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Guglielmo Maria Caporale
Fabio Spagnolo
Nicola Spagnolo

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Abstract

This paper analyses the effects of newspaper coverage of macro news on stock returns in eight countries belonging to the euro area (Belgium, France, Germany, Greece, Ireland, Italy, Portugal and Spain) using daily data for the period 1994-2013. The econometric analysis is based on the estimation of a VAR-GARCH-in-mean model. The results can be summarised as follows. Positive (negative) news have significant positive (negative) effects on stock returns in all cases. Their volatility has a significant impact on both stock returns and volatility; specifically, an increase in news volatility is always associated with a decrease in stock returns. Markets are particularly responsive to negative news, and the reaction is bigger in the PIIGS countries, and during the recent crisis period.

JEL-Code: C320, F360, G150.

Keywords: macro news, volatility spillovers, VAR-GARCH-in-mean model.

*Guglielmo Maria Caporale**
Department of Economics and Finance
Brunel University
United Kingdom – London, UB8 3PH
Guglielmo-Maria.Caporale@brunel.ac.uk

Fabio Spagnolo
Department of Economics and Finance
Brunel University
United Kingdom – London, UB8 3PH
fabio.spagnolo@brunel.ac.uk

Nicola Spagnolo
Department of Economics and Finance
Brunel University
United Kingdom – London, UB8 3PH
nicola.spagnolo@brunel.ac.uk

*corresponding author

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1 Introduction

The effects of macroeconomic news on stock prices have been analysed extensively in the more recent financial literature. The theoretical motivation comes from asset pricing models according to which factors driving macro series such as consumption and investment should also affect asset prices (e.g., Merton, 1973). In particular, according to the efficient market hypothesis, asset prices should fully reflect all available information and therefore react only to the arrival of new information in the form of "surprises" which can affect agents' expectations about future economic activity, and consequently cash flows and the discounting factor (which is a function of the risk-free interest rate and the risk premium). More specifically, two sources of news effects have been identified: scheduled macroeconomic announcements that do not correspond to agents' expectations (the announcement effect) and unscheduled announcements (the surprise effect). Most studies focus on the former, and follow the so-called "excess impact" approach (see Kocenda and Hanousek, 2011, and Hanousek, et al., 2009), calculating the difference between news releases and their expected value based on surveys, and then defining positive and negative news accordingly. This strand of the literature is now extensive, and has provided plenty of evidence that news about monetary variables such as money growth and interest rates can affect stock prices (see, e.g., Chen, 1991; Cornell, 1983; Pearce and Roley, 1983, 1985). By contrast, it is much less clear that real sector news (such as news on GDP, unemployment, retail sales and durable goods) have a significant impact on financial markets. For instance, a well-known study by Flannery and Protopapadakis (2002) concludes that there is no effect of various categories of macro news releases on stock prices. One possible explanation is that the impact of news varies over the business cycle; for instance, McQueen and Roley (1993) are able to find an effect of real sector news during periods of expansion, and also report asymmetric effects of good news depending on the state of the economy. Similarly, Boyd et al. (2005) find that positive news about unemployment increases stock prices during recessions but decreases them during expansions. Even more crucially, as pointed out by Birz and Lott (2013), the effects of news surprises could depend on their interpretation by agents: for instance, during a recession an increase in the growth rate could result in higher stock prices because of the improved economic prospects, but during an expansion the effect might be negative because of the expectation of higher interest rates. For this reason, Birz and Lott (2013) in their study for the US use newpaper headlines, which provide an interpretation of news releases, and find that news on GDP and unemployment affect stock returns.

Following Birz and Lott (2013), the present paper also focuses on the effects of newspaper coverage of macro news on stock prices. However, it has a number of distinctive features. First, unlike the study of Birz and Lott (2013), where only the effects of macro news on stock returns are considered, it adopts an econometric framework that sheds light on both mean and volatility spillovers between these two variables. Specifically, it estimates a VAR-GARCH-in-mean model with a BEKK representation as detailed below. Second, it provides evidence on linkages between macro news and financial markets in the euro area, for which no similar studies exist. The analysis reveals some interesting differences between the core and peripheral (PIIGS) countries in the way financial markets respond to macro news. Third, it examines whether the recent global financial crisis has had an impact on these linkages, in particular whether European financial markets have become more sensitive to macro news.

Fourth, it controls for monetary policy and financial globalisation.

The layout of the paper is as follows. Section 2 outlines the econometric modelling approach. Section 3 describes the data and presents the empirical findings. Section 4 summarises the main findings and offers some concluding remarks.

2 The model

We represent the first and second moments of stock market returns and news using a VAR-GARCH(1,1)-in-mean process.[1] In its most general specification the model takes the following form:

$$\mathbf{x}_t = \boldsymbol{\alpha} + \boldsymbol{\beta}\mathbf{x}_{t-1} + \boldsymbol{\theta}\mathbf{h}_{t-1} + \boldsymbol{\delta}\mathbf{f}_{t-1} + \mathbf{u}_t \tag{1}$$

where $\mathbf{x}_t = (Stock\,\mathrm{Re}\,t_t, PositiveNews_t, NegativeNews_t)$ and $\mathbf{x}_{t-1}$ is a corresponding vector of lagged variables. We control for monetary policy shocks by including in the mean equation the domestic 90-day Treasury Bill rate. Furthermore, exogenous shocks measured by US stock market returns, $\mathbf{f}_{t-1} = (TBill\ Interest_{t-1}, US\ ret_{t-1})$, are used as a proxy for market globalisation[2].The residual vector $\mathbf{u}_t = (e_{1,t}, e_{2,t}, e_{3,t})$ is trivariate and normally distributed $\mathbf{u}_t \mid I_{t-1} \sim (\mathbf{0}, H_t)$ with its corresponding conditional variance covariance matrix given by:

$$H_t = \begin{bmatrix} h_{11t} & h_{12t} & h_{13t} \\ h_{12t} & h_{22t} & h_{23t} \\ h_{13t} & h_{23t} & h_{33t} \end{bmatrix} \tag{2}$$

The parameters vector of the mean return equation (1) is defined by the constant $\boldsymbol{\alpha} = (\alpha_1, \alpha_2, \alpha_3)$, the autoregressive term, $\boldsymbol{\beta} = (\beta_{11}, \beta_{12} + \beta_{12}^*, \beta_{13} + \beta_{13}^* \mid \beta_{21}, \beta_{22}, 0 \mid \beta_{31}, 0, \beta_{33})$, which allows for mean return effects from positive (β_{12}) and negative (β_{13}) news, and the GARCH-in-mean parameter $\boldsymbol{\theta} = (\theta_{12} + \theta_{12}^*, \theta_{13} + \theta_{13}^* \mid 0, 0 \mid 0, 0)$, which allows for mean return effects from positive (θ_{12}) and negative news volatility (θ_{13}). The parameters β_{21} and β_{31} capture the potential reverse causation effect in the case of newspaper news (Birz and Lott, 2013) as journalists might be influenced by the stock market closing prices when writing articles. Furthermore, $\boldsymbol{\delta} = (\delta_{12}, \delta_{13} \mid 0, 0 \mid 0, 0)$ is the vector of control parameters, monetary policy and exogenous shocks respectively appearing in the first equation only. The parameter matrices for the variance Equation (2) are defined as C_0, which is restricted to be upper triangular, and the two unrestricted matrices A_{11} and G_{11}. In order to account for the possible

[1] The model is based on the GARCH(1,1)-BEKK representation proposed by Engle and Kroner (1995).

[2] Birz and Lott (2011) also control for news surprises, computed in the standard way; however, they find that these are not statistically significant. This is not surprising, considering the fact that typically news are released on a very small percentage of trading days (e.g., in the case of the sample for the CIVETS stock markets examined by Wallenius et al., 2013, no release took place on 70.5% trading days and only 4.7% trading days had multiple releases), in contrast to newspaper coverage of macro news, which is daily and can be modelled appropriately using a GARCH framework. For this reason, we do not include news surprises in the model specification. Concerning day-of-the week and business cycle effects, also considered by Birz and Lott (2011), we found that a dummy for the day-of-the-week was not significant (and therefore did not include it in the chosen specification), and similarly that there is no evidence of differences in the responses of stock returns depending on the state of the economy (these additional results are not reported in the paper).

effects of the recent financial crisis, we include a dummy variable (denoted by *) with a switch on 15 September 2008, i.e. on the day of the collapse of Lehman Brothers. Therefore, the second moment will take the following form[3]:

$$H_t = C_0^{'}C_0 + A_{11}^{'} \begin{bmatrix} e_{1,t-1}^2 & e_{2,t-1}e_{1,t-1} & e_{3,t-1}e_{1,t-1} \\ e_{1,t-1}e_{2,t-1} & e_{2,t-1}^2 & e_{3,t-1}e_{2,t-1} \\ e_{1,t-1}e_{3,t-1} & e_{2,t-1}e_{3,t-1} & e_{3,t-1}^2 \end{bmatrix} A_{11} + G_{11}^{'}H_{t-1}G_{11} \quad (3)$$

where

$$A_{11} = \begin{bmatrix} a_{11} & 0 & 0 \\ a_{21} + a_{21}^* & a_{22} & 0 \\ a_{31} + a_{31}^* & 0 & a_{33} \end{bmatrix}; G_{11} = \begin{bmatrix} g_{11} & 0 & 0 \\ g_{21} + g_{21}^* & g_{22} & 0 \\ g_{31} + g_{31}^* & & g_{33} \end{bmatrix}$$

Equation (3) models the dynamic process of H_t as a linear function of its own past values H_{t-1} and past values of the squared innovations $\left(e_{1,t-1}^2, e_{2,t-1}^2, e_{3,t-1}^2\right)$. The parameters of (3) are given by C_0, which is restricted to be upper triangular, and the two matrices A_{11} and G_{11}. Each of these two has four zero restrictions since we are focusing on volatility spillovers (causality-in-variance) from positive news volatility before (a_{21}) and after the crisis ($a_{21} + a_{21}^*$), as well as from negative news volatility before (a_{31}) and after the crisis ($a_{31} + a_{31}^*$), to stock returns volatility. The BEKK representation guarantees by construction that the covariance matrix in the system is positive definite. Furthermore, the conditional correlations between equity markets and positive and negative news respectively will be given by:

$$\boldsymbol{\rho}_{12,t}{=}h_{12,t}/\sqrt{h_{11,t}}\sqrt{h_{22,t}} \text{ and } \boldsymbol{\rho}_{13,t}{=}h_{13,t}/\sqrt{h_{11,t}}\sqrt{h_{33,t}} \quad (4)$$

Given a sample of T observations, a vector of unknown parameters θ and a 3×1 vector of variables $\mathbf{x}_t$, the conditional density function for model (1) is:

$$f\left(\mathbf{x}_t | I_{t-1}; \theta\right) = (2\pi)^{-1} \left|H_t\right|^{-1/2} \exp\left(-\frac{\mathbf{u}_t^{'}\left(H_t^{-1}\right)\mathbf{u}_t}{2}\right) \quad (5)$$

The log-likelihood function is:

$$L = \sum_{t=1}^{T} \log f\left(\mathbf{x}_t | I_{t-1}; \theta\right) \quad (6)$$

where θ is the vector of unknown parameters. The standard errors are calculated using the quasi-maximum likelihood methods of Bollerslev and Wooldridge (1992), which is robust to the distribution of the underlying residuals.

3 Empirical Analysis

3.1 Data

We use daily data (from Bloomberg) for eight countries (Belgium, France, Germany, Greece, Ireland, Italy, Portugal and Spain) belonging to the euro area over the period 03/1/1994 -

[3] The parameters (a_{21}) and (a_{31}) in Equation (3) measure the causality effect of positive and negative news volatility respectively, whereas ($a_{21} + a_{21}^*$) and ($a_{31} + a_{31}^*$) the possible effect of the 2008 financial crisis.

12/5/2013, for a total of 5058 observations. Furthermore, as already mentioned, we control for monetary policy and stock market globalisation using domestic interest rates (90-day Treasury Bill rate) and a proxy for the global stock market index (US stock market index). We define daily returns as logarithmic differences of stock indices.

We consider news coverage of four macro economic data series, i.e. GDP, unemployment, retail sales and durable goods (Birz and Lott (2013), and Lott and Hassett (2006)). The average number of stories about unemployment and GDP is very similar; these account for the majority of news articles, whereas there is less coverage of retail sales and durable goods releases. The index we use does not distinguish between different types of macro news, since the focus of this study is to analyse the effects of positive and negative macro news respectively as reported and interpreted by the media.[4] The daily positive (negative) news index is defined as follows:

$$\begin{aligned}\text{positive (negative) } \textbf{news index} &= ln[\mathbf{e} + \textbf{domestic positive (negative) news} \\ &\quad + \textbf{international positive (negative) news}] \quad (7)\end{aligned}$$

We address the issue of national newspaper stories about the status of the economy potentially being politically biased (Lott and Hassett, 2006) by using both domestic and international (within the euro area) news.

Please Insert Table 1 and Figure 1

The descriptive statistics, presented in Table 1, show that on average the number of positive news releases is bigger than that of negative ones. However, since the onset of the 2008 crisis, negative news releases have become more frequent in all countries but France and Germany. The shift has been particularly marked for the PIIGS countries, that have been hit the most by the crisis. Furthermore, the average number of stories, either negative or positive, has increased substantially since 2008. This is not surprising: the euro area has been affected deeply by the recent global crisis, and even small investors have become increasingly aware of the importance of news on the state of the economy after a decade of steadily growing stock markets that did not seem to reflect the underlying economy fundamentals. This growing interest has been captured and fuelled by a rising number of articles commenting on macro news releases. Furthermore, since 2008 there has been an increase in stock market volatility in all countries (Figure 1). This finding supports the inclusion of a switch dummy in the model specification.

3.2 Hypotheses Tested

We test for mean and volatility spillovers by placing restrictions on the relevant parameters; specifically we consider the following three sets of null hypotheses[5] H_0:

1. Tests of no news spillovers to stock market returns

[4] Neutral and mixed news, which have been found not to be significant in previous studies, have not been considered given the aim of this paper.

[5] The joint restrictions $H_{05} - H_{08}$ are tested by means of a Wald test.

H_{01}:Positive news to stock markets before the 2008 crisis: $\beta_{12} = 0$
H_{02}:Positive news to stock markets after the 2008 crisis: $\beta^*_{12} = 0$
H_{03}:Negative news to stock markets before the 2008 crisis: $\beta_{13} = 0$
H_{04}:Negative news to stock markets after the 2008 crisis: $\beta^*_{13} = 0$

2. Tests of no news volatility spillovers to stock markets volatility
H_{05}:Positive news volatility to stock markets before the 2008 crisis: $a_{21} = g_{21} = 0$
H_{06}:Positive news volatility to stock markets after the 2008 crisis: $a^*_{21} = g^*_{21} = 0$
H_{07}:Negative news volatility to stock markets before the 2008 crisis: $a_{31} = g_{31} = 0$
H_{08}:Negative news volatility to stock markets after the 2008 crisis: $a^*_{31} = g^*_{31} = 0$

3. Tests of no news volatility spillovers to stock market returns
H_{09}:Positive news volatility to stock markets before the 2008 crisis: $\theta_{12} = 0$
H_{10}:Positive news volatility to stock markets after the 2008 crisis: $\theta^*_{12} = 0$
H_{11}:Negative news volatility to stock markets before the 2008 crisis: $\theta_{13} = 0$
H_{12}:Negative news volatility to stock markets after the 2008 crisis: $\theta^*_{13} = 0$

3.3 Discussion of the Results

In order to test the adequacy of the models, Ljung– Box portmanteau tests were performed on the standardized and squared residuals. Overall, the results indicate that the VAR-GARCH(1,1)-in-mean specification captures satisfactorily the persistence in returns and squared returns of all the series considered. Causality effects in the conditional mean and variance vary in magnitude and sign across countries. Note that the signs on cross-market volatilities cannot be determined. The estimated VAR-GARCH(1,1)- in-mean model with the associated robust standard errors and likelihood function values are presented in Tables 2-5. We select the optimal lag length of the mean equation using the Schwarz information criterion. The following points are noteworthy. Concerning the effects of positive news on stock market returns (β_{12}), we find positive and significant causality at the standard 5% significance level for all eight countries. The biggest estimated coefficients are those for Ireland and Portugal, with values equal to 0.0072 and 0.0071, respectively. The post-September 2008 results show an increase in the effect of positive news for all countries but Spain ($\beta_{12} + \beta^*_{12} \langle \beta_{12}$) . As for the effects of negative news on stock market returns (β_{13}), there appears to be negative and significant causality at the standard 5% significance level for all eight countries. Again the largest coefficients (in absolute value) are those for Ireland and Portugal, with values equal to -0.0134 and -0.0242, respectively. The post-September 2008 results indicate an increase in the effects of negative news for all countries, especially in the case of the PIIGS ones, where they double in the second subsample. Overall, we find that negative news have bigger effects (in absolute value) than positive news ($\beta_{12} \langle \beta_{13}$) in all countries considered. This pattern has been reinforced by the recent crisis.

The nature of the model allows us to control and test for the presence of reverse causation, i.e. the effects of stock market activity on the number of positive and negative news stories, measured by β_{21} and β_{31} respectively, but we do not find any statistically significant evidence for it[6].

[6] The results for β_{21} and β_{31} have not been reported to save space, but are available upon request.

Please Insert Tables 2-5 and Figure 2-3 about here

Concerning the conditional variance equations, the estimated "own-market" coefficients are statistically significant and the estimates of g_{11} suggest a high degree of persistence. The patterns are not substantially different for the eight countries considered, with positive and negative volatility news having a significant influence on stock returns volatility (note that the sign cannot be established). The magnitude of the causality effect is bigger (in absolute value) for negative than for positive news volatility in all countries examined. Furthermore, there is evidence of the 2008 crisis affecting the causality-in-variance dynamics. In particular, the post-crisis negative news volatility effect doubled at least for the PIIGS countries, with Greece exhibiting the biggest increase ($a_{31} + a_{31}^{*} = -0.9492$) compared to the pre-September 2008 period ($a_{31} = -0.0873$).

The news GARCH-in-mean coefficients (θ_{12} and θ_{13}) are negative and significant for all eight countries, showing that any increase in (positive or negative) news volatility has a negative effect on the markets. However, the magnitude of this effect is bigger when it is due to negative as opposed to positive news volatility ($\theta_{12} \langle\ \theta_{13}$) for all eight countries. The 2008 crisis seems to have played an important role, the effects of negative news volatility having more than doubled in all PIIGS countries. Also, the exogenous variables considered are statistically significant for all eight countries, their estimated coefficients indicating a negative δ_{12} (TBill interest rate) and positive δ_{13} (US stock returns) effect respectively, as one would expect.

Finally, there is also evidence of co-movement between stock market returns and the news index, as shown by the conditional correlations (Figure 2-3) derived from the VAR-GARCH(1,1)-in -mean model. In particular, the conditional correlations between positive news and stock returns are generally positive, whereas those between negative news and stock returns are negative. The downward shift in pairwise correlations (between stock returns and negative news) is quite evident for the PIIGS countries after 2008, especially in the case of Ireland and Portugal, suggesting that financial markets in economies under pressure were particularly sensitive to negative news.

4 Conclusions

This paper has analysed the effects of macro news on stock returns in eight countries belonging to the euro area (Belgium, France, Germany, Greece, Ireland, Italy, Portugal and Spain) using daily data for the period 1994-2013. As in Birz and Lott (2011), it uses newspaper coverage of macro news as a proxy for the way investors interpret news releases, which is a key factor determining their response. However, it makes a number of original contributions to the literature, by modelling both mean and volatility spillovers, focusing on the euro area and the effects of the global financial crisis, and controlling for both monetary policy and global financial shocks. In particular, the econometric analysis is based on the estimation of a VAR-GARCH(1,1)-in-mean model with a BEKK representation which is ideally suited to testing for both mean and volatility linkages between macro news and stock returns. The results can be summarised as follows. Positive (negative) news have significant positive (negative) effects on stock returns in all cases (especially in Ireland and Portugal); markets respond more to negative news, and the reaction to both types of news appears to have increased during the recent financial crisis. News volatility has a significant impact on both stock returns and their volatility, the effects being again more pronounced in the case of negative news and bigger in the most recent crisis period, especially in the PIIGS countries. Specifically, an increase in news volatility is always associated with a decrease in stock returns. The exogenous factors considered, namely the US 90-day Treasury bill rate and US stock returns, have the expected negative and positive effects respectively on stock returns. Finally, the conditional correlations between stock returns and positive (negative) news are significant and positive (negative), and their increase in absolute value in the case of negative news during the financial crisis (especially in the PIIGS countries) indicates higher sensitivity of financial markets to negative releases. Overall, our findings complement those of Birz and Lott (2011) for the US, confirming that the interpretation of macro news in the form of newspaper coverage plays a very important role in determining the response of asset prices to news releases: overlooking it might lead to underestimating the strength of the linkages between real sector news and financial markets, which appears to have increased even further since the onset of the global financial crisis, at least in the case of the euro area examined in this study (especially in its peripheral members).

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TABLE 1: Descriptive Statistics

	Pre- September 2008				Post- September 2008			
	Mean	Std. dev	Min	Max	Mean	Std. dev	Min	Max
				Positive News				
Belgium	0.12	0.64	0	14	0.31	2.98	0	98
France	0.69	1.92	0	27	1.94	4.26	0	104
Germany	3.28	3.99	0	25	6.43	9.67	0	106
Greece	0.06	0.04	0	9	1.32	6.26	0	91
Ireland	0.04	0.09	0	8	0.48	2.11	0	57
Italy	0.42	0.29	0	15	0.85	4.77	0	86
Portugal	0.11	0.06	0	10	0.57	3.47	0	74
Spain	0.20	0.18	0	12	0.88	5.05	0	77
				Negative News				
Belgium	0.07	0.50	0	8	0.49	4.23	0	102
France	0.25	0.89	0	11	1.47	5.66	0	106
Germany	0.86	2.14	0	18	2.47	4.61	0	99
Greece	0.05	0.45	0	2	1.81	4.77	0	116
Ireland	0.07	0.09	0	3	0.81	2.11	0	95
Italy	0.35	1.18	0	2	1.92	3.73	0	108
Portugal	0.07	0.52	0	2	0.81	3.62	0	77
Spain	0.12	0.89	0	6	1.29	4.01	0	100
				Stock Returns				
Belgium	0.014	0.011			0.062	0.012		
France	0.023	0.012			0.029	0.014		
Germany	0.024	0.012			0.042	0.017		
Greece	0.036	0.015			−0.035	0.021		
Ireland	0.023	0.013			0.051	0.018		
Italy	0.021	0.012			0.006	0.016		
Portugal	0.018	0.009			0.007	0.013		
Spain	0.035	0.011			0.012	0.017		

Note: Stock market returns are the daily percentage changes in the closing values of the national stock market indeces. News counts refer to domestic and international (within the Euro area) media coverage. The number of positive (negative) newspaper headlines index is defined as follows: positive (negative) news index = ln[e+domestic positive (negative) news + international positive (negative) news]. Min and max values refer to the raw story counts. The sample size covers the period 03/1/1994-12/5/2013, for a total of 5058 observations.

TABLE 2: Estimated VAR-GARCH(1,1)-in-mean model

	Belgium		France	
	Coefficient	S.E.	Coefficient	S.E.
		Conditional Mean Equation		
α_1	0.0019	(0.0001)	0.0011	(0.0004)
α_2	0.0168	(0.0103)	0.0351	(0.0081)
α_3	0.1032	(0.0169)	0.1443	(0.0271)
β_{11}	−0.1726	(0.0399)	−0.0279	(0.0137)
β_{12}	0.0009	(0.0002)	0.0032	(0.0013)
β_{12}^*	0.0012	(0.0003)	0.0006	(0.0002)
β_{13}	−0.0010	(0.0004)	−0.0003	(0.0001)
β_{13}^*	−0.0001	(0.0001)	−0.0003	(0.0001)
θ_{12}	−0.0029	(0.0011)	−0.0007	(0.0003)
θ_{12}^*	−0.0048	(0.0021)	−0.0033	(0.0015)
θ_{13}	−0.0111	(0.0046)	−0.0042	(0.0019)
θ_{13}^*	−0.0015	(0.0005)	−0.0012	(0.0005)
γ_{11}	0.3281	(0.0366)	0.0254	(0.0137)
γ_{12}	−0.0482	(0.0191)	−0.0033	(0.0016)
		Conditional Variance Equation		
c_{11}	0.0001	(0.0001)	0.0001	(0.0001)
c_{22}	0.0775	(0.0162)	0.0233	(0.0107)
c_{33}	0.5505	(0.0574)	0.0257	(0.0175)
g_{11}	0.9474	(0.0374)	0.9337	(0.0161)
g_{21}	0.0155	(0.0062)	−0.1571	(0.0614)
g_{21}^*	0.0084	(0.0037)	−0.0302	(0.0112)
g_{22}	0.9631	(0.0209)	0.9852	(0.0326)
g_{31}	0.0941	(0.0423)	−0.1578	(0.0543)
g_{31}^*	−0.6748	(0.2251)	−0.1901	(0.0871)
g_{33}	0.9846	(0.1377)	0.9895	(0.0018)
a_{11}	0.3076	(0.0763)	0.2884	(0.0475)
a_{21}	−0.0516	(0.0231)	0.3701	(0.1541)
a_{21}^*	−0.0026	(0.0011)	0.1834	(0.0752)
a_{22}	0.2376	(0.0113)	0.1757	(0.0257)
a_{31}	−0.2140	(0.1012)	0.4075	(0.2017)
a_{31}^*	-0.3028	(0.1291)	0.7049	(0.3435)
a_{33}	0.1395	(0.0846)	0.1568	(0.0167)
LogLik	26499.96		18467.53	
$LB_{Stock,(10)}$	7.1261		8.4563	
$LB^2_{Stock,(10)}$	9.2298		7.1351	

Note: Standard errors (S.E.) are calculated using the quasi-maximum likelihood method of Bollerslev and Wooldridge (1992), which is robust to the distribution of the underlying residuals. Parameters not statistically significant at the 10% level are not reported. $\text{LB}_{Stock(10)}$ and $\text{LB}^2_{Stock(10)}$ are the Ljung-Box test (1978) of significance of autocorrelations of ten lags in the standardized and standardized squared residuals respectively. The parameters β_{12} and β_{13} measure the causality effect of positive and negative news on stock returns respectively, .a_{21} and a_{31} measure the causality in variance effect of positive and negative news respectively whereas θ_{12} and θ_{13} capture the effect of positive and negative news volatility on stock market returns. The effect of the 2008 financial crises on returns is measured by $(\beta_{12}+\beta^{*}_{12})$ and $(\beta_{13}+\beta^{*}_{13})$ whereas $(a_{21}+a^{*}_{21})$ and $(a_{31}+a^{*}_{31})$ capture the effect on stock return volatilities. The covariance stationarity condition is satisfied by all the estimated models, all the eigenvalues of $A_{11}\otimes A_{11}+G_{11}\otimes G_{11}$ being less than one in modulus. Note that in the conditional variance equation the sign of the parameters cannot be determined.

TABLE 3: Estimated VAR-GARCH(1,1)-in-mean model

	Germany		Greece	
	Coefficient	S.E.	Coefficient	S.E.
		Conditional Mean Equation		
α_1	0.0033	(0.0011)	0.0006	(0.0005)
α_2	0.3058	(0.0369)	0.0007	(0.0014)
α_3	0.1568	(0.0294)	0.0188	(0.0095)
β_{11}	−0.0405	(0.0182)	0.0758	(0.0243)
β_{12}	0.0001	(0.0001)	0.0006	(0.0002)
β^*_{12}	0.0016	(0.0002)	0.0112	(0.0046)
β_{13}	−0.0008	(0.0003)	−0.0007	(0.003)
β^*_{13}	−0.0009	(0.0004)	−0.0054	(0.0026)
θ_{12}	−0.0062	(0.0029)	−0.3547	(0.1274)
θ^*_{12}	−0.0023	(0.0011)	0.3312	(0.1563)
θ_{13}	−0.0026	(0.0009)	−0.0045	(0.0012)
θ^*_{13}	−0.0112	(0.0462)	−0.5332	(0.2219)
γ_{11}	0.3365	(0.0211)	0.1169	(0.0312)
γ_{12}	−0.0008	(0.0002)	−0.0003	(0.0001)
		Conditional Variance Equation		
c_{11}	0.0001	(0.0001)	0.0017	(0.0003)
c_{22}	0.0508	(0.0136)	0.0044	(0.0017)
c_{33}	0.0274	(0.0072)	0.0416	(0.0178)
g_{11}	0.9673	(0.0066)	0.9363	(0.0009)
g_{21}	−0.1319	(0.0543)	0.0097	(0.0043)
g^*_{21}	0.1543	(0.0645)	0.2005	(0.0962)
g_{22}	0.9731	(0.0041)	0.9045	(0.0021)
g_{31}	0.0998	(0.0453)	−0.1350	(0.0034)
g^*_{31}	−0.3301	(0.1231)	−0.2130	(0.0561)
g_{33}	0.9776	(0.0083)	0.9809	(0.0021)
a_{11}	0.2525	(0.0269)	0.3503	(0.0101)
a_{21}	−0.2509	(0.01263)	−0.0732	(0.0321)
a^*_{21}	1.1545	(0.4971)	−0.6615	(0.2231)
a_{22}	0.1655	(0.0194)	0.4485	(0.0764)
a_{31}	0.2712	(0.0087)	−0.0873	(0.0354)
a^*_{31}	0.6585	(0.2291)	−0.8619	(0.2243)
a_{33}	0.2251	(0.0464)	0.1604	(0.0459)
LogLik	12734.36		31115.92	
$LB_{Stock,(10)}$	4.3456		10.564	
$LB^2_{Stock,(10)}$	7.1291		10.452	

Note: See the notes to Table 2.

TABLE 4: Estimated VAR-GARCH(1,1)-in-mean model

	Ireland		Italy	
	Coefficient	S.E.	Coefficient	S.E.
		Conditional Mean Equation		
α_1	0.0048	(0.0007)	0.0021	(0.0002)
α_2	0.0041	(0.0017)	0.0048	(0.0046)
α_3	0.1468	(0.0126)	0.1357	(0.0327)
β_{11}	0.1356	(0.0524)	0.1124	(0.0273)
β_{12}	0.0072	(0.0038)	0.0011	(0.0004)
β_{12}^*	0.0104	(0.0051)	0.0010	(0.0003)
β_{13}	−0.0134	(0.0049)	−0.0015	(0.0005)
β_{13}^*	−0.0129	(0.0023)	−0.0049	(0.0016)
θ_{12}	−0.0036	(0.0015)	−0.0011	(0.0003)
θ_{12}^*	0.0024	(0.0009)	0.0006	(0.0001)
θ_{13}	−0.0236	(0.0098)	−0.0013	(0.0004)
θ_{13}^*	−0.0224	(0.0083)	−0.0008	(0.0002)
γ_{11}	0.4706	(0.0272)	0.1289	(0.0364)
γ_{12}	−0.0005	(0.0001)	−0.0007	(0.0003)
		Conditional Variance Equation		
c_{11}	0.0001	(0.0001)	0.0001	(0.0001)
c_{22}	−0.0005	(0.0002)	0.0109	(0.0053)
c_{33}	0.0087	(0.0012)	−0.3449	(0.0852)
g_{11}	0.9924	(0.0023)	0.9438	(0.0096)
g_{21}	−0.0077	(0.0022)	0.0826	(0.0342)
g_{21}^*	0.0465	(0.0196)	−0.3596	(0.1293)
g_{22}	0.6732	(0.0131)	0.9757	(0.0033)
g_{31}	0.0332	(0.0111)	0.0889	(0.0342)
g_{31}^*	0.1474	(0.0653)	0.2789	(0.1125)
g_{33}	−0.9428	(0.0247)	0.9823	(0.0271)
a_{11}	0.1198	(0.0151)	0.3657	(0.0245)
a_{21}	0.0019	(0.0008)	−0.0892	(0.0056)
a_{21}^*	−0.4845	(0.1896)	0.9796	(0.4431)
a_{22}	0.1973	(0.0872)	0.2095	(0.0284)
a_{31}	−0.4841	(0.2196)	−0.1216	(0.0542)
a_{31}^*	−1.6122	(0.5543)	−0.9487	(0.3494)
a_{33}	0.0955	(0.1185)	0.1441	(0.0251)
LogLik	32471.62		24773.97	
$LB_{Stock,(10)}$	12.453		11.329	
$LB^2_{Stock,(10)}$	9.775		10.764	

Note: See the notes to Table 2.

TABLE 5: Estimated VAR-GARCH(1,1)-in-mean model

	Portugal		Spain	
	Coefficient	S.E.	Coefficient	S.E.
		Conditional Mean Equation		
α_1	-0.0011	(0.0004)	0.0019	(0.0002)
α_2	0.0044	(0.0022)	0.0038	(0.0016)
α_3	0.0007	(0.0003)	0.1346	(0.0391)
β_{11}	0.0226	(0.0098)	-0.0317	(0.0060)
β_{12}	0.0071	(0.0034)	0.0006	(0.0002)
β_{12}^*	0.0064	(0.0026)	-0.0003	(0.0001)
β_{13}	-0.0242	(0.0111)	-0.0041	(0.0017)
β_{13}^*	-0.0228	(0.0112)	-0.0026	(0.0008)
θ_{12}	-0.0333	(0.0151)	-0.0168	(0.0057)
θ_{12}^*	0.0231	(0.0113)	0.0134	(0.0065)
θ_{13}	-0.0453	(0.0221)	-0.0169	(0.0049)
θ_{13}^*	-0.0435	(0.0187)	-0.0263	(0.0112)
γ_{11}	0.1136	(0.0045)	0.2854	(0.0532)
γ_{12}	-0.0001	(0.0001)	-0.0004	(0.0001)
		Conditional Variance Equation		
c_{11}	0.0001	(0.0001)	0.0001	(0.0001)
c_{22}	0.0001	(0.0001)	-0.0036	(0.0025)
c_{33}	0.0012	(0.0004)	0.0556	(0.0189)
g_{11}	0.7149	(0.2349)	0.8954	(0.0183)
g_{21}	-0.0541	(0.0224)	-0.0891	(0.0342)
g_{21}^*	-0.1808	(0.0874)	-0.4929	(0.2231)
g_{22}	0.9783	(0.0065)	0.9816	(0.0045)
g_{31}	-0.0671	(0.0187)	-0.0941	(0.0439)
g_{31}^*	-0.2214	(0.1054)	-0.6119	(0.2135)
g_{33}	0.9941	(0.0078)	0.9165	(0.1706)
a_{11}	0.3255	(0.1275)	0.1872	(0.0816)
a_{21}	0.1674	(0.0756)	0.3298	(0.1353)
a_{21}^*	0.2411	(0.0967)	0.4510	(0.2164)
a_{22}	0.2829	(0.1295)	0.1433	(0.0677)
a_{31}	0.3946	(0.0978)	0.4085	(0.1674)
a_{31}^*	0.2449	(0.0067)	1.0806	(0.4573)
a_{33}	0.1236	(0.0023)	-0.1173	(0.2124)
LogLik	34179.76		27834.26	
$LB_{Stock,(10)}$	6.8961		8.1413	
$LB^2_{Stock,(10)}$	9.7875		10.1267	

Note: See the notes to Table 2.

Figure 1: Stock Market Returns

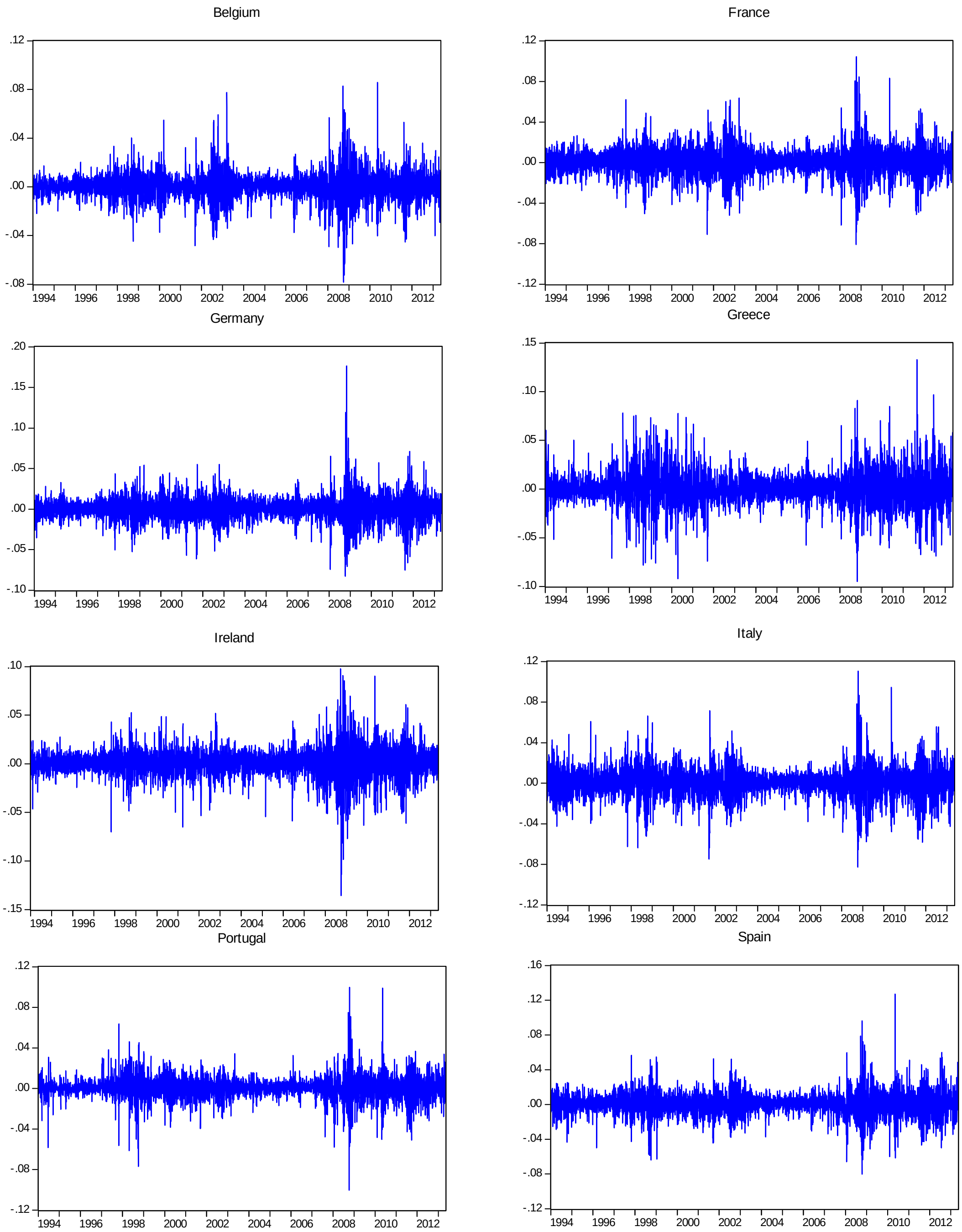

Figure 2: Conditional Correlations between Negative News and Stock Markets Returns

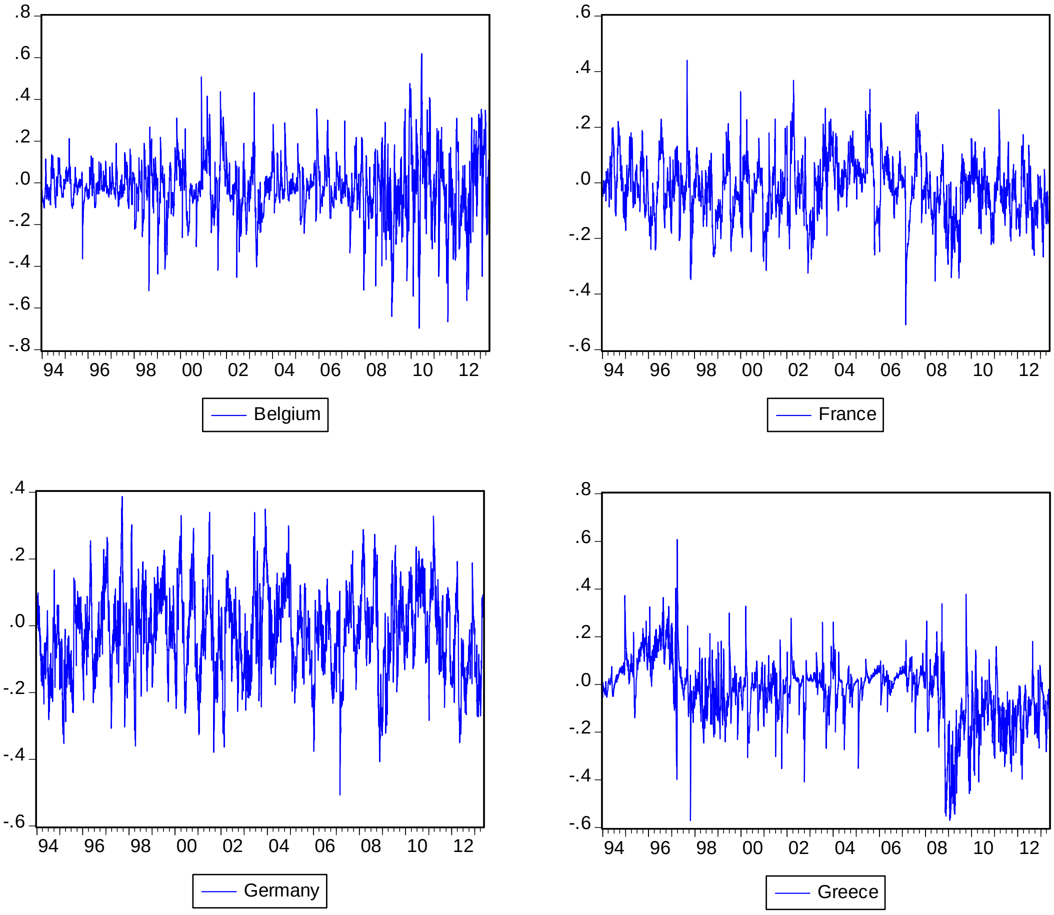

Figure 3: Conditional Correlations between Negative News and Stock Markets Returns