000	-0.126***	-0.129***	0.022
	(0.000)	(0.000)	(0.012)	(0.015)		(0.000)	(0.000)	(0.020)	(0.029)	
Japan	0.000	0.000	0.399***	0.129***	0.195	0.000	0.001	-0.597***	-0.116***	0.216
	(0.000)	(0.000)	(0.014)	(0.016)		(0.000)	(0.000)	(0.021)	(0.027)	
Spain	0.000	0.000	0.795***	-0.024	0.431	0.000	0.000	0.355***	0.085***	0.066
	(0.000)	(0.000)	(0.014)	(0.018)		(0.000)	(0.000)	(0.024)	(0.031)	
Switzerland	0.001***	-0.001***	0.123***	0.235***	0.110	0.000	-0.001***	-0.445***	0.229***	0.078
	(0.000)	(0.000)	(0.013)	(0.021)		(0.000)	(0.000)	(0.021)	(0.035)	
UK	0.000**	0.000	0.541***	-0.028	0.325	0.000**	0.000	-0.201***	-0.301***	0.058
	(0.000)	(0.000)	(0.013)	(0.020)		(0.000)	(0.000)	(0.021)	(0.031)	
US	0.000**	0.000	0.601***	0.114***	0.433	0.000**	0.000	-0.305***	-0.105***	0.091
	(0.000)	(0.000)	(0.013)	(0.016)		(0.000)	(0.000)	(0.018)	(0.022)	

Appendix

Table A1. Variance equations for Table 3. The variance equation of the error term is specified as GARCH(p,q): $\sigma_t^2 = \varpi + \sum_{i=1}^{p} \xi_i \varepsilon_{t-1}^2 + \sum_{i=1}^{q} \zeta_{2i} \sigma_{t-1}^2$. Standard errors are in parentheses. ***: 1% significance; **: 5% significance and *: 10% significance.

	R_{I49}- R_{free}	R_{C49}- R_{free}	R_{B49}- R_{free}	R_{U49}- R_{free}	R_{U49} –R_{I49}	R_{U49} – R_{C49}
ω	0.002***	0.001***	0.002***	0.007***	0.005***	0.005***
	(0.001)	(0.000)	(0.000)	(0.001)	(0.001)	(0.001)
ξ_1	0.116***	0.089***	0.141***	0.192**	0.160***	0.155***
	(0.017)	(0.016)	(0.017)	(0.017)	(0.015)	(0.015)
ξ_2	0.062***	-0.055***	-0.085***	0.048**	-0.099***	-0.077***
	(0.009)	(0.020)	(0.017)	(0.019)	(0.015)	(0.016)
ξ_3	-0.072***	0.037**		-0.105***		
	(0.017)	(0.015)		(0.022)		
ζ_1	0.173***	0.921***	0.941***	-0.002	0.934***	0.916***
	(0.125)	(0.008)	(0.004)	(0.073)	(0.005)	(0.007)
ζ_2	0.707***			0.855***		
	(0.115)			(0.069)		

Table A2. Variance equation coefficients for Table 4. The variance equation of the error term is specified as GARCH(p,q): $\sigma_t^2 = \varpi + \sum_{i=1}^{p} \xi_i \varepsilon_{t-1}^2 + \sum_{i=1}^{q} \zeta_{2i} \sigma_{t-1}^2$. Standard errors are in parentheses. ***: 1% significance; **: 5% significance and *: 10% significance.

	R_{SPI}	R_{SPB}	R_{SPU}	$R_{SPUelectricity}$	R_{SPUgas}	$R_{SPUwater}$	$R_{SPUmulti}$
ω	0.000***	0.000***	0.000***	0.000**	0.000***	0.000***	0.000***
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
ξ_1	0.100***	0.192***	0.135***	0.125***	0.120***	0.174***	0.129***
	(0.022)	(0.023)	(0.022)	(0.020)	(0.015)	(0.020)	(0.024)
ξ_2	-0.044**	-0.129***	-0.088***	-0.069***	-0.070***	-0.122***	-0.073***
	(0.023)	(0.024)	(0.031)	(0.027)	(0.015)	(0.021	(0.025)
ξ_3			0.012				
			(0.020)				
ζ_1	0.931***	0.935***	0.928***	0.977***	0.938***	0.930***	0.926***
	(0.007)	(0.004)	(0.011)	(0.300)	(0.008)	(0.008)	(0.012)
ζ_2				-0.046			
				(0.275)			

Table A3. Variance equation coefficients for Table 5. The variance equation of the error term is specified as GARCH(p,q): $\sigma_t^2 = \varpi + \sum_{i=1}^{p} \xi_i \varepsilon_{t-1}^2 + \sum_{i=1}^{q} \zeta_{2i} \sigma_{t-1}^2$. Standard errors are in parentheses. ***: 1% significance; **: 5% significance and *: 10% significance.

	$R_{SPU} - R_{SPi}$	$R_{SPUelectricity} - R_{SPI}$	$R_{SPUgas} - R_{SPI}$	$R_{SPUwater} - R_{SPI}$	$R_{SPUmulti} - R_{SPI}$
ω	0.000***	0.000***	0.000***	0.000***	0.000***
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
ξ_1	0.133***	0.141***	0.114***	0.178***	0.111***
	(0.019)	(0.019)	(0.021)	(0.020)	(0.020)
ξ_2	-0.076***	-0.083***	-0.065***	-0.129***	-0.049**
	(0.020)	(0.021)	(0.023)	(0.021)	(0.021)
ζ_1	0.925***	0.925***	0.941***	0.939***	0.915***
	(0.009)	(0.010)	(0.008)	(0.007)	(0.011)

Table A4. Variance equation coefficients for Table 6. The variance equation of the error term is specified as GARCH(p,q): $\sigma_t^2 = \varpi + \sum_{i=1}^{p} \xi_i \varepsilon_{t-1}^2 + \sum_{i=1}^{q} \zeta_{2i} \sigma_{t-1}^2$. Standard errors are in parentheses.

	Panel A				Panel B					
	ω	ξ_1	ξ_2	ζ_1	ω	ξ_1	ξ_2	ξ_3	ζ_1	ζ_2
Australia	0.000***	0.110***	-0.084***	0.971***	0.000***	0.148***	-0.084***	-0.032***	0.965***	
	(0.000)	(0.012)	(0.012)	(0.002)	(0.000)	(0.014)	(0.020)	(0.012)	(0.002)	
Belgium	0.000***	0.113***	-0.091***	0.976***	0.000***	0.168***	-0.195***	0.035	1.688***	-0.695***
	(0.000)	(0.016)	(0.016)	(0.002)	(0.000)	(0.018)	(0.037)	(0.022)	(0.057)	(0.054
Canada	0.000***	0.091***	-0.064***	0.971***	0.000***	0.159***	-0.089***	-0.025**	0.953***	
	(0.000)	(0.014)	(0.014)	(0.003)	(0.000)	(0.013)	(0.017)	(0.012)	(0.003)	
France	0.000***	0.057***	0.937***		0.000***	0.174***	-0.133***		0.959***	
	(0.000)	(0.004)	(0.004)		(0.000)	(0.015)	(0.015)		(0.002)	
Germany	0.000***	0.121***	-0.080***	0.955***	0.000***	0.187***	-0.133***		0.947***	
	(0.000)	(0.011)	(0.011)	(0.003)	(0.000)	(0.015)	(0.014)		(0.003)	
Italy	0.000***	0.106***	-0.069***	0.945***	0.000***	0.159***	-0.097***		0.934***	
	(0.000)	(0.014)	(0.014)	(0.005)	(0.000)	(0.015)	(0.016)		(0.005)	
Japan	0.000***	0.124***	-0.077***	0.948***	0.000***	0.200***	-0.140***		0.941***	
	(0.000)	(0.012)	(0.013)	(0.005)	(0.000)	(0.014)	(0.014)		(0.004)	
Netherlands	0.000***	0.128***	-0.103***	0.968***	0.000***	0.209***	-0.128***		0.926***	
	(0.000)	(0.013)	(0.013)	(0.003)	0.000	0.016	0.016		(0.003)	
Spain	0.000***	0.082***		0.893***	0.000***	0.156***	-0.059***		0.900***	
	(0.000)	(0.006)		(0.007)	(0.000)	(0.014)	(0.013)		(0.006)	
Sweden	0.000***	0.118***	-0.094***	0.973***	0.000***	0.114***	-0.078***		0.962***	
	(0.000)	(0.014)	(0.014)	(0.002)	(0.000)	(0.012)	(0.012)		(0.003)	
Switzerland	0.000***	0.114***	-0.100***	0.984***	0.000***	0.208***	-0.165***		0.951***	
	(0.000)	(0.010)	(0.010)	(0.001)	(0.000)	(0.016)	(0.015)		(0.004)	
UK	0.000***	0.086***	-0.055***	0.966***	0.000***	0.156***	-0.032	-0.088***	0.962***	
	(0.000)	(0.012)	(0.013)	(0.003)	(0.000)	(0.015)	(0.022)	(0.014)	(0.003)	
US	0.000***	0.115***	-0.089***	0.972***	0.000***	0.162***	-0.111***		0.948***	
	(0.000)	(0.012)	(0.012)	(0.002)	(0.000))	(0.015)	(0.016)		(0.003)	

Table A5. Variance equation coefficients for Table 7. The variance equation of the error term is specified as GARCH(p,q): $\sigma_t^2 = \varpi + \sum_{i=1}^{p} \xi_i \varepsilon_{t-1}^2 + \sum_{i=1}^{q} \zeta_{2i} \sigma_{t-1}^2$. Standard errors are in parentheses. ***: 1% significance; **: 5% significance and *: 10% significance.

	Panel A				Panel B			
	ω	ξ_1	ξ_2	ζ_1	ω	ξ_1	ξ_2	ζ_1
	0.000***	0.196***	-0.177***	0.979***	0.000***	0.086***	-0.066***	0.976***
Australia	(0.000)	(0.010)	(0.010)	(0.002)	(0.000)	(0.012)	(0.012)	(0.002)
	0.000***	0.207***	-0.094***	0.863***	0.000***	0.130***	-0.108***	0.975***
Belgium	(0.000)	(0.008)	(0.009)	(0.008)	(0.000)	(0.009)	(0.010)	(0.002)
	0.000***	0.079***	-0.022***	0.930***	0.000***	0.127***	-0.096***	0.966***
Canada	(0.000)	(0.013)	(0.014)	(0.006)	(0.000)	(0.015)	(0.016)	(0.003)
	0.000***	0.220***	-0.177***	0.951***	0.000***	0.183***	-0.139***	0.946***
France	(0.000)	(0.013)	(0.013)	(0.003)	(0.000)	(0.010)	(0.010)	(0.004)
	0.000***	0.140***	-0.085***	0.934***	0.000**	0.138***	-0.096***	0.961***
Germany	(0.000)	(0.014)	(0.014)	(0.005)	(0.000)	(0.012)	(0.012)	(0.002)
	0.000***	0.109***	-0.066***	0.954***	0.000***	0.112***	-0.083***	0.966***
Italy	(0.000)	(0.012)	(0.012)	(0.003)	(0.000)	(0.015)	(0.015)	(0.003)
	0.000***	0.143***	-0.102***	0.956***	0.000***	0.086***	-0.043***	0.950***
Japan	(0.000)	(0.014)	(0.014)	(0.003)	(0.000)	(0.014)	(0.015)	(0.005)
	0.000***	0.103***	-0.065***	0.961***	0.000***	0.119***	-0.079***	0.953***
Spain	(0.000)	(0.014)	(0.014)	(0.002)	(0.000)	(0.015)	(0.015)	(0.004)
	0.000***	0.168***	-0.126***	0.951***	0.000***	0.070***	-0.016***	0.934***
Switzerland	(0.000)	(0.014)	(0.014)	(0.003)	(0.000)	(0.009)	(0.009)	(0.005)
	0.000***	0.129***	-0.072***	0.921***	0.000***	0.106***	-0.064***	0.950***
UK	(0.000)	(0.014)	(0.014)	(0.007)	(0.000)	(0.013)	(0.013)	(0.004)
	0.000***	0.108***	-0.061***	0.951***	0.000***	0.136***	-0.101***	0.962***
US	(0.000)	(0.014)	(0.014)	(0.003)	(0.000)	(0.013)	(0.014)	(0.003)

Table A6. Regression results for Equation (2) specification using DS-data for the G12 countries for the 1 January 1996 – 31 July 2014 period (4848 daily observations). D_{08} is equal 1 from 15 September 2008 till 31 July 2014 and zero otherwise. Standard errors are in parentheses. ***: 1% significance; **: 5% significance and *: 10% significance.

	Panel A: R_I					Panel B: R_B				
	Const.	D_{08}	R_M	R_M xD_{08}	R^2 adj.	Const.	D_{08}	R_M	R_M xD_{08}	R^2 adj
Australia	0.000	0.000	0.760***	0.003	0.381	0.000	0.000	0.901***	0.178***	0.649
	(0.000)	(0.000)	(0.012)	(0.023)		(0.000)	(0.000)	(0.009)	(0.016)	
Belgium	0.000**	0.000	0.637***	0.336***	0.295	0.000***	-0.001	1.372***	0.464***	0.637
	(0.000)	(0.000)	(0.016)	(0.030)		(0.000)	(0.000)	(0.008)	(0.020)	
Canada	0.000	0.001**	0.686***	-0.026	0.235	0.000*	0.000	0.792***	0.022	0.485
	(0.000)	(0.000)	(0.023)	(0.033)		(0.000)	(0.000)	(0.013)	(0.020)	
France	0.000	0.000	0.984***	0.042***	0.809	0.000	0.000	1.092***	0.593***	0.644
	(0.000	(0.000)	(0.008)	(0.012)		(0.000)	(0.000)	(0.011)	(0.015)	
Germany	0.000**	-0.001*	0.761***	0.372***	0.451	0.000	-0.001***	1.021***	0.253***	0.577
	(0.000)	(0.000)	(0.013)	(0.021)		(0.000)	(0.000)	(0.010)	(0.024)	
Italy	0.000	0.000	0.876***	-0.133***	0.436	0.000	-0.001**	0.970***	0.506***	0.797
	(0.000)	(0.000)	(0.015)	(0.022)		(0.000)	(0.000)	(0.008)	(0.015)	
Japan	0.000	-0.001**	1.027***	0.176***	0.606	0.000*	0.000	1.176***	-0.060***	0.674
	(0.000)	(0.000)	(0.013)	(0.018)		(0.000)	(0.000)	(0.011)	(0.016)	
Netherlands	0.001***	0.000	0.501***	0.556***	0.324	0.000	-0.001***	1.173***	-0.832***	0.352
	(0.000)	(0.000)	(0.015)	(0.028)		(0.000)	(0.000)	(0.011)	(0.024)	
Spain	0.000**	0.000	0.726***	0.098***	0.617	0.000	0.000	1.105***	0.321***	0.867
	(0.000)	(0.000)	(0.009)	(0.013)		(0.000)	(0.000)	(0.007)	(0.010)	
Sweden	0.000*	0.000	0.886***	0.309***	0.740	0.000***	0.000***	0.887***	0.301***	0.636
	(0.000)	(0.000)	(0.008)	(0.014)		(0.000)	(0.000)	(0.010)	(0.017)	
Switzerland	0.001***	0.000	0.569***	0.107***	0.237	0.000	-0.001**	1.271***	0.139***	0.694
	(0.000)	(0.000)	(0.013)	(0.028)		(0.000)	(0.000)	(0.011)	(0.026)	
UK	0.000	0.000	0.848***	0.162***	0.44	0.000	0.000*	1.210***	0.158***	0.675
	(0.000)	(0.000)	(0.015)	(0.023)		(0.000)	(0.000)	(0.011)	(0.021)	
US	0.000*	0.000	0.945***	0.170***	0.674	0.000	0.000*	1.020***	0.336***	0.625
	(0.000)	(0.000)	(0.011)	(0.016)		(0.000)	(0.000)	(0.010)	(0.021)	

Table A7. Regression results for Equation (2) specification using DS-data for 11 of the G12 countries for the 1 January 1996 – 31 July 2014 period (4848 daily observations). D_{08} is equal 1 from 15 September 2008 till 31 July 2014 and zero otherwise. Standard errors are in parentheses. ***: 1% significance; **: 5% significance and *: 10% significance.

	Panel A: R_U					Panel B: $R_U - R_I$				
G12(11)	Const.	D_{08}	R_M	R_M xD_{08}	R^2 adj.	Const.	D_{08}	R_M	R_M xD_{08}	R^2 adj.
Australia	0.000***	-0.001**	0.515***	0.265***	0.241	0.001**	-0.001**	-0.190***	0.230***	0.007
	(0.000)	(0.000)	(0.016)	(0.024)		(0.000)	(0.000)	(0.021)	(0.034)	
Belgium	0.000	0.000	0.521***	-0.333***	0.215	0.000	0.000	-0.097***	-0.700***	0.111
	(0.000)	(0.000)	(0.012)	(0.015)		(0.000)	(0.001	(0.020)	(0.034)	
Canada	0.000***	0.000	0.429***	0.016	0.253	0.000	-0.001	-0.238***	0.065	0.041
	(0.000)	(0.000)	(0.011)	(0.016)		(0.000)	(0.000)	(0.026)	(0.037)	
France	0.000	-0.001**	0.899***	0.141***	0.485	0.000	0.000	-0.100***	0.119***	-0.005
	(0.000)	(0.000)	(0.013)	(0.022)		(0.000)	(0.000)	(0.013)	(0.026)	
Germany	0.000***	-0.001***	0.715***	0.153***	0.386	0.000	-0.001*	-0.084***	-0.239***	0.023
	(0.000)	(0.000)	(0.013)	(0.019)		(0.000)	(0.000)	(0.004)	(0.019)	
Italy	0.000*	0.000	0.623***	-0.152***	0.375	0.000	0.000	-0.141***	-0.109***	0.021
	(0.000)	(0.000)	(0.012)	(0.014)		(0.000)	(0.000)	(0.019)	(0.029)	
Japan	0.000	0.000	0.400***	0.139***	0.196	0.000	0.000	-0.597***	-0.146***	0.216
	(0.000)	(0.000)	(0.013)	(0.016)		(0.000)	(0.000)	(0.019)	(0.027)	
Spain	0.000	0.000	0.793***	-0.024	0.430	0.000	0.000	0.028	-0.062***	0.000
	(0.000)	(0.000)	(0.013)	(0.017)		(0.000)	(0.000)	(0.018)	(0.025)	
Switzerland	0.001***	-0.001***	0.148***	0.191***	0.103	0.000	-0.001***	-0.413***	0.137***	0.072
	(0.000)	(0.000)	(0.012)	(0.023)		(0.000)	(0.000)	(0.020)	(0.037)	
UK	0.000***	0.000	0.546***	-0.049**	0.324	0.000**	0.000	-0.249***	-0.261***	0.053
	(0.000)	(0.000)	(0.013)	(0.020)		(0.000)	(0.000)	(0.019)	(0.032)	
US	0.000***	0.000	0.609***	0.114***	0.343	0.000***	0.000	-0.316***	-0.095***	0.091
	(0.000)	(0.000)	(0.012)	(0.016)		(0.000)	(0.000)	(0.017)	(0.022)	