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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 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 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 amongst different countries led to many studies in the literature. It is generally found that there is some evidence for

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the presence of country clusters that share common characteristics of business cycle movements (e.g. timing, duration, and amplitude). De Haan, Inklaar, and Jong-A-Pin (2008), Camacho, Perez-Quiros, and Saiz (2006, 2008), Gouveia and Correia (2008), Drake and Mills (2010), Papageorgiou, Michaelides, and Milios (2010), Konstantakopoulou and Tsionas (2011), Aguiar-Conraria and Soares (2011), and Aguiar-Conraria, Martins, and Soares (2013) provide a review of the literature and empirical evidence on business cycle synchronization in Europe. Aguiar-Conraria, Martins, and Soares (2013), for instance, analyze the business cycle synchronization by using economic sentiment index data for the Euro zone countries and find that the similarity and the synchronization of economic sentiments increased in Europe after the EMU.

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, Inklaar, and Jong-A-Pin (2008) cites the trade linkages as one of the most important business cycle transmission channels. However, at times of extreme economic and financial stress, such as the global financial crisis or the recent 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 amongst 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 comovements. An earlier work by Anderton, di Mauro, and Moneta (2004) also argues in favour of 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, di Mauro, and Moneta 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 pairwise causal relationships between the 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 (BCI) data for Germany and France because these countries have largest economy amongst the Euro zone countries. This is supported by the findings of Aguiar-Conraria, Martins, and Soares (2013) who find the presence of high correlations amongst economic sentiment index of Germany, France, and Euro zone countries. Hence, it can be said that these countries represent overall mood of the Euro zone.

Our empirical methodology is based on Hong, Liu, and Wang's (2009) extreme risk spillovers test. Hong, Liu, and Wang's (2009) test is also called the downside risk Granger-causality test or the Granger-causality-in-risk test. Hong, Liu, and Wang'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 be a more pronounced spillover effect from the deterioration of business sentiment in one country to the business sentiment in another country in times of crisis. If that effect weakens or disappears in non-crisis times, the tests that include both non-crisis and crisis episodes may not detect a causal relationship in the overall time span. Hence, it is possible that the business confidence channel may not be as important as the other channels of business cycle transmission under normal times; but manifests itself more strongly under times of extreme economic stress. 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. Our study also shows the differences that can arise from the use of linear Granger-causality tests that combine high, normal, and low business sentiments period in the sample vs. the downside-risk version, which focuses only on the periods with extremely low levels of business confidence.

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, Liu, and Wang's (2009) Granger-causality-in-risk test

Hong, Liu, and Wang (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, which are derived from general asset, return distributions cannot adequately serve as a measure of market risks in those high stress periods. Moreover, Hong, Li, and Zhao (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, Liu, and Wang (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, Liu, and Wang (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 (2012), for instance, employ the Granger-causality-in-risk test to investigate the money-income causality for the US.

The test methodology proposed by Hong, Liu, and Wang (2009) is closely related to extreme downside behaviour 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. BCI 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 in 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 $1-\alpha$, 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:

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

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 is an extensive literature on how to estimate the time-varying VaR, including the variance–covariance method, the historical simulation approach, and Monte Carlo simulation approaches. Fan et al. (2008) note that the most common estimation approaches are parametric, such as the GARCH model and the RiskMetrics methodology. In Fan et al. (2008), the GARCH modelling approach his 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]:

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

In Equation (2), ΔBCI_t indicates the first difference of the logarithm of BCI[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 possibility of obtaining spurious results due to the effects of common and 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. (2004), for instance, provide 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 more strongly come into play 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:

$$\begin{aligned} \Delta \text{BCI}_{lt} &= \mu + \sum_{i=1}^{k} \rho_i \Delta \text{BCI}_{lt-i} + \delta_1 \text{INF}_{l,t-1} + \delta_2 \text{GIP}_{l,t-1} + \delta_3 \Delta \text{BCI}_{Europe,t-1} \\ &\quad + \delta_4 \Delta \text{BCI}_{US,t-1} + \varepsilon_{lt} \\ \sigma_{lt}^2 &= \omega + \alpha \varepsilon_{lt-i}^2 + \beta \sigma_{lt-1}^2 \end{aligned} \tag{3}$$

where $\Delta \text{BCI}_{i,t}$ is first difference of the logarithm of the BCI for country l in the sample, and $\text{INF}_{l,t-1}$ and $\text{GIP}_{l,t-1}$ 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, Liu, and Wang (2009) state the null and alternative hypotheses to test for one-way downside Granger-causality between business confidence indices as follows:

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

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

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:

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

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:

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

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

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:

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

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

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

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

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

where $\hat{S}_l = \hat{\alpha}_l(1 - \hat{\alpha}_l)$ 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:

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

where M is a predetermined lag order and $k(j/M)$ is a weight function. Hong, Liu, and Wang (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, Liu, and Wang (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;

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

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 possibility of obtaining spurious results due to the effects of common and 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 and 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, di Mauro, and Moneta (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 as for 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 databases.

The descriptive statistics are presented in Table 1. The means of the first differences of all BCI 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 BCI series. The Ljung–Box Q statistic indicates the presence of serial correlation in the first differences and the squared first differences of all BCI 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.

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 VaR series for testing the presence of causal relationships amongst business confidence indices. In choosing the appropriate GARCH model, we estimate various models and compare their likelihood ratios. We use the Akaike information criterion 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 behaviour 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 BCI series – with and without accounting for the effects of common and third factors.

The results in Table 2 suggest that BCI 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 BCI 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.

Table 1. Descriptive statistics for first differences of BCI series.

	France	Germany	Greece	Italy	Portugal	Spain
N	297	297	297	297	297	297
Mean ($\times 10^4$)	−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	118.248	131.862	11.993	213.035	10.160
	[0.001]	[0.000]	[0.000]	[0.002]	[0.000]	[0.006]
ARCH (5)	234.98	617.63	161.40	150.13	208.80	160.39
	[0.000]	[0.000]	[0.000]	[0.000]	[0.000]	[0.000]
Q (20)	80.817	1022.6	296.98	769.58	697.96	962.81
	[0.476]	[0.000]	[0.000]	[0.000]	[0.000]	[0.000]
Qs (20)	299.315	412.261	372.72	290.50	290.29	410.19
	[0.000]	[0.000]	[0.000]	[0.000]	[0.000]	[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.
***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	Portugal	Spain	France	Germany	Greece	Italy	Portugal	Spain
Mean equation												
$\mu(\times 10^4)$	−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												
$\omega(\times 10^6)$	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***
v	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	21.313	19.719	15.152	25.812	31.857	18.342	14.428	11.106	15.007	21.867	26.314
	[0.413]	[0.212]	[0.288]	[0.513]	[0.077]	[0.010]	[0.304]	[0.636]	[0.802]	[0.595]	[0.189]	[0.049]
Q_s (20)	15.119	15.996	17.931	13.835	15.403	25.648	29.305	13.213	18.685	15.971	18.421	22.523
	[0.653]	[0.592]	[0.460]	[0.739]	[0.634]	[0.108]	[0.044]	[0.778]	[0.414]	[0.594]	[0.428]	[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 BCI series and squared BCI series respectively.
*, ** and ***Significance at the 10, 5 and 1% level respectively.

3.2. Linear bivariate Granger-causality test results

In this section, we present the results from the linear bivariate Granger-causality test for the countries in our sample. While our paper aims to investigate the presence of extreme risk or downside Granger-causality, the results presented in this section provide a comparison between the linear and downside risk Granger-causality tests in our context.[8] In order to provide better comparability with the downside risk Granger-causality test results in the next section (Section 3.3), we carry out the Granger-causality tests with and without the inclusion of the common and third factors. The results are presented in Table 3.

The results shown in Table 3 indicate that with the exception of a few cases (mainly, Greece) there is a feedback between the business confidence indices of the countries in our study when the common and third factors are ignored. The findings change substantially when the common and third factors are accounted for. There is no finding of a causal business confidence spillover feedback between the country pairs. Business sentiment in France is found to be unidirectional Granger-caused by the

Table 3. Linear Granger causality test results.

Causality direction	Common and third factors are ignored	Common and third factors are accounted for
France → Germany	16.357***	5.420
France → Greece	21.744***	5.237
France → Italy	32.421***	7.294
France → Portugal	30.014***	3.402
France → Spain	22.771***	4.177
Germany → France	38.623***	28.144***
Germany → Greece	41.366***	5.282
Germany → Italy	28.750***	18.425***
Germany → Portugal	22.783***	0.241
Germany → Spain	41.588***	15.533***
Greece → France	0.982	7.431
Greece → Germany	1.783	3.898
Greece → Italy	10.041**	5.862
Greece → Portugal	5.714	5.118
Greece → Spain	6.499	9.604**
Italy → France	36.242***	14.248***
Italy → Germany	2.834	3.856
Italy → Greece	35.851***	3.870
Italy → Portugal	21.133***	12.982**
Italy → Spain	14.672***	6.613
Portugal → France	24.406***	10.772**
Portugal → Germany	13.271***	5.964
Portugal → Greece	30.008***	7.904
Portugal → Italy	18.022***	4.350
Portugal → Spain	15.176***	6.791
Spain → France	28.786***	9.059*
Spain → Germany	12.183***	3.845
Spain → Greece	22.095***	0.577
Spain → Italy	25.405***	5.059
Spain → Portugal	39.469***	15.982***

Notes: Lag specifications were selected by the BIC.
*, ** and ***The existence of causal link at the 10, 5 and 1% level respectively. Lag specifications were selected by the BIC.

business sentiment developments in Germany, Italy, Spain, and Portugal – but not by Greece. German business sentiment, on the other hand, causes the business confidence in France, Italy, and Spain. Developments in Greece are found to cause business sentiment changes only in Spain. Italian business sentiment developments Granger-cause the ones in France and Portugal, but they are themselves affected by the economic developments in Germany. Business confidence in Portugal is found to be unilaterally Granger-caused by the business confidence in Italy and Spain. However, there is a unilateral causal effect from Portugal to France. Finally, Spanish business sentiment developments are found to cause those in France and Portugal, but the developments in Germany and Greece appear to cause changes in the Portuguese business sentiment indicators.

One implication of these results is that Greece, despite making the headlines and causing concern for investors, does not have an effect on Germany and France – albeit it has some effect on the business sentiment in Spain. Business confidence in Spain, in turn, has some weaker effect on France and a stronger effect (as measured by the statistical significance levels) on Portugal. This finding is also in line with the results that business confidence neither in Spain nor Portugal has an effect on Germany and France; thereby, consistent with the results that Greek business confidence does not cause business confidence in France or Germany.

While these findings are illustrative of the inter-linkages between the business confidence developments in these six Eurozone countries, they cannot distinguish whether the causal linkages exist in both good and bad economic times, or whether they exist in bad or good economic times only (or at varying degrees in different times).This point is important since, business sentiment spillovers might be more pronounced under economic and financial stress conditions. In order to address this question, we now turn to tests of downside risk Granger-causality.

3.3. *Hong, Liu, and Wang's (2009) downside risk Granger-causality test results*

As a first step in testing for Granger-causality-in-risk, we calculate 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, only three or four extreme cases are determined for all series, which would not be adequate for statistical inferences. Hence, we could not consider the 1% risk levels for the time-varying VaR in our study. Tables 4 and 5 present the cases of extreme low business confidence chosen at the 5 and 10% risk levels, respectively.[9]

Based on the periods identified in Tables 4 and 5, Table 6 presents the contemporaneous downside Granger-causality test results between the business confidence indices in our sample by means of Hong, Liu, and Wang's (2009) Q_2 test statistic.

The results presented in Table 6 suggest a strong contemporaneous downside causality between France and Germany, France and Portugal, Germany and Portugal, and

Table 4. Extremely low business confidence cases (common and third factors ignored).

Common and third factors are ignored 10% risk level					
France	Germany	Greece	Italy	Portugal	Spain
1988M11	1988M07	1988M11*	1988M06	1989M02*	1990M04
1989M07*	1989M06*	1989M02*	1989M03*	1989M08	1990M07
1989M12*	1990M04	1989M07	1989M08	1990M12	1991M01*
1990M02	1990M08	1990M06*	1990M05*	1992M05*	1991M09*
1990M08*	1990M10	1990M11*	1991M08*	1992M09	1992M05*
1991M02	1991M02	1991M01	1992M11*	1992M11*	1992M09
1991M06	1992M07*	1992M03*	1993M12	1993M03*	1992M10*
1992M03*	1992M08*	1992M11	1995M03	1994M11*	1995M09*
1992M09	1995M03	1993M10	1995M08*	1995M02*	1996M01
1994M05	1995M11	1994M09	1995M09	1995M08*	1998M08*
1995M08	1998M04*	1994M10	1996M01*	1996M07*	1998M10
1996M05	1998M09*	1995M11	1997M02*	1997M02	2000M05*
1998M07*	2000M06	1995M12*	1998M09	1997M05	2000M08
1999M12*	2001M02	1997M12	2000M04	1998M04*	2001M01*
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
30	30	30	30	30	30

*Extremely low business confidence cases chosen at the 5% level.

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 BCI series.

The downside bidirectional confidence spillover test results are presented in Table 7. One observation in Table 7 is the decrease in the number of statistically significant results when the common and third factors are accounted for, which is in line with the findings from the linear Granger-causality tests presented earlier in Section 3.2. 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

Table 5. Extremely low business confidence cases (after accounting for common and third factors).

Common and third factors are accounted for 10% risk level					
France	Germany	Greece	Italy	Portugal	Spain
1989M07*	1988M07	1988M11*	1989M03*	1988M05	1989M11*
1989M12*	1989M06	1989M02*	1989M08*	1989M02*	1990M04*
1990M02	1990M10	1990M06*	1990M05*	1989M08	1990M07
1990M08*	1991M02	1990M11	1990M06*	1992M05	1991M01*
1990M09	1992M02*	1991M01	1990M10	1992M11*	1992M05*
1990M10*	1992M07	1992M03*	1991M08*	1993M01	1992M06
1991M02	1992M08*	1993M10*	1993M12	1993M03*	1992M10*
1992M03	1995M03	1994M08	1995M08*	1994M11*	1995M09*
1993M01	1995M11*	1994M09*	1996M01*	1995M02*	1996M01
1993M05	1997M08	1994M10*	1996M04*	1995M08*	1999M07
1994M05	1998M04*	1995M12*	1996M10	1996M07*	2000M05*
1995M08*	1998M09	1997M06	1997M02*	1997M05	2000M08
1998M07	2000M06	1997M12	1998M07	1997M08	2001M07
1998M12*	2001M02	1998M08	1998M09	1998M04	2002M01*
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
30	30	30	30	30	30

*Extremely low business confidence cases chosen at the 5% level.

while the extreme pessimism in Spain appears to be taking its toll on the business mood in Italy as well. In comparison to the findings from linear Granger-causality tests (Section 3.2), these findings indicate fewer cases of spillover effects of business sentiment changes. The feedback relationship between Spain and Portugal remain valid under both the linear Granger-causality test and under the downside risk Granger-causality test. Nevertheless, the linear Granger-causality test misses the business confidence spillover causality from Spain to Italy. This may be due to a weak or no causal linkage under normal or good economic times between the business sentiment indices of Spain and Italy. When the normal and good economic times are combined with the bad economic times, this leads to the failure to detect the causal linkages that exist only under times of high economic stress. Furthermore, the other cases of causal relationships that are found under the linear Granger-causality tests do not appear to be robust when we consider only the

Table 6. Extreme contemporaneous confidence spillover test results.

	Hong et al. Q_2 statistics			
	Common and third factors are ignored		Common and third factors are accounted for	
Causality direction	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 ↔ Portugal	−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 ↔ Portugal	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 ↔ Portugal	5.929	1.302*	0.628	0.347
Greece ↔ Spain	0.630	2.722***	−0.459	2.622***
Italy ↔ Portugal	1.880**	1.302*	−0.459	−0.499
Italy ↔ Spain	−0.488	−0.308	−0.077	1.405*
Portugal ↔ Spain	2.486***	0.292	0.628	1.405*

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

downside risk causal relationships between the business confidence indicators of the respective countries.

An examination of the results presented in Table 7 indicates that there are fewer cases of cross-country spillovers of economic developments in Europe compared to the literature discussed earlier. Nevertheless, it should be kept in mind that our analysis specifically focuses on the economic sentiment spillover during severe times, which is an under-researched area in the literature. Our study also differs from the earlier studies in the literature as we use an asymmetric (or downside only) version of the Granger-causality test, which is not utilized in the literature in this context.

From an economic policy point of view, our findings suggest that Spain is the key country in the context of the potential spillovers of the economic problems amongst the Southern European eurozone countries. In response to the economic crisis, extraordinary fiscal measures and packages were announced in the respective countries. Greece, Spain, Portugal, and Italy have all been undertaking ambitious fiscal adjustment packages in order to bring down the budget deficits substantially and to restore macroeconomic balances. The policies have shown some positive effects, and as of August 2014, the business confidence indicator in Spain nearly returned to its level at the beginning of 2008 after improving steadily since the middle of 2012. In Italy, the situation is more complex. Nevertheless, the business confidence indicator is improving gradually since the middle of 2013. In Portugal, as well, the BCI is on the rise since the beginning of 2013. In this sense, the Italian and the Portuguese business sentiment indicators appear to be following that of Spain's with some lag, which is in line with the notion of Granger-causality. Still, the common and third factors in each country may have a pronounced effect. This is seen in the case of Greece, for instance, where the BCI is generally improving since 2012, but it also shows more volatility.

Table 7. Extreme confidence spillover test results.

	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		
Causality direction	$M = 1$	$M = 2$	$M = 3$	$M = 1$	$M = 2$	$M = 3$	$M = 1$	$M = 2$	$M = 3$	$M = 1$	$M = 2$	$M = 3$
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 → Portugal	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 → Portugal	−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 → Portugal	−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 → Portugal	−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
Portugal → 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
Portugal → 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
Portugal → 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
Portugal → 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
Portugal → 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 → Portugal	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: M represents the maximum lag.
*, ** and ***The existence of causal link at the 10, 5 and 1% level respectively. M represents the maximum lag.

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, Liu, and Wang'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 causes 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 some evidence of a wider extreme risk business confidence spillover effects across the countries in our sample. There are, for instance, concurrent 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, Perez-Quiros, and Saiz'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 in another cluster with more proximity to Denmark, Turkey, Luxembourg, and Finland, amongst others. Nevertheless, Camacho, Perez-Quiros, and Saiz (2008) use data from 1962 to early 2004, not including the most recent large business cycle fluctuations. 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 BCI in Spain (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 effect 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 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 vs. the downside-risk version that focuses 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.

Notes

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 18 December 2012, which remains unchanged as of August 2014.
3. Anderton, di Mauro, and Moneta (2004) investigate the relationship between the Euro area and the US for the period between 1980 and 2002. Anderton, di Mauro, and Moneta'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 amongst 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 due to the lack of consistent business confidence index data that cover the whole of our analysis period.
6. We also implemented the EGARCH and the GJR-GARCH models to determine the presence of leverage effect in the volatility of BCI series. However, EGARCH and GJR-GARCH models do not outperform the GARCH model according to log-likelihood values.
7. We consider first difference of log of business confidence index series due to stationary problem in the level of series.
8. We would like to thank an anonymous referee for his/her comments that led to the inclusion of linear Granger-causality test results in this section.
9. Our findings may appear to suggest that there is low persistence in extremely low business confidence. Nevertheless, it is not necessarily true since the VaR methodology identifies "cases" of extremely low confidence rather than "periods" of extremely low confidence. The cases need not be adjacent periods. This conceptual distinction coupled with the fact that we also account for the influence of third and common factors might help facilitate the interpretation our findings. We thank an anonymous referee for letting us make this point clearer.

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