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Abstract

This paper employs Hong et al.'s (2009) extreme risk spillovers test to investigate the bilateral business confidence spillovers between Greece, Italy, Spain, Portugal, France, and Germany. After controlling for domestic economic developments in each country and common international factors, downside risk spillovers are detected as a causal feedback between Spain and Portugal and unilaterally from Spain to Italy. Extremely low business sentiments in France, Germany, and Greece are mostly due to the common adverse economic environment and to each country's own domestic economic developments.

Keywords: European economy, Business confidence, Downside risk, Granger-causality.

JEL Codes: C32, E32, F44

1. Introduction

The future of Euro zone countries and the Euro itself has been increasingly questioned due to the structural fiscal problems and debt levels. Greece, Ireland, Italy, Portugal, and Spain made the earlier news headlines, but the weaknesses in other countries came increasingly to the surface. Earlier attempts through rescue packages did not solve the fiscal problems. The concerns over fiscal sustainability in Greece, for instance, were not calmed down and led to a government change in November 2011.[1] The economic crisis also led to the end of the

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Berlusconi era in Italy. The economic crisis reflects itself in the sovereign ratings of the European countries as well. Greece's long- and short-term foreign currency sovereign ratings, for instance, were rated as a "Selective Default, or SD" by the Standard and Poor's twice in 2012. [2] Other countries faced rating downgrades in January 2012 by the Standard and Poor's: Italy (from A to BBB+), Portugal (from from BBB- to BB), Spain (from BBB+ to BBB-), and France (from AAA to AA+). Other rating agencies such as Moody's and Fitch also took similar actions.

The issue at large relates to two research avenues in the literature. The first is the business cycle synchronization across countries and the closely-related second one is the contagion channels of macroeconomic shocks across countries. The question of whether there is evidence of business cycle synchronization in Europe or among different countries led to many studies in the literature. It is generally found that there is some evidence for the presence of country clusters that share common characteristics of business cycle movements (e.g., timing, duration, and amplitude). De Haan et al. (2008), Camacho et al. (2006, 2008), Gouveia and Correia (2008), Drake and Mills (2010), Papageorgiou et al. (2010), Konstantakopoulou and Tsionas (2011), and Aguiar-Conraria and Soares (2011) provide a review of the literature and empirical evidence on business cycle synchronization in Europe.

Regarding the transmission channels of business cycles and economic shocks across countries, trade and capital flows, financial market linkages, common policies, and business and consumer confidence spillovers are said to play the key roles. The literature reviewed in De Haan et al. (2008), for instance, cites the trade linkages as one of the most important business cycle transmission channels. However, at times of extreme economic and financial stress, such the global financial crisis or the recent / on-going economic and fiscal crisis especially in the Southern European countries, the influence of the confidence factors in the transmission of shocks take a new and a higher dimension. Kappler's (2011) estimates, for example, show that trade channel has low predictive power in explaining business cycle transmission among the Euro zone countries. Kappler (2011: 263) suggests that common factors including "…shared economic confidence and sentiment…" are more prominent factors in explaining business cycle co-movements. In this context, Aguiar-Conrarria et al. (2013) analyze the business cycle synchronization by using economic sentiment index data for the Euro zone countries. An earlier work by Anderton et al. (2004) also argues in favour of

[1] Chamley and Pinto (2011) provides an overview of the previous attempts to relieve the Greek debt situation until early 2011 and argue that such rescue packages will not work.

[2] Standard and Poor's raised Greece's long-term foreign currency sovereign rating to B- on December 18, 2012.

the increased importance of the confidence factors in business cycle spillovers during periods of financial crises. Accordingly, the confidence channels "…contain factors not necessarily included in the other factors that usually explain business cycle linkages…these factors are given various names, such as information 'cascades', 'fads', or 'herd' behaviour" (Anderton et al., 2004: 46-47).[3] These arguments suggest an asymmetric relationship in the transmission of business confidence spillovers across countries depending on the state of the economy.[4]

This paper analyzes the causal relationships between the bilateral business confidence indicators of Greece, Italy, Spain, Portugal, Germany and France for the period between January 1988 and September 2012. Except for Germany and France, these countries have experienced very high financial and economic pressure after the global financial crisis.[5] Furthermore, we consider business confidence index data for Germany and France because these countries have largest economy among the Euro zone countries. In addition, Aguiar-Conrarria et al. (2013) find the presence of high correlation among economic sentiment index of Germany, France and Euro zone countries and hence it can be said that these countries represent overall mood of the Euro zone. We employ Hong et al's (2009) extreme risk spillovers test in our study. Hong et al.'s (2009) test is also called the downside risk Granger-causality test or the Granger-causality-in-risk test. Hong et al.'s (2009) test employs the value-at-risk (VaR) approach to determine the extreme risk periods in the sample and then examines the nature of the (Granger-) causal relationships between the variables of interest in those periods.

The essence of the test is that there might be asymmetric causal relationships at work in periods of high economic or financial stress (downside risk) compared to the normal or more optimistic times. In other words, the traditional symmetric causality tests provide an aggregate outcome for the causal relationships that exist in both good times and bad. It might be that the business confidence channel becomes less important in normal and good times in explaining the economic developments in other countries. There might exist a more pronounced causal spillover effect from the deterioration of business sentiment in one country

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[3] Anderton et al. (2004) investigate the relationship between the Euro area and the US for the period between 1980 and 2002. Anderton et al.'s (2004: 48) findings from a VAR model indicate that the US confidence indicators (both consumer confidence and business confidence) Granger-cause the confidence indicators in the Euro area.

[4] Kappler (2011) investigates the effects of trade linkages on business cycle transmission among the Euro zone countries using a cross-section augmented VAR model with unobserved common factor structure. The results indicate that the trade linkages have low explanatory power in the short-run while the common factor structure has high predictive power.

[5] Ireland is excluded from sample countries because business confidence index data is not available after 2008.

on the business sentiment in another country in crisis times but if that effect weakens or disappears in normal times, the tests that combine both good and pessimistic sentiment episodes might not detect a causal relationship in the overall time span. Hence, the downside-risk Granger-causality notion is better-suited to the study of the causal links in the transmission of pessimistic business sentiments between Greece, Italy, Portugal, Spain, and two of the major EU countries, namely, Germany and France since the outlook for the euro and the EU in general is rather sensitive to the news on economic and fiscal developments in a number of countries, such as Greece, Italy, Portugal, and Spain. To the best of our knowledge, this study is the first one to make extreme business confidence risk spillovers inference or the causality-in-risk tests for the business confidence spillovers in Europe.

The rest of the paper is organized as follows. In Section 2, we discuss the ideas behind and the methodological aspects of the econometric methods used in our study. In Section 3, we present the estimates from the causality-in-risk tests. Section 4 concludes.

2. Hong et al.'s (2009) Granger-Causality-in-Risk Test

Hong et al. (2009) indicate that although volatility spillover effects are important in financial risk management, they can only adequately represent small risk in practice. In addition, volatility alone cannot satisfactorily capture risk in scenarios of occasionally occurring extreme market movements. In this context, Longin (2000) and Bali (2000) show that when volatility in the financial market increase, volatility estimates that are derived from general asset return distributions cannot adequately serve as a measure of market risks in those high stress periods. Moreover, Hong et al. (2004, 2007) point out that volatility includes both gains and losses in a symmetric way; however financial risk is only clearly related to losses but not gains. In view of these, Hong et al. (2009) propose a test procedure to examine the presence of causal links for the downside risk between financial returns series. The test is also called as "Granger causality in risk". Hong et al. (2009) indicate that the application of the test procedure is not limited to financial markets and financial positions but it can also be used in macroeconomic analysis such as international business cycles transmission. Lee and Yang (2006), for instance, employ the Granger-causality-in-risk test to investigate the money-income causality for the U.S.

The test methodology proposed by Hong et al. (2009) is closely related to extreme downside behavior of the series that is determined by calculating the left-tail probabilities. Therefore, it requires the estimation of the time-varying Value at Risk (VaR) for each series (i.e., business confidence index in our case) first. Subsequently, the presence of downside causal links between series can be examined.

In essence, the VaR model provides a quantitative measure of loss on a portfolio given a time period and a confidence level for market risk. In other words, it can be said that VaR shows the maximum amount that can be lost over a given period of time with a given confidence level. Specifically, at the given confidence level of 1-α (where $\alpha \in (0, 1)$) and given the time horizon τ, VaR is the maximum amount that can be lost with a probability of α and hence VaR implies the negative α-quantile of conditional probability distribution of a time series. Therefore, VaR can be formulated as $V_t \equiv V(I_{t-1}, \alpha)$ that is the negative α-quantile of conditional probability distribution of a time series Y_t which satisfies the following equation:

$$P\left(Y_t < -V_t \middle| I_{t-1}\right) = \alpha \tag{1}$$

where $I_{t-1} \equiv \{Y_{t-1}, Y_{t-2}, \ldots\}$ is the information set available at time t-1. In practice, commonly used levels for α are 5% and 1%.

There has been extensive literature on how to estimate the time-varying VaR which include the variance-covariance method, the historical simulation approach, and Monte Carlo simulation approaches. Nevertheless, Fan et al. (2008) indicate that the most common estimation approach for VaR in the literature is the parametric approach such as the GARCH model and the RiskMetrics methodology. In Fan et al. (2008), the GARCH modeling approach is used while Liu et al. (2008) consider both the threshold GARCH (TGARCH) and GARCH models to examine the presence of downside Granger causality between series.

We follow Fan et al. (2008) and Liu et al (2008) and employ the following GARCH model that uses the generalized error distribution (GED) for the error term:[6]

$$\begin{aligned} \Delta BCI_t &= \mu + \sum_{i=1}^{k} \rho_i \Delta BCI_{t-i} + \varepsilon_t \\ \sigma_t^2 &= \omega + \alpha \varepsilon_{t-i}^2 + \beta \sigma_{t-1}^2 \end{aligned} \tag{2}$$

[6] We also implemented the EGARCH and the GJR-GARCH models to determine the presence of leverage effect in the volatility of business confidence index series. However, EGARCH and GJR-GARCH models do not outperform the GARCH model according to log-likelihood values.

In Equation (2), ΔBCI_t indicates the first difference of the logarithm of business confidence index[7] and ε_t is an error term that follows a GED distribution. In the GARCH model, when $\omega > 0$, α and $\beta \geq 0$, the positive conditional variance condition is satisfied.

A common problem in investigating the causal interrelationships is the possibly of obtaining spurious results due to the effects of common third factors or because there are confounding variables. We address this problem by controlling for the influence of the domestic real economic and monetary developments (e.g. industrial production and inflation) as well the possible common international influences (e.g. business confidence developments in the US and in the EU). Sensier et. al. (2003), for instance, provides evidence on the influence of domestic and international variables on business cycles in Europe. Removing the possible common influences and confounding factors is important since there might be no or little confidence spillover effects left after these factors are controlled for. At times of economic and financial stress, however, business confidence spillovers might come into play more strongly and become independently significant channels of shock transmission.

We estimate the following GARCH model to take into account the common external effects and domestic real and monetary developments:

$$\Delta BCI_{lt} = \mu + \sum_{i=1}^{k} \rho_i \Delta BCI_{lt-i} + \delta_1 INF_{l,t-1} + \delta_2 GIP_{l,t-1} + \delta_3 \Delta BCI_{Europe,t-1} + \delta_4 \Delta BCI_{US,t-1} + \varepsilon_{lt}$$
$$\sigma_{lt}^2 = \omega + \alpha \varepsilon_{lt-i}^2 + \beta \sigma_{lt-1}^2 \qquad (3)$$

where $\Delta BCI_{i,t}$ is first difference of the logarithm of the business confidence index (BCI) for country l in the sample, and $INF_{l,t\text{-}1}$ and $GIP_{l,t\text{-}1}$ indicate the monthly inflation rate and the monthly growth rate of the industrial production index, respectively, in country l. The GARCH model in Equation (3) is a modified version of Bollerslev (1986) and includes common and third factor in the mean equation of GARCH model.

Hong et al. (2009) state the null and alternative hypotheses to test for one-way downside Granger causality between business confidence indices as follows;

$$H_0 : P\left(Y_{1t} < -V_{1t} \middle| I_{1(t-1)}\right) = P\left(Y_{1t} < -V_{1t} \middle| I_{t-1}\right)$$

$$H_1 : P\left(Y_{1t} < -V_{1t} \middle| I_{1(t-1)}\right) \neq P\left(Y_{1t} < -V_{1t} \middle| I_{t-1}\right)$$

[7] We consider first difference of log of business confidence index series due to stationary problem in the level of series.

where $I_{t-1} \equiv \left(I_{1(t-1)}, I_{2(t-1)}\right)$, $I_{1(t-1)} = \left\{Y_{1(t-1)}, \ldots Y_{11}\right\}$, $I_{2(t-1)} = \left\{Y_{2(t-1)}, \ldots Y_{22}\right\}$ and the null hypothesis suggests that the time series $\{Y_{2t}\}$ does not Granger cause the time series $\{Y_{1t}\}$ in risk at a given α level with respect to I_{t-1}. On the other hand, the alternative hypothesis indicates the presence of Granger causality running from the time series $\{Y_{2t}\}$ to the time series $\{Y_{1t}\}$ in risk at a given level of α with respect to I_{t-1}. Then, the downside risk indicator used in testing for Granger-causality can be defined as follows:

$$Z_{lt} \equiv \mathbf{1}\left(Y_{lt} < -V_{lt}\right),\ l = 1, 2, \ldots \tag{4}$$

where $\mathbf{1}(.)$ is the indicator function and Z_{lt} takes value 1 when actual loss exceeds VaR and takes value 0 otherwise. In this context, we can restate the null and alternative hypotheses for the downside indicator as the following:

$$H_0 : P\left(Z_{1t} \middle| I_{1(t-1)}\right) = P\left(Z_{1t} \middle| I_{t-1}\right)$$

$$H_1 : P\left(Z_{1t} \middle| I_{1(t-1)}\right) \neq P\left(Z_{1t} \middle| I_{t-1}\right)$$

Note that the downside Granger causality between $\{Y_{1t}\}$ and $\{Y_{2t}\}$ can be considered as Granger-causality-in-mean between $\{Z_{1t}\}$ and $\{Z_{2t}\}$. If we assume to have a random sample for $\{Y_{1t}\}$ and $\{Y_{2t}\}$ of size T and given the estimator $\hat{\beta}_l$, the estimates of the downside risk indicator can be obtained from:

$$\hat{Z}_{lt} \equiv Z_{lt}\left(\hat{\beta}_l\right),\ l = 1, 2, \ldots \tag{5}$$

where $\hat{Z}_{lt}\left(\hat{\beta}_l\right) \equiv \mathbf{1}\left[Y_{lt} < -V_{lt}\left(\hat{\beta}_l\right)\right]$. Then the sample cross-covariance function between $\hat{Z}_{1t}$ and $\hat{Z}_{2t}$ can be defined as:

$$\hat{C}(j) = \begin{cases} T^{-1} \sum_{t=1+j}^{T} \left(\hat{Z}_{1t} - \hat{\alpha}_1\right)\left(\hat{Z}_{2(t-j)} - \hat{\alpha}_2\right), & 0 \le j \le T-1 \\ T^{-1} \sum_{t=1-j}^{T} \left(\hat{Z}_{1(t+j)} - \hat{\alpha}_1\right)\left(\hat{Z}_{2t} - \hat{\alpha}_2\right), & 1-T \le j \le 0 \end{cases} \tag{6}$$

where $\hat{\alpha}_1 \equiv T^{-1} \sum_{t=1}^{T} \hat{Z}_{lt}$. The sample cross-correlation between $\hat{Z}_{1t}$ and $\hat{Z}_{2t}$ is given by

$$\hat{\rho}^2(j) \equiv \hat{C}(j) \big/ \hat{S}_1 \hat{S}_2, \quad j = 0, \pm 1, \ldots, \pm (T-1) \tag{7}$$

where $\hat{S}_l = \hat{\alpha}_l\left(1 - \hat{\alpha}_l\right)$ is the sample variance of $\hat{Z}_{lt}$. Then, the Q_1-statistic for the downside causality test is defined as:

$$Q_1(M) = \frac{T\sum_{j=1}^{T-1} k^2\left(\frac{j}{M}\right)\hat{\rho}^2(j) - C_{1T}(M)}{\sqrt{2D_{1T}(M)}} \tag{8}$$

where the terms $C_{1T}(M)$ and $D_{1T}(M)$ are obtained from:

$$\begin{aligned} C_{1T}(M) &= \sum_{j=1}^{T-1}(1-j/T)k^2(j/M) \\ D_{1T}(M) &= 2\sum_{j=1}^{T-1}(1-j/T)\{1-(j+1)/T\}k^4(j/M) \end{aligned} \tag{9}$$

where M is a predetermined lag order and $k(j/M)$ is a weight function. Hong et al. (2009) show that non-uniform weighting method (such as Bartlett, Daniell, Parzen, and Quadratic-Spectral kernel) outperforms in the Monte Carlo simulation and hence we use the Daniell kernel $k_D = \sin(\pi z)/\pi z$ as the weighting method in this study.

In addition, Hong et al. (2009) develop another statistic, the Q_2-statistic, for testing the presence of contemporaneous downside causal link between the series that is obtained similarly by using the indicator variables $\hat{Z}_{1t}$ and $\hat{Z}_{2t}$ in Equation (5). The Q_2-statistic is formulated as follows:

$$Q_2(M) \equiv \frac{T\sum_{|j|=1}^{T-1} k^2\left(\frac{j}{M}\right)\hat{\rho}^2(j) - C_{2T}(M)}{\sqrt{2D_{2T}(M)}} \tag{10}$$

where $C_{2T}(M)$ and $D_{2T}(M)$ are the centering and scaling factors;

$$\begin{aligned} C_{2T}(M) &= \sum_{|j|=1}^{T-1}(1-|j|/T)k^2(j/M) \\ D_{2T}(M) &= 2\left[1+\hat{\rho}^4(0)\right]\sum_{j=1}^{T-1}(1-|j|/T)\{1-(|j|+1)/T\}k^4(j/M) \end{aligned}. \tag{11}$$

The Q_1 and Q_2 statistics in testing for downside Granger-causality are one-sided. Therefore, the upper-tailed normal distribution critical values should be used, for which the asymptotic critical value at the 5% level is 1.645. If the computed Q_1 (or Q_2) statistic is larger than the asymptotic critical value at the desired confidence level, then the null hypothesis of "no downside causality" at all lags is rejected.

3. Data and Empirical Results

3.1. Data Description and Preliminary Analysis

We use monthly data on business confidence indices for the period from January 1988 to September 2012 for six EU countries, namely, Greece, Italy, Portugal, Spain, France, and Germany. A common problem in investigating the causal interrelationships is the possibly of obtaining spurious results due to the effects of common third factors or because there are confounding variables. This is important since a spurious causal relationship between two variables, X and Y, can arise when a common third factor, Z, that causes both X and Y is not included in the model (Hsiao, 1982). We address this problem in line with Anderton et al (2004) and Fei (2011) by controlling for the influence of the domestic real economic and monetary developments (e.g. industrial production and inflation) as well the possible common international influences (e.g. business confidence developments in the US and in the EU in general). All data are taken from the OECD's Main Economic Indicators (MEI) databases.

The descriptive statistics are presented in Table 1. The means of the first differences of all business confidence index series are found to be negative. All series show evidence of strong negative skewness and excess kurtosis which indicate that they are leptokurtic. The Jarque-Bera normality test also rejects the normality for the first differences of all business confidence index series. The Ljung-Box *Q* statistic indicates the presence of serial correlation in the first differences and the squared first differences of all business confidence index series. Finally, all series are found to be stationary upon testing for the presence of unit roots by means of the augmented Dickey-Fuller (ADF), Phillips-Perron (PP), and the Kwiatkowski, Phillips, Schmidt and Shin (KPSS) unit root tests.

< Please insert Table 1. approximately here >

The preliminary analysis of data indicates the presence of ARCH effects in the business confidence indices. Hence, we estimate the GARCH models to determine the standardized residuals and the time-varying value-at-risk (VaR) series for testing the presence of causal relationships among business confidence indices. In choosing the appropriate GARCH model, we estimate various models and compare their likelihood ratios. We use the Akaike information criterion (AIC) in selecting the number of autoregressive parameters in the ARMA models. We find that the GARCH (1,1) model is adequate to describe time series behavior of the data during the sample period.

Table 2 presents the maximum likelihood estimates of the AR-GARCH model results. Note that we estimate two different GARCH models for each business confidence index series – with and without accounting for the effects of third factors.

<Please insert Table 2 approximately here>

The results in Table 2 suggest that business confidence index series are significantly affected by the common and third factors. Specifically, the developments in the business sentiments for the Euro area are found to be statistically significant at the 5% level in all cases. In addition, the US business confidence index variable is statistically significant at conventional significance levels for all countries except for France and Spain. On the other hand, country specific factors are not found to be statistically significant except for France and Italy where the growth rate of industrial production significantly affects business confidence. Furthermore, the log-likelihood values for the GARCH models with common and third factors are found to be higher than the GARCH models without common and third factors. These findings indicate that the common and third factors increase the explanatory power of the GARCH model.

3.2 Hong et al.'s (2009) Downside Risk Granger-Causality Test Results

As a first step in testing for Granger-causality-in-risk, we calculate value-at-risk (VaR) at the 5% and 10% risk levels to detect the presence of downside risk spillovers. Although the commonly used levels for α are 5% and 1% in the finance literature where high frequency data are used, we consider the 5% and 10% risk levels for the time-varying VaR in our study since our data frequency is monthly and relatively small compared to high frequency data sets. Note that Granger-causality-in-risk test depends on extreme cases in the series where the extreme cases are determined according to time-varying VaR level. Therefore, it can be said that it is possible to determine much more extreme cases when high frequency data are used. In this context, when we consider 1% risk level for α, it can be determined only three or four extreme cases for all series. It is well known that it is not adequately number of observations to examine the presence of causal relation between series. Hence, we cannot consider the 1% risk levels for the time-varying VaR in our study. Table 3 and Table 4 present the cases of extreme low business confidence chosen at the 5% and 10% risk levels, respectively.

<Please insert Table 3 approximately here>

<Please insert Table 4 approximately here>

Based on the periods identified in Table 3 and Table 4, Table 5 presents the contemporaneous downside Granger-causality test results between the business confidence indices in our sample by means of Hong's et al. (2009) Q_2 test statistic.

<Please insert Table 5 approximately here>

The results presented in Table 5 suggest strong contemporaneous downside causality between France and Germany, France and Portugal, Germany and Portugal, and Germany and Spain at the 5% risk level. When the downside risk definition is taken at 10%, a contemporaneous causal relationship between Greece and Spain, France and Italy, Italy and Spain, Portugal and Spain are also detected.

Next, we investigate the unidirectional downside Granger-causality effects using the time-varying VaRs that are obtained from GARCH model with common and third factors and employ Hong et al.'s Q_1 test statistics for adjusted business confidence index series.

The downside bidirectional confidence spillover test results are presented in Table 6. One striking observation in Table 6 is the decrease in the number of statistically significant results when the third factors are accounted for. The only statistically significant downside Granger-causal relationships are found to be running from Portugal to Spain at the 5% risk level and from Spain to Italy and Portugal at the 10% risk level. These results indicate an overall feedback relationship in downside risk transmission between Spain and Portugal while the extreme pessimism in Spain appears to be taking its toll on the business mood in Italy as well.

<Please insert Table 6 approximately here>

4. Conclusions

The business confidence channel of business cycle and economic shock transmission is an under-researched area in the literature. Under normal economic times, business confidence channel may not be as important as the other channels such as trade, financial and capital flows channels in explaining international business cycle transmission. However, at times of extreme economic and financial stress, the influence of the confidence factors in the transmission of shocks might become more pronounced. Using Hong et al.'s (2009) downside risk Granger-causality tests, our study furthers the evidence for the presence of confidence channel effects in business sentiment transmission between the economically stressed Southern European countries (Greece, Italy, Portugal, and Spain) and France and Germany. An examination of the downside risk Granger-causality tests results suggest that a further deterioration in business confidence in Spain and Portugal cause a worsening in each other. In addition, while there is a causal effect from Spain to Italy, we do not find evidence of Granger causality in risk from extreme pessimism in Italy on other countries, such as Germany and France.

The downside risk Granger-causality test results indicate that extreme pessimism in business sentiment in Greece does not Granger cause in risk similar business mood in other countries in the sample after common and third factors effects are accounted for. That being said, it should be emphasized that the results from the contemporaneous causality-in-risk tests still indicate the some evidence for the presence of a wider extreme risk business confidence spillover effects across the countries in our sample. There are, for instance, concurrent or current month risk spillover effects between Germany and all other countries in our sample. Furthermore, there is evidence for the same month effects in extremely low business confidence transmission between France and Portugal and Greece and Spain. These results are generally qualitatively in line with the Camacho et al.'s (2008) study where Greece, Portugal, Italy, Germany, and France were found to be in the same cluster with similar business cycle properties. Spain, however, was classified to be in another cluster with more proximity to Denmark, Turkey, Luxembourg, and Finland, among others. Nevertheless, Camacho's study uses (monthly) data from 1962 to early 2004, hence, the most recent large co-movements are not included in the estimations. Furthermore, we examine only the downside risk causal relationships.

The results from the contemporaneous causality-in-risk tests indeed complement those from the unidirectional causality in risk tests that involve require lagged responses. For instance, the contemporaneous-causality-in-risk test results suggest that any negative spillovers originating from Greece are reflected in the current month's business confidence index in Greece (and vice versa). However, the lack of a causality-in-risk relationship in any direction between Greece and Spain indicate that any short-term reactions do not last more than a month, leading to a rather neutral effects over longer periods.

Overall, despite the presence of some short-term, same month spillover effects, our results suggest that the transmission of extremely low business confidence across the countries in our sample has been rather localized (a feedback between Spain and Portugal and from Spain to Italy) so far. The pessimistic business mood in in the countries in our sample is mostly due to the common adverse economic environment and to each country's own domestic economic developments.

From a methodological point of view, these findings highlight the differences that can arise from the use of Granger-causality tests that include periods of high, normal and low business sentiments in the sample versus the downside-risk version that focusses on the causal relationships that might arise only under a low sentiment economic environment. As such, our findings shed further light into the causal linkages in business sentiment transmission in view of the current crisis in Europe.

References

Aguiar-Conraria, L. and M.J. Soares (2011), Business Cycle Synchronization and the Euro: A Wavelet Analysis, Journal of Macroeconomics. 33: 477-489.

Anderton, R., di Mauro, F. and Moneta, F. (2004), Understanding the impact of the external dimension on the Euro area: Trade, capital flows and other international macroeconomic linkages. European Central Bank Occasional Paper Series, No. 12, April.

Bali, T.G. (2000), Testing the empirical performance of stochastic volatility models of the short term interest rate, Journal of Financial and Quantitative Analysis. 35: 191-215.

Camacho, M., Perez-Quiros, G. and Saiz, L. (2006), Are European business cycles close enough to be just one? Journal of Economic Dynamics and Control. 30: 1687-1706.

Camacho, M., Perez-Quiros, G. and Saiz, L. (2008), Do European business cycles look like one? Journal of Economic Dynamics and Control. 32: 2165-2190.

Chamley, C. P. and Pinto, B. (2011), Why official bailouts tend not to work: An example motivated by Greece 2010. The Economists' Voice 8(1): Article 3. (http://www.bepress.com/ev/vol8/iss1/art3) (Last accessed date: January 31, 2012).

De Haan, J., R. Inklaar, and R. Jong-A-Pin (2008). Will Business Cycles in the Euro Area Converge? A Critical Survey of Empirical Research, Journal of Economic Surveys. 22(2): 234-273.

Drake, L. and Mills, T. (2010), Trends and cycles in Euro are GDP, Applied Economics. 42: 1397-1401.

Fan, Y., Y-J. Zhang, H-T. Tsai, and Y-M Wei (2008), Estimating 'Value at Risk' of crude oil price and its spillover effect using the GED-GARCH approach, Energy Economics. 30 (6): 1356-1371.

Fei, S. (2011), "The confidence channel for the transmission of shocks", Banque de France Working Paper, No. 314.

Gouveia, S. and Correia, L. (2008), Business cycle synchronisation in the Euro area: The case of small countries, International Economics and Economic Policy. 5: 103-121.

Hong, Y., H. Li, and F. Zhao (2004), Out-of-sample performance of discrete-time short-term interest models, Journal of Business and Economic Statistics. 22: 457–473.

Hong, Y., H. Li, and F. Zhao (2007), Can the random walk model be beaten in out-of-sample density forecasts? Evidence from intraday foreign exchange rates, Journal of Econometrics. 141: 736–776

Hong, Y., Y. Liu, and S. Wang (2009), Granger causality in risk and detection of extreme risk spillover between financial markets, Journal of Econometrics. 150, 271-287.

Hsiao, C., (1982). Autoregressive modeling and causal ordering of economic variables, Journal of Economic Dynamics and Control. 4, 243–259.

Kappler, M. (2011), Business cycle co-movement and trade intensity in the Euro area: Is there a dynamic link, Jahrbücher für Nationalökonomie und Statistik. 231(2): 247-265.

Konstantakopoulou, I. and E. Tsionas (2011), The business cycle in Eurozone economies (1960 to 2009), Applied Financial Economics. 21: 1495-1513.

Lee, T-H and W. Yang (2006), Money-income Granger-causality in quantiles. http://www.faculty.ucr.edu/~taelee/paper/paper1.pdf.

Liu, X., S. Cheng, S. Wang, Y. Hong, and Y. Li (2008), An empirical study on information spillover effects between the Chinese copper futures market and spot market, Physica A. 387 (4): 899-914.

Longin, F.M. (2000), From Value at Risk to stress testing: The extreme value approach, Journal of Banking and Finance. 24: 1097–1130.

Papageorgiou, T., P.G. Michaelides, and J.G. Milios (2010), Business cycles synchronization and clustering in Europe (1960-2009), Journal of Economics and Business. 62: 419-470.

Sensier, M., M. Artis, C.R. Birchenhall, and D.R. Osborn (2003), Domestic and international influences on business cycle regimes in Europe, The University of Manchester Discussion Paper, http://www.ses.man.ac.uk/cgbcr/discussi.htm.

Table 1: Descriptive statistics for first differences of business confidence index series

	France	Germany	Greece	Italy	Portuguese	Spain
N	297	297	297	297	297	297
Mean ($x10^4$)	-0.521	-0.252	-0.903	-0.854	-1.410	-0.618
Std. Dev.	0.0017	0.0023	0.0023	0.0018	0.0020	0.0015
Skewness	-0.329	-0.953	-1.009	-0.435	-0.834	-0.184
Kurtosis	3.853	5.434	5.566	3.460	6.799	3.828
Jarque-Bera	14.369 [0.001]	118.248 [0.000]	131.862 [0.000]	11.993 [0.002]	213.035 [0.000]	10.160 [0.006]
ARCH (5)	234.98 [0.000]	617.63 [0.000]	161.40 [0.000]	150.13 [0.000]	208.80 [0.000]	160.39 [0.000]
Q (20)	80.817 [0.476]	1022.6 [0.000]	296.98 [0.000]	769.58 [0.000]	697.96 [0.000]	962.81 [0.000]
Qs (20)	299.315 [0.000]	412.261 [0.000]	372.72 [0.000]	290.50 [0.000]	290.29 [0.000]	410.19 [0.000]
ADF	-5.479***	-4.742***	-7.137***	-4.797***	-5.627***	-4.626***
PP	-4.170***	-4.246***	-4.352***	-4.578***	-4.172***	-4.626***
KPSS	0.030***	0.028***	0.121***	0.036***	0.034***	0.044***

Notes: The figures in square brackets show the probability (*p*-values) of rejecting the null hypothesis. ARCH (5) indicates LM conditional variance test. $Q(20)$ and $Q_s(20)$ indicate Ljung-Box serial correlation test for return and squared return series respectively. *** indicate that the series in question is stationary at the 1% significance level.

Table 2: GARCH model results

Parameters	Common and third factors are ignored						Common and third factors are accounted for					
	France	**Germany**	**Greece**	**Italy**	**Portuguese**	**Spain**	**France**	**Germany**	**Greece**	**Italy**	**Portuguese**	**Spain**
	Mean equation						**Mean equation**					
$\mu(x10^4)$	-1.240	-0.790	1.000	-1.140	-0.960	-0.560	-0.099	0.120	0.210	-0.100	-1.740	0.490
ρ_1	1.574***	1.812***	1.428***	1.547***	1.318***	1.326***	1.227***	1.511***	1.389***	1.184***	1.152***	1.084***
ρ_2	-1.049***	-1.159***	-0.990***	-1.014***	-0.653***	-0.728***	-0.793***	-0.850***	-1.092***	-0.706***	-0.590***	-0.594***
ρ_3	0.537***	0.289***	0.325***	0.469***	0.161***	0.379***	0.386***	0.236***	0.502***	0.222***	0.088	0.304***
ρ_4	-0.176***	-	-	-0.117**		-0.123**	-0.139**	-	-0.159***	-		-0.126**
δ_1							-0.010	-0.005	-0.007	-0.020	0.014	-0.026
δ_2							0.003***	-0.0005	-0.00004	-0.007**	0.0004	0.001
δ_3							0.686***	0.509**	0.561***	0.705***	0.606***	0.571***
δ_4							0.020	0.071**	0.101*	0.072**	0.131***	0.024
	Variance equation						**Variance equation**					
$\omega(x10^6)$	0.028	0.032**	0.493**	0.068	0.120**	0.034*	0.024*	0.022*	0.461*	0.024	0.093**	0.042
α	0.030	0.151**	0.131	0.077	0.144**	0.043	0.059	0.096**	0.126	0.046	0.154**	0.058*
β	0.880***	0.711***	0.405	0.769*	0.699***	0.872***	0.844***	0.798***	0.363	0.888***	0.706***	0.817***
ν	1.475***	1.987***	1.945***	1.494***	1.646***	1.911***	1.705***	1.807***	1.646***	1.752***	1.863***	1.808***
L-Likelihood	1808.966	1859.034	1624.583	1757.551	1684.335	1768.964	1833.834	1860.829	1644.970	1776.669	1698.213	1787.439
Q (20)	16.581 [0.413]	21.313 [0.212]	19.719 [0.288]	15.152 [0.513]	25.812 [0.077]	31.857 [0.010]	18.342 [0.304]	14.428 [0.636]	11.106 [0.802]	15.007 [0.595]	21.867 [0.189]	26.314 [0.049]
Q_s (20)	15.119 [0.653]	15.996 [0.592]	17.931 [0.460]	13.835 [0.739]	15.403 [0.634]	25.648 [0.108]	29.305 [0.044]	13.213 [0.778]	18.685 [0.414]	15.971 [0.594]	18.421 [0.428]	22.523 [0.209]

Notes: The figures in square brackets show the *p*-values. *v* indicates GED. $Q(20)$ and $Q_s(20)$ indicates Ljung-Box serial correlation test for business confidence index series and squared business confidence index series respectively. *, ** and *** indicates statistically significance at the 10%, 5% and 1% level respectively.

Table 3: Extremely Low Business Confidence Cases (common and third factors ignored)

Common and third factors are ignored											
5% Risk Level						10% Risk Level					
France	Germany	Greece	Italy	Portuguese	Spain	France	Germany	Greece	Italy	Portuguese	Spain
1989M07	1989M06	1988M11	1989M03	1989M02	1991M01	1988M11	1988M07	1988M11	1988M06	1989M02	1990M04
1989M12	1992M07	1989M02	1990M05	1992M05	1991M09	1989M07	1989M06	1989M02	1989M03	1989M08	1990M07
1990M08	1992M08	1990M06	1991M08	1992M11	1992M05	1989M12	1990M04	1989M07	1989M08	1990M12	1991M01
1992M03	1998M04	1990M11	1992M11	1993M03	1992M09	1990M02	1990M08	1990M06	1990M05	1992M05	1991M09
1998M07	1998M09	1992M03	1995M08	1994M11	1992M10	1990M08	1990M10	1990M11	1991M08	1992M09	1992M05
1999M12	2001M08	1995M12	1996M01	1995M02	1995M09	1991M02	1991M02	1991M01	1992M11	1992M11	1992M09
2002M06	2006M12	2004M05	1997M02	1995M08	1998M08	1991M06	1992M07	1992M03	1993M12	1993M03	1992M10
2003M01	2007M07	2005M05	2000M06	1996M07	2000M05	1992M03	1992M08	1992M11	1995M03	1994M11	1995M09
2003M12	2008M04	2008M08	2001M09	1998M04	2001M01	1992M09	1995M03	1993M10	1995M08	1995M02	1996M01
2005M01	2008M06	2008M09	2002M06	2002M07	2003M03	1994M05	1995M11	1994M09	1995M09	1995M08	1998M08
2008M04	2008M08	2008M10	2002M10	2005M05	2007M04	1995M08	1998M04	1994M10	1996M01	1996M07	1998M10
2008M09	2008M09	2008M11	2006M07	2008M08	2007M12	1996M05	1998M09	1995M11	1997M02	1997M02	2000M05
2008M10	2008M10	2008M12	2008M06	2008M09	2008M08	1998M07	2000M06	1995M12	1998M09	1997M05	2000M08
2011M04	2011M03	2011M03	2008M09	2011M05	2008M09	1999M12	2001M02	1997M12	2000M04	1998M04	2001M01
2011M07	2012M02	2012M05	2008M10	2011M08	2011M07	2001M03	2001M08	1998M05	2000M06	2000M12	2001M07
						2001M08	2003M02	1998M08	2000M12	2002M04	2002M09
						2002M06	2004M05	1999M05	2001M05	2002M07	2003M01
						2003M01	2005M01	2000M03	2001M09	2003M10	2003M03
						2003M02	2006M12	2002M12	2002M03	2005M05	2006M01
						2003M12	2007M07	2004M05	2002M06	2005M11	2007M04
						2005M01	2008M04	2005M05	2002M10	2006M08	2007M12
						2005M03	2008M06	2006M10	2003M11	2007M06	2008M02
						2008M02	2008M08	2007M12	2004M11	2008M03	2008M08
						2008M04	2008M09	2008M08	2006M07	2008M08	2008M09
						2008M09	2008M10	2008M09	2007M05	2008M09	2008M10
						2008M10	2011M01	2008M10	2008M06	2011M02	2009M02
						2010M04	2011M03	2008M11	2008M09	2011M03	2011M01
						2011M04	2012M02	2008M12	2008M10	2011M05	2011M03
						2011M07	2012M03	2011M03	2008M11	2011M08	2011M07
						2012M03	2012M05	2012M05	2012M04	2011M11	2012M06
15	15	15	15	15	15	30	30	30	30	30	30

Table 4: Extremely Low Business Confidence Cases (after accounting for common and third factors)

Common and third factors are accounted for											
5% Risk Level						**10% Risk Level**					
France	**Germany**	**Greece**	**Italy**	**Portuguese**	**Spain**	**France**	**Germany**	**Greece**	**Italy**	**Portuguese**	**Spain**
1989M07	1992M02	1988M11	1989M03	1989M02	1989M11	1989M07	1988M07	1988M11	1989M03	1988M05	1989M11
1989M12	1992M08	1989M02	1989M08	1992M11	1990M04	1989M12	1989M06	1989M02	1989M08	1989M02	1990M04
1990M08	1995M11	1990M06	1990M05	1993M03	1991M01	1990M02	1990M10	1990M06	1990M05	1989M08	1990M07
1990M10	1998M04	1992M03	1990M06	1994M11	1992M05	1990M08	1991M02	1990M11	1990M06	1992M05	1991M01
1995M08	2001M08	1993M10	1991M08	1995M02	1992M10	1990M09	1992M02	1991M01	1990M10	1992M11	1992M05
1998M12	2006M12	1994M09	1995M08	1995M08	1995M09	1990M10	1992M07	1992M03	1991M08	1993M01	1992M06
1999M12	2007M07	1994M10	1996M01	1996M07	2000M05	1991M02	1992M08	1993M10	1993M12	1993M03	1992M10
2002M06	2008M04	1995M12	1996M04	2001M12	2002M01	1992M03	1995M03	1994M08	1995M08	1994M11	1995M09
2003M02	2008M06	2002M12	1997M02	2002M09	2003M09	1993M01	1995M11	1994M09	1996M01	1995M02	1996M01
2005M01	2008M08	2004M05	2000M06	2005M05	2006M01	1993M05	1997M08	1994M10	1996M04	1995M08	1999M07
2008M04	2008M09	2005M05	2001M09	2006M03	2007M04	1994M05	1998M04	1995M12	1996M10	1996M07	2000M05
2008M09	2008M10	2007M12	2002M06	2008M08	2007M12	1995M08	1998M09	1997M06	1997M02	1997M05	2000M08
2010M01	2011M01	2008M12	2002M10	2008M09	2008M08	1998M07	2000M06	1997M12	1998M07	1997M08	2001M07
2010M04	2011M07	2009M02	2003M11	2009M04	2009M02	1998M12	2001M02	1998M08	1998M09	1998M04	2002M01
2011M07	2012M02	2011M03	2006M07	2011M08	2011M01	1999M12	2001M08	1999M05	2000M06	2001M12	2002M03
						2001M03	2003M05	2000M03	2001M08	2002M04	2002M09
						2001M08	2004M05	2002M12	2001M09	2002M09	2003M01
						2002M01	2005M01	2004M05	2002M03	2003M10	2003M09
						2002M06	2006M12	2004M07	2002M06	2005M05	2004M07
						2003M01	2007M07	2005M05	2002M10	2006M03	2006M01
						2003M02	2008M04	2006M10	2003M09	2008M03	2007M04
						2003M12	2008M06	2007M05	2003M11	2008M04	2007M12
						2005M01	2008M08	2007M12	2003M12	2008M08	2008M02
						2007M03	2008M09	2008M09	2004M11	2008M09	2008M08
						2008M04	2008M10	2008M12	2006M07	2009M04	2008M09
						2008M09	2011M01	2009M02	2007M05	2011M02	2009M02
						2010M01	2011M03	2009M11	2008M06	2011M03	2009M11
						2010M04	2011M07	2010M02	2008M09	2011M08	2011M01
						2011M04	2012M02	2010M04	2009M02	2011M11	2011M07
						2011M07	2012M03	2011M03	2011M01	2012M09	2011M11
15	15	15	15	15	15	30	30	30	30	30	30

Table 5: Extreme Contemporaneous Confidence Spillover test results

Hong et al. Q_2 Statistics				
Causality Direction	**Common and third factors are ignored**		**Common and third factors are accounted for**	
	5% Risk Level	**10% Risk Level**	**5% Risk Level**	**10% Risk Level**
France ↔ Germany	3.184***	4.552***	3.180***	2.622***
France ↔ Greece	3.184***	0.292	-0.077	-0.499
France ↔ Italy	2.486***	-0.308	0.628	1.405*
France ↔ Portuguese	-0.488	-0.501	3.180***	-0.289
France ↔ Spain	0.630	1.302*	-0.459	-0.336
Germany ↔ Greece	7.211***	2.722***	-0.077	-0.336
Germany ↔ Italy	5.929***	1.302*	-0.459	2.891***
Germany ↔ Portuguese	2.486***	-0.308	3.180***	2.891***
Germany ↔ Spain	0.630	1.302*	3.180***	1.225
Greece ↔ Italy	0.374	-0.308	-0.459	-0.501
Greece ↔ Portuguese	5.929	1.302*	0.628	0.347
Greece ↔ Spain	0.630	2.722***	-0.459	2.622***
Italy ↔ Portuguese	1.880**	1.302*	-0.459	-0.499
Italy ↔ Spain	-0.488	-0.308	-0.077	1.405*
Portuguese ↔ Spain	2.486***	0.292	0.628	1.405*

Notes: *, ** and *** indicates the existence of causal link at the 10%, 5% and 1% level respectively.

Table 6: Extreme Confidence Spillover test results

Causality Direction	Common and third factors are ignored						Common and third factors are accounted for					
	5% Risk Level			10% Risk Level			5% Risk Level			10% Risk Level		
	M=1	M=2	M=3	M=1	M=2	M=3	M=1	M=2	M=3	M=1	M=2	M=3
France →Germany	-0.635	-0.351	-0.215	-0.358	0.505	1.343	-0.767	-0.875	-1.000	-0.398	-0.486	-0.709
France → Greece	1.002	1.138	1.316*	-0.694	-0.594	-0.464	-0.142	-0.051	-0.151	-0.262	0.054	0.009
France → Italy	-0.674	-0.597	-0.382	1.852**	2.145***	2.441***	-0.098	-0.276	-0.295	-0.265	-0.385	-0.356
France → Portuguese	3.471***	3.420***	2.800***	0.465	0.311	0.232	-0.761	-0.651	-0.738	-0.446	-0.468	-0.582
France → Spain	-0.533	-0.270	-0.114	0.507	0.256	0.097	-0.491	-0.236	-0.498	-0.276	-0.169	-0.464
Germany → France	10.202***	9.737***	8.881***	6.302***	6.091***	5.472***	-0.752	-0.698	-0.764	0.480	0.806	1.180
Germany → Greece	5.620***	7.110***	9.606***	4.183***	4.828***	5.438***	0.829	0.605	0.404	-0.370	-0.051	-0.106
Germany → Italy	3.565***	3.565***	3.363***	1.767**	2.180**	2.359***	-0.704	-0.478	-0.266	-0.409	-0.574	-0.651
Germany → Portuguese	-0.639	-0.522	-0.366	-0.747	0.382	0.988	1.081	0.843	0.624	-0.755	-0.746	-1.040
Germany → Spain	1.011	2.590***	2.889***	3.874***	4.882***	5.175***	-0.167	0.235	0.187	0.528	0.794	0.710
Greece → France	4.441***	4.519***	4.341***	0.462	0.442	0.561	-0.142	0.156	0.268	-0.458	-0.686	-0.653
Greece → Germany	0.827	0.714	0.444	-0.771	-0.709	-0.912	-0.141	-0.194	-0.178	-0.282	-0.583	-0.617
Greece → Italy	8.318***	7.912***	7.160***	6.355***	6.097***	5.453***	0.862	0.892	0.767	-0.345	-0.494	-0.497
Greece → Portuguese	-0.802	-0.599	-0.514	-0.486	-0.623	-0.770	-0.766	-0.450	-0.249	-0.494	-0.509	-0.564
Greece → Spain	-0.625	-0.429	-0.213	1.721**	3.271***	4.337***	-0.109	-0.285	-0.396	-0.646	-0.589	-0.442
Italy → France	-0.278	-0.630	-0.262	-0.206	-0.197	0.084	-0.021	-0.019	-0.317	1.259	0.480	0.896
Italy → Germany	-0.664	-0.904	-0.892	-0.634	-0.242	0.285	-0.032	-0.327	-0.348	-0.499	-0.278	-0.133
Italy → Greece	3.486***	4.231***	4.699***	0.429	0.422	0.582	-0.642	-0.809	-0.836	-0.456	-0.477	-0.584
Italy → Portuguese	-0.816	-0.935	-1.058	-0.786	-0.636	-0.528	1.001	-0.284	0.566	-0.636	-0.857	-0.906
Italy → Spain	0.405	0.241	0.015	1.737**	1.788**	1.691**	-0.722	-0.831	-0.942	0.471	0.418	0.174
Portuguese → France	3.378***	3.476***	3.252***	-0.454	0.078	0.495	-0.476	-0.501	-0.526	-0.630	-0.580	-0.373
Portuguese → Germany	3.544***	3.477***	3.411***	2.012**	1.765**	1.445*	0.763	0.987	1.117	-0.503	-0.501	-0.618
Portuguese → Greece	0.496	0.552	0.606	0.394	0.317	0.134	-0.216	-0.215	-0.290	-0.720	-0.380	-0.439
Portuguese → Italy	6.775***	6.377***	5.880***	1.887**	1.834**	1.538*	0.815	0.622	0.435	-0.441	-0.480	-0.570
Portuguese → Spain	3.499***	3.259***	2.778***	4.324***	3.874***	3.664***	4.487***	4.312***	3.953***	-0.701	-0.539	-0.393
Spain → France	0.883	0.652	0.447	3.843***	3.687***	3.211***	0.859	0.858	0.760	0.362	0.204	0.138
Spain → Germany	4.576***	4.543***	4.471***	6.298***	6.221***	5.780***	0.959	1.007	1.293	0.311	0.434	0.507
Spain → Greece	1.356	1.020	1.593*	-0.407	0.512	1.296*	-0.230	0.059	0.154	-0.304	-0.562	-0.586
Spain → Italy	15.006***	14.695***	13.661***	9.633***	9.196***	8.387***	0.850	1.016	1.364*	1.964**	1.846**	1.635*
Spain → Portuguese	3.357***	3.208***	2.747***	0.344	0.177	-0.034	0.849	1.094	1.141	1.887**	1.766**	1.502*

Notes: *, ** and *** indicates the existence of causal link at the 10%, 5% and 1% level respectively. M represents the maximum lag.